

Working Memory for the Associative Learning of Language

© John H Andreae

Main Points

Steven Pinker is wrong in saying that associative learning cannot support working memory (**WM**).

Jerry Fodor and Zenon Pylyshyn are wrong in saying that associative learning isn't computational.

Multiple context associative learning (MCAL) **can** support **WM** for the learning of language.

MCAL is computational.

Artificial neural networks (ANNs) with a computational base are needed for learning language.

PP, an implementation of MCAL, is the brain of a simulated robot in a microworld containing another robot controlled by a human teacher. An interaction between the two robots of 493 steps illustrates the use of **WM**.

PP's novelty goals are its own goals.

An extension of the interaction to 997 steps in the Appendix demonstrates other aspects of MCAL.

An additional interaction of 149 steps shows planning and learning without Teacher approval.

I am hoping that someone will continue this research as I am 90 this year.

Contents

1. Introduction
2. Multiple-Context Associative Learning (MCAL)
3. The PURR-PUSS (PP) System
4. Novelty goals
5. Competence
6. Operation of PP
7. Two Robots in a Simple World
8. Choosing Templates for PP
9. Sensors and Templates for Imitation
10. Working Memory **WM**
11. Learning Language
12. Before the Interaction
13. Taking Turns to Squash the Cake
14. Storage of Words in Working Memory (**WM**)
15. Access of Words from Working Memory (**WM**)
16. A Detailed Explanation of How PP Produces the Command on Step 464
17. The Second Challenge: Reading **WM** to Check on Step 464 Which Robot's Turn It Is Next
18. The Third Challenge: Making the Right Command
19. Other Ways of Implementing Working Memory
20. Planning
21. Prompting and Unblocking
22. Future Research
23. Conclusion
24. Appendix: Extension of the Interaction and Additional Interaction
 - A1. Steps 494-596: Slot and Filler.
 - A2. Steps 597-717: Remembering Numbers.
 - A3. Counting and Recursion.
 - A4. Steps 718-997: Talking about Touching.
 - A5. Planning in Additional Interaction without Approval.
25. References.

Figures

- Figure 1. Network structure for action event-types.
- Figure 2. The Initial Configuration of the World.
- Figure 3. Hierarchies of the Action-Predicting Templates.
- Figure 4. Event-Types and Delays of the Speech Action-Predicting Templates.
- Figure 5. The Reflex Motion Algorithm.
- Figure 6. Situations Within 2 Steps of a Squash in the NW Corner.
- Figure 7. Taking Turns in the First 492 Steps of the Interaction.
- Figure 8. Choosing FLT-Next on Step 464.
- Figure 9. Choosing FLT-Mine on Step 464.
- Figure 10. Choosing the FLT-Wait Command on Step 464.
- Figure 11. The Sentences Being Learned.
- Figure 12. Learning To Remember The Numbers.
- Figure 13. Associations Of Templates SA and SB Learned To Remember Numbers.
- Figure 14. Statements and Questions about Touching Stumps.
- Figure 15. Steps where Correct Statements and Questions occur.
- Figure 16. Associations for Saying 'Look' in 'Look I Am Touching Black Stump'.
- Figure 17. Associations for Saying 'Look' in 'Look You Are Touching Black Stump'.
- Figure 18. Event-Types and Delays of the Hand-Pointing-Predicting Templates.
- Figure 19. Associations Causing Robot B to Point at a Stump after Saying "Look".
- Figure 20. Plan Constructed on step 143 of the Additional Interaction.
- Figure 21. Event-Types and Delays of the Body Move-Predicting Templates.
- Figure 22. Event-Types and Delays of Other-Action-Predicting Templates.
- Figure 23. Event-Types and Delays of Stimulus-Predicting Templates.
- Figure 24. Event-Types, Events and their Abbreviations.

1. Introduction

Noam Chomsky's [1959] review of B.F. Skinner's *Verbal Behavior* destroyed behaviourism and threw doubt on the viability of the associative learning of language. Chomsky's [1980] innate "universal grammar" (UG) became the standard explanation of how children acquire language. Assuming that language couldn't be learned, Jerry Fodor [1976] argued that there must be a "language of thought" (LOT). Fodor [2008] puts thinking before language and then needs a LOT for the thinking. Recently, Fodor and Pylyshyn [2015] have said "This transition from associative to computational accounts of cognitive processes has the look of a true scientific revolution."

Some confidence was restored to associative learning by artificial neural networks (ANNs), but in his acclaimed book *The Blank Slate*, Steven Pinker [2002] dismissed associative learning—and ANNs in particular—as "silly putty" and pointed to the inability of ANNs to provide **working memory**:

For example, storing the value of a variable in the brain, as in " $x = 3$ ", is a critical computational step in navigating and foraging, which are highly developed talents of animals in the wild. But this kind of learning cannot be reduced to the formation of associations, and so it has been ignored in neuroscience. [Pinker 2002, p.21]

So, according to Pinker, the formation of associations certainly couldn't account for the learning of the much more complex structures of language. Knowledge of *Associative Learning for a Robot Intelligence* [Andreae, 1998] might have persuaded Pinker otherwise, but more than a decade later Vyvyan Evans [2014] argues that the standard view is still that language is innate, somehow inherited as Chomsky's universal grammar (UG). Michael Tomasello [2003] and Evans [2014] have given substantial arguments to reject an innate UG, but Chomsky [2016] remains scathing about these arguments: "To deny the existence of UG---that is, of a biological endowment underlying the capacity for language---would be to hold that it is a miracle that humans have language but other organisms do not." With Berwick [2016], his poverty of the stimulus argument is strongly maintained: "what is quickly acquired vastly exceeds evidence available to the child", but it is admitted that the "core principles of language ... may have arisen from something as straightforward as a slight rewiring of the brain,". In

terms of the following discussion, the “slight rewiring” might have been an extension of one or more of the templates of the PP system to be described, but this could hardly be called ‘language specific’... or could it?

2. Multiple-Context Associative Learning (MCAL)

Our earlier work [Andrae et al, 1979; MacDonald & Andrae, 1981] proved that **multiple-context associative learning (MCAL)** has the competence to handle the complex structures of language, such as the centre-embedding of clauses. In the following Interaction between two simulated robots, I demonstrate performance: how associative learning can use **working memory (WM)** and begin to cope with the learning of language. My implementation of MCAL is called PURR-PUSS (**PP**) and is a system that I have been developing as the teachable brain of a robot.

Working memory **WM** is an essential component of a system that will learn and understand language. The psychology of **WM** is extensive and quite controversial, e.g. [Gathercole & Baddeley, 1993], so I focus on the basic differences between STM (short-term memory), **WM** and LTM (long-term memory). **WM** differs from STM in being capable of storing selected items for longer periods than STM and it differs from LTM in being selectable and not permanent. Also, LTM is vast, while STM and **WM** are relatively small. **WM** would be needed, for example, for holding information while a system processes a relative clause so that it can return to and continue the main sentence.

In the following, I demonstrate how MCAL can support **WM** in order to counter Pinker’s claim. This is done by a conversation between two simulated robots in a simple World. One of the robots is controlled by the learning brain, PP, while the other robot is controlled by a human (me). Other ways in which MCAL could support **WM** are discussed. In passing, it will be proposed that the easy way in which PP handles simple language and learns from single examples suggests that some ANNs should, like PP, be designed with a computational/logical base and a statistical cover rather than being statistical throughout.

In his masterpiece *Foundations of Language*, Ray Jackendoff [2002] points out, in support of UG, that even for normal abilities like seeing, navigating, manipulating objects and social interaction, “we are far from being able to describe the f-mental processes that constitute these abilities and are **even farther from being able to specify a simple learning process that leads to these abilities without support from a rather richly specified initial state.**” [my emphasis] PP has a richly specified initial state (hierarchies of templates) that is hardly language-specific, and it promises to lead to those abilities.

If the learning of language starts from hearing sounds, words and sentences in the context of real world happenings, as it must, the structure of those real world happenings may well be the driving force behind early learning. In the demonstration of early language learning to be presented, we will see Body Moves, Hand Pointing and Speech Actions, together with their associated stimuli from vision and touch, being combined by the associations of PP’s templates. Recently, Alistair Knott [2012], basing his arguments on the latest neuroscience of the brain, has proposed a way of learning Chomsky’s UG from the sensorimotor structure of real world happenings, and he is trying to demonstrate it using ANNs. If he is successful, that would be a major development and a resolution of the UG debate.

Michael Tomasello’s book *Constructing a Language* [2003] presents the learning of language from the child development point of view. He says “There are two fundamental points: (1) children have at their disposal much more powerful learning mechanisms than simple association and blind induction; and (2) there exist plausible and rigorous theories of language that characterize adult linguistic competence in much more child-friendly terms than does generative grammar----which make the endpoint of language acquisition seem much closer.” MCAL is much more powerful than simple association. Tomasello’s step by step construction of language through the stages exhibited by children is the way I would like to take future experiments with PP.

MCAL didn’t originate from a neuroscience view of the brain [Knott, 2012], or from a child development viewpoint [Gogate & Hollich, 2013], but rather from engineering considerations of what information the brain uses and an attempt to design a robot brain that had the potential to learn language and converse with humans. Nevertheless, I do see MCAL as being realized in the neocortex of the brain [Andrae, 1977 and 1998]. A template would specify the sources and destinations of neural connections in and out of each small area of the neocortex. Neurons would perform the AND functions needed to recognize particular associations. In the end it will be for neuroscience to discover how human brains actually work, but engineering solutions are likely to guide the neuroscience research. Control system principles, like feedback and feedforward, are already used in neuroscience explanations. Multiple-context principles could be helpful in a similar way. As an example, **the PP system learns from single exposures to inputs** [Andrae 1977; 1998], as we do, with repetition strengthening the

learning. Most ANNs require many exposures. The simple mechanism described here for **WM** may be found useful by psychologists.

In his book *How Children Learn the Meanings of Words*, Paul Bloom [2000] gives the following reasons why associative learning cannot account for the learning of words. (i) “Any associationist procedure requires that the right correlations are present in the environment. In the case of word learning, this entails that the words are presented at the same time that children are attending to what the words refer to. John Locke [1690] is clear about this ... But Locke is wrong. Words are not ordinarily used at the same time that their referents are perceived.” (ii) “The fact that object-name acquisition is typically both fast and errorless suggests that it is not a form of statistical learning”. (iii) “Things get worse for an associationist account when one considers the problems that arise with the learning of names for things that you cannot see or touch. These include imaginary things, such as fictional characters, as well as abstract entities like numbers, geometrical forms, ideas and mistakes. This is a problem that Locke and his contemporaries were well aware of, but it has never been solved.” (iv) “The case against associationist theories of word learning gets stronger when we consider certain experiments that find that a statistical covariation between word and percept is neither necessary nor sufficient for word learning.” (v) “... nonhuman primates, who are excellent at associative learning and have rich perceptual and motor systems, are quite abysmal at word learning.” None of these reasons apply to MCAL. Even the difficulty experienced by apes is easily accounted for by inadequate templates.

The ultimate goal for the development of PP, that was set in [Andreae, 1987; 1998 ch.7] and pursued in [Andreae, 2011], is to have robots talking to each other about what they are doing, what they have done and what they intend to do. Here I have focused on the relatively simple provision of **WM**. In the meantime, much research is needed on templates and architectures for MCAL.

3. The PURR-PUSS (PP) System

I designed the first version of PP in 1973 with the help of theoretical ideas of John Cleary [Andreae & Cleary, 1976]. Our claims were dismissed in a considered and friendly way by Pat Hayes [1977], the eminent AI researcher, and so mainstream AI put us in the ‘weird’ box, where I have remained. The claims, that PP makes its own goals, becomes its experience and can be taught in any language, remain true. PP would have been the first truly embodied robot had we been able to give it an adequate robot body. Quoting from my first book [Andreae, 1977], “Sometimes people think of their bodies as cages within which they live, but bodies are quite the opposite of cages. My body connects me to the world around me in such an intimate and interactive way that I become part of that world. I can participate in the dynamic society and culture of humanity. My cage is wide open. Only if we enable our machines to interact freely with the world around them can we release them from the cage of paradox” [Gödel’s theorem]. I then suggested that the human Teacher had to provide the ‘missing link’ to the wide world until such time as an adequate body was available.

The abbreviation PP has recently been used by Andy Clark [2016] to name his comprehensive theory of Predictive Processing and my PP seems to lie quite comfortably as a simple implementation of his impressive and much more complex scheme. Equally relevant would be the interpretation of PP as a Parallel Processor.

The PP system can start, and usually is started, with a blank slate, i.e. with no associations stored under any of its templates. By starting PP from a blank slate, we can be sure about what has been learned. The idea of a blank slate is more than 3 centuries old:

Let us then suppose the mind to be, as we say, white paper void of all characters, without any ideas. How comes it to be furnished? Whence comes it by that vast store which the busy and boundless fancy of man has painted on it with an almost endless variety? Whence has it all the materials of reason and knowledge? To this I answer, in one word, from EXPERIENCE. In that all our knowledge is founded; and from that it ultimately derives itself. Our observation, employed either about external sensible objects, or about the internal operations of our minds perceived and reflected on by ourselves, is that which supplies our understandings with all the materials of thinking. [Locke, 1690, p.26]

Pinker used the first part of this quotation to introduce the **blank slate** in his book [2002] of that name. In 1690 John Locke would have been ignorant of most of what we now know about the complexities of vision and hearing, reflexes and

autonomous mental processes, neurons and evolution. Nevertheless, he would have seen that complex machinery was required to transfer experience to the ‘white paper’ of the mind, and that it was needed also for the ‘operations of the mind.’ Ideas, reason and knowledge were to be obtained from experience by learning. His description applies well to the PP system, which starts with no associations, and therefore white paper, a blank slate or *tabula rasa*. However, the association of ideas by “resemblance, contiguity and causation” expounded by David Hume [1740] becomes, in PP, the multiple association of events under hierarchies of templates.

Pinker shows how extension of the blank slate idea led to the dangerous notion of the ‘noble savage’ by which all people would be equal if exposed to the same experience. A multiple-context blank slate would not suffer from the same flawed extension, because small differences in the (innate) templates can have major consequences for its ability to absorb experience, and also because emotional aspects, such as approval, disapproval and mood, are outside the blank slate that is seen as the neocortex. I am not doubting Pinker’s important historical account. **My disagreement with Pinker is solely about his dismissal of all associative learning.**

If language is learned through a multiple-context system with hierarchies of templates for the assembly of sounds into syllables, words, phrases and sentences, the complexity of the result may well be comparable with Chomskyan generative grammars, but each individual learning a language will follow a different route and there will be no final structure to describe. With the known plasticity of the human brain, it could well be that neural equivalents of templates, if they exist, could grow or shrink according to the needs of the learning.

A further reason for starting PP from a blank slate, apart from being sure about what has been learned, is to confirm that PP can learn without an innate UG. If we were unable to show that language could be learned in this way, there would be some reason for priming the system with innate language-specific information, but even then there are problems with ascribing innateness, as discussed at length by Elman et.al. [1996]. Anyway, this is unlikely as the competence of multiple-context systems is well established [Andreae,1998].

4. Novelty goals

A special feature of the PP system is its novelty-seeking mechanism that enables it to explore the world in a particularly effective manner. The goal-seeking mechanism in PP finds paths to goals through the network of learned associations (avoiding negative goals, i.e. disapproval), and uses these paths to guide its choice of actions. Some goals are associations that have received approval from the teacher or the world. Such goals enable PP to be guided, but do not assist it to explore. But PP also marks new associations (when they are first learned) as **novelty goals** which then lead PP to try to experience that association again. When an association marked with novelty is encountered again, the mark is removed, indicating that the association is now integrated into the system’s networks. Novelty goals are **PP’s own goals**, rather than imposed from outside, because they depend only upon its own experience in the World. They cause PP to explore its World and enlarge its experience creatively. Being able to plan and follow routes to one’s own goals is the unconscious part of free will. (For PP to consciously know that it has free will, will require that it can talk about, and can answer its own questions about, itself, others and the world [Andreae, 1987,1998].) Perhaps, novelty goals account for “the mysterious creative aspect of language use that was the primary criterion for mind for Descartes and his followers.” [Chomsky, Foreword to Moro, 2015]

Novelty goals solved a problem with teaching by reinforcement (reward and punishment, here approval and disapproval). Withholding teacher reinforcement doesn’t disrupt a learned behaviour because continuing with something new provides continuing novelty goal reinforcement. In fact, teaching didn’t require teacher-given reinforcement if the learner could be led to new situations. PP’s learning is much more natural and exploratory if teacher-given reinforcement is limited.

The PP system is a partially observable Markov decision process [Spaan, 2014] but it goes beyond standard reinforcement learning systems [Sutton & Barto, 1998] (i) in its self-rewarding with novelty goals, (ii) in its emphasis on event types, which allow different input and output types to be processed with different hierarchies of templates, (iii) in there being no reward function, (iv) in their being no convergence onto an optimal behaviour, and (v) in the vagaries of a real human teacher. As soon as one behaviour is learned adequately, reinforcement for that behaviour is dropped and teacher begins using reinforcement to teach the next behaviour, which may use the first behaviour. Novelty goals make this sequence possible by taking over from the withdrawn reinforcement. The aim of the research is to make PP teachable in a child-like way by developing new hierarchies of templates.

Novelty-seeking is not, however, behaviour conducive to compact demonstrations, so the teaching used here (first interaction) controls the behaviour tightly with approval and disapproval. Given that human children take a couple of years to begin to use language, we would expect a learning robot such as PP to also require a large amount of interaction with its world in order to learn and use language. Demonstrating learning in a way that is sufficiently compact to be readable requires additional artificial constraints on the Interaction, quite apart from the severe restriction from implementing the system on a serial computer. The demonstration presented here uses the following six constraints to reduce the length of the Interaction:

- (i) The World of the learning robot (PP) is made as simple as possible.
- (ii) We sidestep the need for the robot to learn how to speak by assuming that it can say any Word that it hears.
- (iii) The Speech the robot hears is segmented into discrete Words.
- (iv) The robot Body is given a simple random routine (**reflex-motion, RM**, Fig. 5) which takes it around the environment when it is unable to decide which Body Move to select.
- (v) The number of tasks to be learned is kept to a minimum.
- (vi) Teaching is consistent and uses approval/disapproval to prevent PP from chasing novelty goals (since novelty-seeking behaviour is unpredictable and seldom compact). (Approval by Teacher is dropped in the second interaction, Appendix, A5.)

Under these six constraints, a demonstration of just 493 steps will be enough to show that a robot fitted with a PP brain can learn the beginnings of language through a conversation with a second robot, driven by a human teacher, in a simple World. The demonstration also shows the use of **working memory, WM**, though I am not suggesting that the **WM** used in this demonstration should replace the standard psychological models of **WM**, such as the well-known Baddeley model [Gathercole & Baddeley, 1993]. My intention is solely to show that associative learning can support **WM**.

5. Competence

The possibility of extending the conversation to include complex linguistic constructions, such as centre-embedded clauses, is a matter for future work, but the computational competence of MCAL to cope with such tasks has already been established in detail. In particular, it was proved in [MacDonald & Andrae, 1981] and in chapter 5 of [Andrae, 1998] that, if novelty-seeking was switched off, a multiple-context system with just 11 simple templates could emulate a complete Universal Turing Machine (UTM) with extendable tape. Even the tape (the UTM's **WM**) was held by associations in the multiple context system. Turing machine power was proved, not just by putting a set of associations into the system, but by showing the acquisition of those associations from a blank slate (no associations) start. Of course, emulating a UTM is not typical behaviour of a human, who would normally get bored very quickly, as would PP if novelty was not turned off, but some people with Aspergers' syndrome do show remarkable feats of calculation and precision processing. The competence of MCAL systems was also shown in [Andrae et al, 1979 and chapter 8 of Andrae, 1998] with the learning of associations for an hierarchical task that required the handling of nested subroutines, using **WM**.

In addition to having competence, the PP system must also be able to be expanded in size if it is to become a significant 'brain'. As PP's body and world become more realistic, the number of templates needed will rise rapidly. PP is designed for parallel computing with each template having its own processor, so I don't expect the speed of the system to decrease with size. However, I don't expect the numbers of event types in contexts to increase markedly, partly because of Miller's [1956] magic number 7 ± 2 and partly because the event types will be the result of more complex processing. In the following, I will talk about associations being stored and in the present implementation both the context and the prediction of an association are stored because it helps in developing and debugging the computer program. However, PP is designed to use contexts only as addresses in memory where predictions are to be stored (e.g. by 'hashing'; for an early discussion see [Andrae, 1977]), so the memory required is economical and independent of context size.

6. Operation of PP

PP has a computational base, overlaid with a probabilistic network for goal-seeking. The computational base is a number of hierarchies of **templates** for storing of, and predicting from, associations. An **association** is a context of events and one or

it the Words it can speak (i.e. sounds it can make). Arm pushing and imitation show it the hand pointing it can do. Imitation will be described later.

Figure 2. The Initial Configuration of the World.

```

-E--C
-#--w
---#-
-----

```

The two robots are in a World consisting of 4 rows by 5 columns of squares, surrounded by a Wall. Since we are going to be discussing hundreds of situations in the World, a compact description will be used throughout. After a few minutes acclimatisation, the reader will find this format easy to follow. The starting configuration of the World is given in Figure 2 that shows 4 rows of 5 characters. The surrounding Wall is assumed, but not shown. Empty squares are represented as dashes “-”. At positions (2,2) and (3,4) of the World, there are two Stumps: immovable objects which can be seen and reached over but cannot be climbed over. These are shown by “#” signs. The one in the second row is a Brown Stump, while the one in the third row is a Black Stump. Because the stumps are distinguishable by their colours and touch, the World loses its symmetry and has unambiguous North (upwards), East, South and West directions.

Robot B is shown by an upper case “N”, “E”, “S” or “W”, depending on whether it is facing North, East, South or West, respectively. Robot A is shown by a lower case “n”, “e”, “s” or “w”, depending on the direction it is facing. The World also contains a Cake object “C” which can be Pushed, Squeezed and Squashed.

Robot B has an initial position of (1, 2) and a direction East; robot A has an initial position of (2,5) and direction West. The Cake is initially at (1,5).

Of course, robot B knows nothing of absolute directions, so when it sees the direction of the other robot, that direction is relative to its own direction, which is taken as North. Thus, in Figure 2, robot B will see robot A as facing South.

Each robot has the same repertoire of actions.

- Body Moves: FORWARD, LEFT, RIGHT, WAIT, PAT, and SLAP.
- Hand Pointing actions: noPoint, PointMe, PointYou, PointCake and some others for pointing at the Stumps and corners. With PointMe a robot points to itself. With PointYou and PointCake it points to the other robot and to the Cake, which must be visible to it. An object is visible to a robot if it isn’t behind the robot.
- Speech actions, comprising intonation, a stress mark (- or <) and a Word.

The intonation part of a Speech action is FLT (Flat), RIS (Rise for questions), CMD (for commands), DRP (Drop), YES (for approval) or NEG (for disapproval). These intonations control the conversation between the robots, the DRP and CMD intonations indicating that a robot is finishing speaking and pointing. A Word is just a name for a sound that the robot hears. By convention, its first letter is in upper case. The Words help teacher to teach consistently. By the end of the Interaction, some of the words will be beginning to have some significance for PP. Teacher can introduce a new Word, with intonation and stress, at any time. At the start of the Interaction, only three speech actions mean anything to PP and they are CMD, DRP or FLT, with no stress (-) and the word Quiet (i.e. CMD-Quiet, DRP-Quiet and FLT-Quiet). CMD-Quiet and DRP-Quiet mean no sound and end a speech and pointing sequence. FLT-Quiet plays a special role in questions.

The LEFT and RIGHT Body Moves are left and right turns, i.e. 90° rotations to the left or right within a square. FORWARD moves the robot into the square in front of it, unless that square is blocked by the Wall, a Stump or the other robot, in which case the robot’s action is automatically disapproved. If the Cake object is in front of the robot doing the FORWARD move, there are three possible outcomes. (i) If there is an empty square beyond the Cake or just a single empty square to one side of the Cake, the Cake will be **Pushed** into the empty square by a FORWARD move. (ii) If there are two empty squares, one each side of the Cake, but it is blocked beyond, then the Cake will be **Squeezed** into one of the two empty squares, randomly chosen. However, (iii) if there is no empty square into which the Cake can be pushed or squeezed, it will be **Squashed**. Squashing causes the Cake to vanish (be consumed) and a new Cake to appear at random in one of the other empty squares of the World. The action of the robot that Squashes is automatically approved (rewarded). A WAIT action keeps the robot where it is. A position is within reach of a robot if the square of the North-South distance (measured in squares) plus the square of the East-West distance is not more than 10, and the position is not behind the robot. A PAT

approves and a SLAP disapproves the other robot's Body Move, if the other robot is within reach. Approval and disapproval are volatile forms of reward and punishment.

Each robot has the same repertoire of stimulus event-types. The robot Body is supposed to have eyes for vision, touch sensors for feeling, ears for hearing and hands for pointing. Eyes can't see behind the robot, and touch sensors can't feel behind the robot. These sensors provide the robot with the following sensory information:

- Where the other robot is and which way it is facing, if visible. (Event-types: VOthrPosn, VOthrDirn)
- What Body Move the other robot has just done, if visible. (Event-type: VOthrMove)
- Where the Cake is, if visible. (Event-type: ObPosn)
- What it is touching in front and to left and right. (Event-types: Touch, TchF, TchL, TchR)
- Where the Stumps are, if visible. (Event-types: VBrown, VBlack)
- Who is pointing at what, in so far as they can be seen. (Event-types: PointOthr, PointOF, PointFO)
- What it and the other robot are saying. (Event-types: HearOthr, HearOF, HearFO)
- Imitation information, to be discussed below. (Event-types: EOthrPosn, EOthrDirn, EObPosn, ...)

I assume that the raw sensory information is pre-processed before becoming events for PP. Thus, PP is not presented with retinal or haptic details but with the 'high level' positions of objects, which have been recognized as the other robot, the Cake and the Stumps, possibly by Fodorian modules [Fodor, 1983].

8. Choosing Templates for PP

A major concern in the design of the PP system is the choice of templates to prescribe the associations that PP can acquire. Each template specifies the event-type predicted by the associations of the template and the event-types and delays of their contexts. Associations with more events in their context are more specific, if redundant information is avoided, because they will make predictions in fewer situations than associations with fewer events in their contexts. The templates for prescribing associations that predict each action event-type are organized in a hierarchy which specifies the priority of the templates. The hierarchies for Body Moves, Speech and Hand Pointing are shown in Figure 3. The template SW for **WM** (not shown) is the only "recency" template and is on its own without a hierarchy. An association of a "recency" template retains only the most recent event associated with its context. An association of a normal "choice" template stores all events that have been associated with (i.e. immediately followed) its context in the past.

The design of the templates should be guided by the following principles:

- (1) Design for the robot Body and World, not for specific tasks.
- (2) Use a set of templates that prescribe a wide range of different contexts spread over the stimulus and action space .
- (3) More specific templates should be placed higher in the priority hierarchy and more general templates should be placed lower. In particular, if the context event- types of one template are a proper subset of the context event-types of another template for the same prediction event-type, the one must be placed below the other in their hierarchy
- (4) Templates may be at the same level in a hierarchy, but their context event-types should then share similar information (redundancy) as little as possible.
- (5) Imitation templates should usually have a low or medium priority so that they apply to a wide range of situations.
- (6) Sequences of words in contexts should not be too long. An early experiment with nursery rhymes [Andrae & MacDonald, 1991] confirmed that Miller's [1956] famous magic number 7 ± 2 was about right.

The underlying computational power of the PP system arises from the convergence of predictions from associations of different templates. The combining process has several features. When associations are used for selecting an action (Body Moves, Speech actions or Hand Pointing), associations from templates higher in the hierarchy get preference: if any predictions are made by the associations of one template, predictions from templates below it in the hierarchy are disregarded. If several predictions are made by one or more associations of equal priority in a hierarchy, then each prediction is weighted by expectation values computed by leakback. Where a prediction from the **WM** template SW corroborates the prediction from an ordinary template, the latter prediction is given additional weight. Learning begins with PP using associations of the more general imitation templates and then moving up the template hierarchy to stronger, more specific templates to make

the required discriminations. If a task is already supported by associations of strong templates, it will not be affected by changes to the more general associations resulting from a new task. For this reason, it will be better to achieve good learning of a task before starting to teach new tasks.

Figure 3. Hierarchies of the Action-Predicting Templates.

Body Moves			Speech			Hand Pointing		
BA	BB		SA	SB		PA	PB	Highest
	BC		SC	SD		PC	PD	
BD	BE	BF	SE	SF	SG	PF	PG	
BG	BH	BI	SH	SI	SJ	PH	PI	
			SK	SL		PJ		Lowest

The version of PP used in this demonstration has 67 templates: 32 for predicting actions (Figure 3) and 35 for predicting stimuli, of which 6 are for imitation. 13 of the action-predicting templates are for predicting Speech, of which one (SW) is for **WM**, 9 for predicting Body Moves, and 10 for predicting Hand Pointing actions. The 6 stimulus-predicting templates for imitation are linked closely with 6 action-predicting templates. Details of the Speech action-predicting templates are given in Fig. 4. These will be explained as we use them.

Figure 4. Event-Types and Delays of the Speech Action-Predicting Templates.

Template:	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SW	SOD SOI SOK		
Event-type	Delays													Event-type		
BodyMove	0	0	-	0	-	-	-	0	-	0	0	-	-	VOthrMove	0	-
VOthrMove	0	-	-	-	-	-	-	-	-	-	-	-	-	EOthrDirn	-	0
VOthrDirn	-	0	0	-	0	0	0	-	0	-	-	-	-	EOthrPosn	0	0
VOthrPosn	0	0	0	0	0	0	0	-	0	-	-	-	-	EObPosn	0	0
OShape	-	0	0	-	-	-	-	-	-	-	-	-	-	EBrown	-	0
ObPosn	0	0,1	0	0	0	0	0	-	0	-	-	-	-	EBlack	-	0
VBrown	0	-	0	-	0	0	0	-	0	-	-	-	-	ETchF	-	1
VBlack	0	-	0	-	0	0	0	-	0	-	-	-	-	ETouch	0	0
TchF	-	1	-	-	-	-	-	-	-	1	-	-	-	PointOF	0	-
Touch	0,1	0	-	0	-	-	-	0-2	-	0,1	0	-	-	HearOF	1-4	-
PointFO	0	0,1	0,1	0	0	0	0	-	-	0,1	-	0,1	-	HearOthr	-	1
HearFO	1-7	1-6	1-4	0-3	1-3	0,2,3	0,1,3	0-2	-	1	-	0-4	0-2	InSSay	-	0
HearOthr	0	0	0	-	-	-	-	-	0	0	-	-	-	HearSOF	-	1
InSSay	0	0	0	-	-	-	-	-	1	1	-	-	-			
HearSFO	-	-	-	-	-	-	-	-	-	-	0	-	-			
Twin templates:				SOD					SOI					SOK	SD	SI

The 29 stimulus-predicting templates not used for imitation are used for planning which has been a feature of the author's learning robots since 1963 [Andreae,1963; Gaines & Andreae, 1966]. In planning, PP internalizes its sensorimotor experience for a simple form of thinking by journeying towards its goals through the stored associations in its LTM [Andreae, 1998]. Planning will be demonstrated and discussed in section A5, so these 29 templates will be ignored until then. Two other mechanisms of PP—belief memory and trail memory—which were used in [Andreae, 2011] are also not used in this account.

9. Sensors and Templates for Imitation

Learning to use Working Memory (**WM**) depends upon imitation. Since the discovery of “mirror neurons” [Arbib, 2006], it has become clear that humans, and some animals, have innate mechanisms for detecting how others are behaving. This is

my justification for using an innate imitation mechanism in PP. Of course, mirror neurons are not needed for imitating speech, since speech can be heard, but heard words still have to be converted to the saying of words. Presumably a human infant learns this conversion by experimenting with its voice in babbling. PP is assumed to have this conversion done by imitation, so we can avoid the babbling stage and treat imitation similarly for Body Moves, Speech and Hand Pointing.

In earlier work, I used a reflex mechanism called “echo-speech” in [Andrae, 1977] and “mimic-sound” in [Andrae,1998]. If PP heard a sound and hadn’t made a sound itself, the heard sound was stored as if PP had made it itself. Then it tended to make sounds as it had heard others saying them. We do seem to have a tendency to complete speech sequences to ourselves or even aloud, when someone starts a familiar sequence. Imitation stores the other robot’s speech in the other robot’s context, while echo-speech and mimic-sound store the other robot’s speech in the hearing robot’s context. Imitation is more logical but I have wondered whether there is still a place for my old method.

PP has been given a range of sensors that detect what the other robot is doing, touching and seeing, when the other robot is visible. In the case of hand pointing, the object being pointed at must also be visible. The stimuli from these imitation sensors correspond directly to the robot’s own actions and stimuli, as will be explained later. Imitation takes place by the context, in which robot A moves, speaks or points, being transcribed into a matching context that enables robot B to do the same action in the same context.

The associations of the SW template can hold, as predictions, one **WM** speech word for each distinct context of 3 words. If a stressed word follows an SW context, that word is stored as the prediction of an SW association with that context. If the context occurs again, the same word, unstressed, is predicted. If a new stressed word occurs in the same context, it will replace the existing stored word. The stress on words is an example of what were called **auxiliary actions** in [Andrae,1998]. Auxiliary actions are actions of any event-type which are not directly needed for the carrying out of a task. The human face is equipped with many muscles which are not needed in carrying out ordinary tasks so they would qualify as auxiliary actions and many of them would be imitable by another person, so they could be learned. Auxiliary actions can be used for distinguishing different kinds of **WM**. In [Andrae et al, 1979, and Andrae,1998] a single auxiliary action, called ‘raise eyebrows’, was used to provide the **WM** for several layers of nested subroutine. Michael Corballis [2002] has given an account of how modern language could have evolved from manual and facial gestures through a protolanguage supported by those gestures. Treating the gestures—particularly the facial ones that don’t interfere with tool use—as auxiliary actions, it is not difficult to see how they, with enlarging templates, would have aided the transition from a simple protolanguage to the recursion of modern syntax. Michael’s [Corballis, 2011] convincing (for me) account of recursive thought and language originating together from gestures removes all need for the Fodorian LOT and Chomskyan UG.

What factors influence the choice of templates for imitation? If the context is very narrow and specific, imitation will be very accurate but the context will hardly ever occur. So we must use a spread of contexts and put up with frequent ‘errors’ of imitation from the weaker contexts. Approval and disapproval are still needed to separate wanted and unwanted actions derived from the imitations. Here, I will focus on imitations of speech since they provide the only means by which robot B can speak at all. The approving and disapproving intonations, YES and NEG, will help to separate desired speech from the rest, but there is a snag. Robot A can’t give approval or disapproval until robot B has completed a sequence of speaking and pointing, so several words together with pointing might be given disapproval when only one was at fault. An extreme case, which happens only a few times (e.g. step 125), is when PP says a sentence correctly but ends it with the CMD intonation when it is not a command. I try to copy a mother’s attempt to help with speaking by **prompting** a word that the child is hesitating to say. When a speech word has been blocked by a stored association marked with disapproval, robot A (the teacher) is given the chance to leave it blocked, **unblock** it, or prompt with a different word. In the 493 step Interaction presented in the main part of this account, 11 of the 436 Body Moves by PP, 124 of the 1529 speech words and 136 of the 1688 hand pointings have been unblocked. 18 speech words have been prompted. These are not negligible numbers and they need careful justification, so a section 21 “Unblocking and Prompting” is devoted to this question after we have seen how they are used. In the Interactions, Speech and Pointing ends with a full stop “.” unless unblocked or prompted.

A mother has many ways to encourage and discourage an infant. Patting, slapping and intonation of voice will suffice here. When the Interaction begins, left and right mean nothing to the robot, just as its actions, its stimuli and the World mean nothing to it. But PAT and SLAP by the other robot do have a specific, built-in, effect on the robot: they cause associations predicting Body Moves to be marked with approval and disapproval, respectively. Similarly, the YES and NEG intonations cause associations predicting speech and hand pointing to be marked with approval and disapproval, respectively. There is plenty of “innate structure” in PP, but is any of it language-specific? Note that robot A has to sacrifice a Body Move to PAT

or SLAP robot B, so the human teacher driving robot A often has to omit Patting and Slapping.

10. Working Memory WM

The **WM**, which I will demonstrate, uses the stress on a Speech Word to cause that Speech Word to be stored with its context in an association of the **special template SW**. The same context, but without the stress, accesses the stored Speech Word. For all other templates, storage and access occur at a different stage of the learning cycle. Prediction events are accessed from the associations in LTM when actions are being selected for PP to carry out. Storage takes place when the robot has finished doing an action in the World. This difference in the operation of template SW enables PP to use what is stored in **WM** to take its turn with robot A in Squashing the Cake at one of the corners of the World. Using stress it can then change **WM** to prescribe whose turn it will be for the next Squash. In the Interaction, we will also see PP learn to advise robot A before the Squash as to whose turn it is next.

In order for teacher through robot A to show PP how to use **WM**, PP will need to be able to control robot B's Body Moves, so the Interaction will also show robot B learning to **do what it is told**. If robot A says "You move Forward" or "You Push Cake" or "You Squeeze Cake" or "You Squash Cake", robot B should do a FORWARD Body Move with the appropriate effect. If told "You Turn Left" or "You Turn Right" robot B should do a LEFT or RIGHT turn, respectively. As a by-product of the learning by imitation, PP will begin to learn to **say what it is doing**. In this case, if robot B has done a FORWARD Body Move, it should say "I Moved Forward", "I Pushed Cake", "I Squeezed Cake" or "I Squashed Cake", according to the effect of the FORWARD Body Move.

Figure 5. The Reflex Motion Algorithm.

The random number generator produces numbers from Rand=0 to Rand=19.
(The algorithm is somewhat more complicated when some Body Moves are blocked.)

```
If robot B is facing the Wall:
    if Rand is less than 17, turn RIGHT, otherwise turn LEFT.
If robot B is facing a Stump or the other robot:
    if Rand is less than 17, turn LEFT, otherwise turn RIGHT.
If robot B is facing the Cake or a Space:
    if Rand is less than 16, move FORWARD;
    if Rand is 17, turn LEFT;
    if Rand is 18, turn RIGHT;
    if Rand is 19, WAIT.
```

The teaching isn't organized or optimized, but there are some principles that the human teacher has to bear in mind while selecting the actions for robot A. Imitation won't happen unless robot B has seen and heard robot A doing and saying what robot B needs to imitate. The RM behaviour of robot B tends to make it go round the World in a clockwise direction (Figure 5). If this were all that happened, robot A would have to go round the World in an anticlockwise direction to achieve Squashes, in which case robot B would never be in the same situation as robot A and imitation would be of little use to it. Teaching must encourage robot B to go along routes that it has already seen robot A go along, so that imitation can make it copy robot A. Robot B will learn to do what it is told by direct reinforcement (Pat and Slap) and it will learn to say what it is doing by imitating what it sees and hears robot A doing and saying. Robot A cannot teach both at the same time because it cannot show robot B how to say what it is doing at the same time as telling robot B what Body Move to do. Inevitably, robot B imitates the telling as well as the saying, and the inappropriate telling has to be disapproved.

It is a pity that PP's exploratory and creative behaviour can't be demonstrated in this 493 step Interaction, but **WM** is the focus of this account so care has been taken to ensure that PP's actions are controlled by Teacher's approval and disapproval. A key principle here is for robot A to direct robot B from positions where robot B is visible and reachable. Robot A can't PAT and SLAP when it is moving, because PAT and SLAP are Body Moves. This leads to "unnatural" behaviour by robot B for the sake of fast, controlled learning of the use of **WM**. This tight control of the learning will be relaxed in the extension

of the Interaction. In the second interaction (Appendix A.5) learning proceeds without any approval by Teacher and planning is demonstrated.

It is noteworthy that PP can learn from a single example but consolidates its learning by repetition. Also, by inspecting the associations that have been stored, it is always possible to analyse the reasons for behaviour down to the finest detail. In these ways, PP differs from ANNs. It should be possible to replace each template of the PP system with a separate ANN, when ANNs can do what MCAL templates do. At present, to our knowledge, there are no ANNs (apart from the original networks of McCulloch & Pitts [1943]) that have the computational base, which is characteristic of the templates in PP and which is necessary for learning language. Section 1.1 of [Andrae,1998] suggests that it should not be difficult to replace templates by neural networks. Of course, there are many uses for statistical ANNs in modelling features of the human brain, including the identification of the phonemes used by a language and the segmentation of speech, both of which are by-passed here.

PP is designed to be a parallel processing system with a separate processor for each template. In the current implementation on a serial computer, if the allocated memory for a template is used up, forgetting takes place with the least important association and all its parts being removed.

11. Learning Language

Although this Report is mainly a formal demonstration that Working Memory (**WM**) can be supported by associative learning, the interaction does show the acquisition of some ability with language. Now, no infant's first experience of learning language is to be told "Next turn is yours so you move forward," although it will hear adults speaking. A baby has to discover what sounds it can make and it has to resolve sound sequences into words. By-passing those processes may be a reasonable strategy, but the World that PP is operating in is so simple, compared with the real world that a baby lives in, that I may not be justified in inferring that PP's ability to acquire words and sentences has any relevance to how an infant does the same. And then there is the question of "meaning". Is PP in robot B acquiring any meaning from imitating the words and phrases of the teacher robot A? This is where being able to inspect the details of individual associations that have been acquired will enable me to say something about the meaning, or at least significance, in those associations.

In his book *The Crucible of Language*, Vyvyan Evans [2015] gives a modern account of how meaning arises in language. It will enable me to consider (i) how foundational concepts of time and space might arise from the sensori-motor hierarchy of templates (BA to BI) that predict Body Moves, and (ii) how word-to-word relationships, rather than word-to-world relationships, might lead to the establishment of grammar. In this way, I may be able to show how MCAL can connect with significant aspects of language in spite of the drastic simplifications enforced by simulation on a serial computer. However, there being only two robots in PP's World will certainly limit PP's ability to develop a theory of mind, as it won't be able to observe the interaction of other robots.

12. Before the Interaction

It is worth emphasising that, at the start, PP has no means of choosing actions or expecting stimuli. It doesn't know what actions it can perform or what stimuli it can expect. This is because it has no associations. The fixed and innate processes of approval, disapproval and RM are best seen as part of robot B's Body, which PP eventually learns about. As PP accumulates associations, its knowledge of its Body and the World increases. It becomes better at choosing actions and at anticipating stimuli. What PP knows at the start is, of course, unconscious, procedural knowledge implicit in its computer program. PP has no associations stored (blank slate) but it does know (and doesn't know that it knows!) how to:

- (1) process the different kinds of approval and disapproval.
- (2) respond to DRP-Quiet, CMD-Quiet and FLT-Quiet.
- (3) follow the conversational protocol of different intonations.
- (4) distinguish new events in its given set of event-types.
- (5) store associations and use them for selecting actions.

(6) acquire and use associations for imitation.

(7) plan.

The Interactions consist of a series of steps. Each step begins with a Body Move by robot B, followed by a sequence of alternate Speech and Hand-Pointing started by robot B, a possible interchange of Speech and Hand-Pointing with robot A, then a Body Move by robot A, followed by a sequence of Speech and Hand-Pointing actions started by robot A. The **conversational protocol** is very simple: The FLT, YES and NEG intonations on speech actions indicate that the robot is continuing to speak, while the CMD and DRP intonations indicate the end of the robot's current Speech-plus-Pointing sequence and time for the next Body Move. The RIS intonation indicates that the robot is handing over the Speech-and-Pointing sequence to the other robot so that it can reply to a question.

13. Taking Turns to Squash the Cake

Learning to store the next robot's turn in **WM** is relatively easy because it follows the context of a Squash in one of the 4 corners of the World. The context is different according to which robot is doing the Squashing, which corner the Squashing is taking place in and whether the robot doing the Squashing is on the left or right of the other robot, seen from the middle of the World. (As Teacher controlling robot A, I will avoid Squashes of the Cake at positions not in one of the 4 corners.) If robot B Squashes the Cake, Teacher wants robot B to say "I Squashed the Cake so the next turn is yours." If robot A Squashed the Cake, Teacher wants robot B to say "You Squashed the Cake so the next turn is mine."

Figure 6. Situations Within 2 Steps of a Squash in the NW Corner.

-w---	Cw---	--w---	-w---	--w---	-Cw--	--Cw-	cBA
C#---	N#---	-#---	-#---	C#---	N#---	-#---	
N--#-	---#-	C--#-	C--#-	N--#-	---#-	N--#-	
-----	-----	N----	N----	-----	-----	-----	
24W, 32	33W, 32	16W, 32	15W, 32	25W, 32	34W, 33	34W, 33	VOthr, ObPosn
33/44	42/U	24/35	24/35	33/44	42/U	33/44	VBrown/VBlack
WlCkSp	WlCkBn	WlCkSp	WlCkSp	WlCkSp	WlSpBn	WlSpSp	Touch is TchL TchF TchR
WAIT	WAIT	W/F	WAIT	W/F	WAIT	W/F	B to command if B's turn
WAIT	SQUASH	W/F	WAIT	FORWARD	WAIT	W/F	B to command if A's turn
=====							
-CW--	CW---	--CW-	--CW-	-CW--	-W---	--W--	cAB
n#---	n#---	-#---	n#---	-#---	C#---	-#---	
---#-	---#-	n--#-	---#-	n--#-	n--#-	C--#-	
-----	-----	-----	-----	-----	-----	n----	
22E, 32	31E, 32	22E, 32	31E, 32	22E, 32	30E, 31	30E, 31	VOthr/ObPosn
31/U	40/U	22/39	22/39	31/U	40/U	31/U	VBrown/VBlack
SpCkWl	BnCkWl	SpCkWl	SpCkWl	SpCkWl	BnSpWl	SpSpWl	Touch
WAIT	WAIT	W/F	WAIT	W/F	PUSH	PUSH	B to command if B's turn
WAIT	SQUASH	W/F	WAIT	FORWARD	PUSH	PUSH	B to command if A's turn
=====							

Abbreviations: W/F = WAIT/FORWARD. Stimulus event-types are given in Figure 4. See also Figure 24.

The symbols cAB and cBA will be used to distinguish the situations cAB in which robot A is on the left of robot B, as seen from the centre of the World, and situations cBA when robot B is on the left of robot A.

Learning to access whose turn it is next is difficult. As the conditions for a Squash are approached, we want robot B to advise robot A what to do to expedite a Squash with statements like "Next turn is yours so you XXX," where XXX should be "Squash Cake", "Move Forward", "Push Cake" or "Wait", or "Next turn is mine so you YYY," where YYY should be "Squash Cake", "Move Forward", "Push Cake" or "Wait", according to the situation. The relevant situations are where the robot is within 2 steps of a Squash. Figure 6 shows 14 configurations of the World in which the robots are within 2 steps of a Squash in the NW corner. There is some symmetry between the corners for those templates that don't have event types distinguishing the two Stumps, but obviously only a small fraction of the situations can be learned in the first 500 steps.

14. Storage of Words in Working Memory (WM)

Robot B will store either “Mine” or “Yours” in **WM** to say whose turn it is to Squash the Cake next. It will be stored with the context “Next Turn Is” in an association of the special template SW, so access will also need to use this same context. The simple **WM** being illustrated can store a word in any 3-word context.

The template SW is special (i) because it is processed in a different part of the operating cycle, and (ii) because it is a **recency** template. The other templates are **choice** templates. A choice template stores associations with all the prediction events that are associated with its context. A recency template stores only the latest prediction event, discarding all earlier ones. In the current implementation, the most recent prediction event is put at the head of the list of predictions, so any template can be used as a recency template just by disregarding all prediction events except the one on the top of the list. The difference between choice and recency memory is the difference between remembering what kinds of fruit one likes and remembering the last kind of fruit one ate.

Figure 7 summarises the Taking of Turns in the first 492 steps of the Interaction. The listing of the Interaction has a brief introduction and provides comments with every step so it is more or less self-explanatory. When a step is referred to, the reader should look at the step in the listed Interaction.

Part (a) of Figure 7 shows which corner of the World each Squash occurred in, which robot did the Squashing, and which orientation (cAB or cBA) the robots were in. It can be seen that there is a good distribution over the corners.

Part (b) of Figure 7 gives more detail. The first column has the numbers of the steps on which a Squash took place. The next 3 columns give the robot responsible for the Squash, the corner in which it occurred and the orientation cAB or cBA.

The next column (5th) also gives steps, but these are the steps at which PP in robot B comments on the Squash saying either that the next step is “Mine” (column 6) if robot A did the Squashing, or “Yours” if robot B did the Squashing itself. It makes only one mistake in saying “**Mine**” on step 88, the purple emphasising the mistake. The others are all red to indicate correctness. Robot A let PP do an extra Squash on step 104 because robot B’s **WM** was still saying “Mine” after the mistake on step 88. As I said earlier, learning to respond after the Squash is relatively easy.

There is one feature of the post-Squash response which robot B finds difficult. After robot A Squashes the Cake, robot B is required to **turn away from the Wall**. The idea behind this requirement was to have robot B facing the World, not the Wall, after a Squash so it was ready to go for its next challenge. Looking through the Interaction, we find 3 errors out of 12 by PP (excluding 2 from RM) and the last one on step 475.

The last column in Figure 7 shows the World configurations for the Squashes. It is sufficient to show 2 rows of the World because the Stumps indicate which rows they are. The 7th and 8th columns will be discussed in the next section.

Figure 7. Taking Turns in the First 492 Steps of the Interaction.

(a)									
	NWcncr	NEcncr	SEcncr	SWcncr					
A cBA	17,150	228,390	116,316	289,474					
A cAB	350	255	421	60,179,446					
B cBA	242,404	3,435	341,492	36,104					
B cAB	88	165,200,465	139	267,303					

(b)									
Step		Squashed		Step		Set-up WM		Says/SW/choice/cmd/place	
								Step Reads WM	
								Squash configurations	
3	B	NEcncr	cBA					---EC	
17	A	NWcncr	cBA					-#---n	Cw---
36	PP	SWcncr	cBA					N#---	s---#-
60	A	SWcncr	cAB	61	PP:	<Mine		CW---	CW---
88	PP	NWcncr	cAB	88	PP:	<Mine	109 Yours^/Y/M/-/χ	n#---	S---#-
104	PP	SWcncr	cBA	104	PP:	<Yours	110 Yours/Y/Y/-/χ		Cw---
116	A	SEcncr	cBA	117	PP:	<Mine	133 Mine^/M/Y/-/χ		
139	PP	SEcncr	cAB	139	PP:	<Yours	144 Yours^/Y/M/-/χ		---#S
									---eC
									---#s

150	A	NWcnr	cBA	151	PP:<Mine	145	Yours/Y/YM/-/χ	Cw---	---	EC
						149	Yours/Y/Y/-/√	N#---		
165	PP	NEcnr	cAB	165	PP:<Yours	164	Mine^/Y/Y/-/√	---	eC	
179	A	SWcnr	cAB	180	PP:<Mine	179	Yours^/Y/M/Sq/√	-#--N	S--#-	
200	PP	NEcnr	cAB	200	PP:<Yours	199	Mine/M/MY/-/√		Cw---	---
228	A	NEcnr	cBA	229	PP:<Mine	227	Yours-ub/Y/Y/Fd/√	---	EC	-#--N
						228	Yours-ub/Y/Y/Sq/√	-#--n		
						240	Mine^/M/Y/Sq/√			
242	PP	NWcnr	cBA	242	PP:<Yours	241	Mine/M/MY/-/√	Cw---		
						244	Yours/Y/Y/Sq/χ	N#---		
						249	Yours^/Y/M/Sq/χ			
						254	Yours/Y/MY/Fd/√			
255	A	NEcnr	cAB	256	PP:<Mine	255	Yours/Y/MY/Sq/√		---	eC
267	PP	SWcnr	cAB	267	PP:<Yours	266	Mine/M/MY/-/√		-#--N	S--#-
						285	Yours^/Y/M/-/χ			Cw---
						288	Yours/Y/Y/Fd/√			
289	A	SWcnr	cBA	290	PP:<Mine	289	Yours/Y/Y/Sq/√	s--#-		
303	PP	SWcnr	cAB	303	PP:<Yours	302	Mine/M/MY/Sq/√	CW---	S--#-	
316	A	SEcnr	cBA	317	PP:<Mine	326	Mine/M/MY/-/χ		Cw---	---
				319	PP:<Mine	329	Mine/M/M/-/χ			#S
						332	Mine/M/M/-/χ			eC
						335	Mine^/M/Y/-/χ			
341	PP	SEcnr	cBA	341	PP:<Yours	345	Yours^/Y/M/-/χ			---
						348	Yours^/Y/M/-/√			#S
						349	Yours^/Y/M/Fd/√			eC
350	A	NWcnr	cAB	351	PP:<Mine	358	Mine/M/M/-/χ/√	CW---		
						368	Mine^/M/Y/Fd/√	n#---		
370	PP	NEcnr	cAB	370	PP:<Yours	369	Mine^/M/MY/Wt/√		---	eC
						384	Yours/Y/MY/-/χ		-#--N	
						389	Yours/Y/Y/-/√			
390	A	NEcnr	cBA	391	PP:<Mine	390	Yours/Y/Y/Sq/√		---	EC
						402	Mine^/M/Y/-/√		-#--n	
404	PP	NWcnr	cBA	404	PP:<Yours	403	Mine/M/M/Wt/√			Cw---
						419	Yours^/Y/M/-/χ			N#---
						420	Yours/Y/MY/Fd/√			
421	A	SEcnr	cAB	422	PP:<Mine	421	Yours/Y/MY/Sq/√	---	#s	
						432	Mine/M/M/Wt/√	---	EC	
						433	Mine/M/MY/Fd/√			
435	PP	NEcnr	cBA	435	PP:<Yours	434	Mine^/M/Y/Sq/√		---	EC
446	A	SWcnr	cAB	447	PP:<Mine	446	Yours-ub/Y/MY/Sq/√	-#--n	S--#-	
465	PP	NEcnr	cAB	465	PP:<Yours	464	Mine/M/MY/Wt/√ noCQ		Cw---	---
474	A	SWcnr	cBA	475	PP:<Mine	474	Yours/Y/Y/Sq/√	s--#-		eC
492	PP	SEcnr	cBA	493	PP:<Yours	491	Mine/M/M/Pu/√	CW---	---	#S
										eC

15. Access of Words from Working Memory (WM)

WM doesn't select actions. It only adds weight to actions. PP must already be predicting the alternatives for **WM** to add weight to one of them and thereby select it. In the current Interaction, robot A is trying to teach robot B to use **WM** to select either "Mine" or "Yours" in order to tell whether it's robot A's turn to Squash the Cake, or its own. It would take a long time for PP in robot B to acquire the two predictions "Mine" and "Yours" by imitation for the many relevant situations, so we will find that prompting is used frequently by Teacher through robot A to give PP the extra prediction needed. Looking down the 8th column of Figure 7, wherever there is "Mine^" or "Yours^" with the hat sign ^, there has been a prompt in the step shown in the 7th column. This can be checked against the listing of the Interaction.

The 8th column of Figure 7 has 5 parts. First, there is the Word said by PP, with or without the prompt sign ^ and with or without the unblock sign -ub. Second, there is a /M or /N recording whether **WM** has "Mine" or "Yours". Third, there is a / followed by M and/or Y giving the predictions "Mine" and/or "Yours" of PP. Fourth, an abbreviation for the Word by PP commanding a Body Move: Sq for "Squash", Fd for "Forward", Wt for "Wait", and Pu for "Push". The fifth and final

part is the tick \checkmark or cross χ indicating whether the Word “Mine” or “Yours” said by PP was correct for the situation, or not. To be correct it must agree with **WM** and be close to a Squash situation (Figure 6). If PP has been disapproved for its command, the row in the 8th column is coloured purple. If PP has accessed **WM** properly and has been approved for the command, the row in the 8th column is coloured red. In some cases PP didn’t have the two predictions for proper access from **WM**, but does make the appropriate command. In this case, just the last two parts of the row in column 8 are coloured red.

16. Explanation of How PP Produces the Command on Step 464

There are 3 challenges for PP to produce a correct command prior to a Squash. First there is knowing when to do it. This is a matter of saying “Next ...” in an appropriate situation, e.g one of those illustrated in Figure 6 for a Squash in the NW corner. Second, there is the reading of **WM** to check whose turn it is to Squash the Cake. The third challenge is to choose a correct command.

Note. All information about the storage and use of associations is obtained from a data file generated by the computer program during an interaction. Associations used by PP to select actions are given in the Interaction but other associations referred to here are taken from the data file. The computer program and data file will be available from the internet, but the data file is not readable without detailed knowledge of the computer program

On step 464, we see from the listing of the Interaction that “Next” is chosen by the associations 391SA and 378SB. Figure 8 sketches the way these associations were learned. Association 309SK was stored on step 103 by imitation of robot A’s FLT-Next on that step (See Interaction, step 103). It is used to start a command on steps 133, 136 and 137, but the first two are too far from a Squash situation and the third on step 137 isn’t completed. Teacher decides not to approve with YES-Good. On step 164 (See Interaction), there is a similar situation but Teacher prompts to give PP a second prediction of FLT-Mine. Teacher takes the questionable decision to approve by robot A saying YES-Good in spite of the statement not being completed after FLT<Mine^.

Recall that when an action is being sought from the predictions of contexts that have events matching what is in STM, only the highest priority associations are used. However, after the action has been selected, all associations with matching contexts are stored. So, after FLT-Next has been chosen on step 164 using 309SK (the highest priority association offering a prediction), the event FLT-Next is stored with all templates whose contexts can be filled from the current STM, namely 284SA, 283SB, 271SC, 884SD, 262SE, 266SF, 265SG, 248SH, 706SI, 254SJ, 309SK and 116SL. All but the last two still have a single prediction of FLT-Next on step 493 at the end of this section of the interaction. Checking back to Figure 4, we see that template SL is very weak with only Pointing and Speech in its context. Template SK has some Touch but it acquires the additional prediction YES-Good by imitation on step 473, which is an acceptable precursor to FLT-Next as robot A often says it. The strong associations 284SA and 271SC are not used again in this part of the Interaction, but the remainder all contribute usefully to the Next statements on steps 199, 255, 302, 369 and 464 (compare with Figure 7), either as selectors of the FLT-Next Word or as lower priority supports.

Referring back to Figure 8, it can be seen that the association 706SI stored on step 164 goes on to select the approved FLT-Next on step 199. This is a rise in template priority from the SK of 309SK to the SI of 706SI, as we move across the Figure to the right. On step 199, associations 391SA and 378SB are the highest, and equal, priority associations stored and these then choose the approved FLT-Next on step 464. Figure 8 illustrates the **general principle** of learning from low priority general associations to higher priority specific associations, while retaining lower priority associations for generalizing to neighbouring situations.. Notice, however, that on step 464 the high priority selection of FLT-Next strengthens the lower priority 706SI by storing or strengthening all associations that have, or could have, contexts from the current STM. There may be a need later for lower priority associations to select FLT-Next in situations not covered by the higher priority associations.

By comparing the steps in the listing of the Interaction with Figure 7, we can deduce the contexts of the four associations, given in Figure 8 and shown at the bottom of Figure 8 with graphic versions. (The contexts are also given in a data file produced by the computer program.) It can be seen that the association 309SK, which starts things off on step 103, is too general to be of much use itself because it requires only that there has been a FORWARD Body Move pushing the Cake and having the Wall on its right, a Space on its left. The other robot can be anywhere. On steps 133 and 136, it causes FLT-Next to be selected in inappropriate situations, but on steps 137 and 164 it selects FLT-Next correctly, causing stronger associations to be stored. Here, I have picked out the storage of association 706SI on step 164, which leads on step 199 to

the storage of associations 378SB and 391SA. These two strong associations then produce the start (FLT-Next) of the successful command on step 464 (Figure 7). Once FLT-Next has been selected, the Words “FLT-Turn” and “FLT-Is” follow easily (with 379SB and 392SA, and 380SB and 393SA, not listed here). The second challenge arrives with the choice of “FLT-Mine” or “FLT-Yours”.

Figure 8. Choosing FLT-Next on Step 464.

```

Imitation
103
309SK
FLT-Next
133 x          Increasing template priority ---> (see Figure 3.)
FLT-Next
136 x
FLT-Next
137 ✓
FLT-Next
164
164 ✓ YES ----->706SI
FLT-Next          FLT-Next          199          199
                  199 ✓ YES -----> 378SB -----> 391SA
                  FLT-Next          FLT-Next          FLT-Next
                  464 <----- 464 <-----> 464 ✓ YES
                  FLT-Next          FLT-Next          FLT-Next

```

Associations (cf. Figures 4 and 7.):

```

[309SK: BodyMove:FORWARD TchF:Ck Touch:SpCkWL HearSFO:Quiet >> YES-Good Nov=1, FLT-Next Nov=4]
[706SI: 31E ObPosn:32 VBrown:38 VBlack:U HearOthr:CQ InSSay:Q >> FLT-Next Nov=4]
[378SB: 31E OShape:Cake ObPosn:23,32 TchF:Sp Touch:SpCkWL PointFO:-PtMe,-PtMe HearFO:FLT-Is,
FLT-Yours,FLT-So,FLT-You,FLT-Move,FLT-Forward HearOthr:CQ InSSay:Q >> FLT-Next Nov=4]
[391SA: BodyMove:FORWARD VOthrMove:WAIT VOthrPosn:31 ObPosn:32 Touch:BkSpWL Touch:SpCkWL VBrown:38
VBlack:U PointFO:-PtMe HearFO:FLT-Turn,FLT-Is,FLT-Yours,FLT-So,FLT-You,FLT-Move,FLT-Forward
HearOthr:CQ InSSay:Q >> FLT-Next Nov=4]

```

Abbreviations used: See Figure 24.

Nov=1 is a Novelty Goal, Nov=4 is an Approval Goal,

Nov=5 is a Novelty Goal plus an Approval Goal.

✓ means the prediction (e.g. FLT-Next) is correct, x incorrect.

YES means robot A has said YES-Good, NEG means robot A has said NEG-Bad.

If position of robot is specified but not direction, o is used instead of n,e,s,w.

Position Code: Position = 41 - 9f + r, where f is the number of places in front of the robot
|r| < 5 and r is the number of places to the right of the robot.
Places to the left of the robot have a negative r.

Contexts of associations:

(Parts of context specified by associations are shown in orange.)

309SK		706SI	378SB	391SA
-----	-----	---eC	---C	-----
PP:F -#---	PP:F -#--- etc	---#N etc	---#N -> -#N etc	A:W -#---
S--#-	---#-	---#-	---#N	PP:F -#N
C----	-EC--	-----	-----	---#N
HearSFO:Quiet		CQ/Q	FLT-Is,..Forward CQ/Q	FLT-Turn,..Forward CQ/Q

17. Reading WM on Step 464 to Check Whose Turn Next

PP has to be predicting both FLT-Mine and FLT-Yours from the context “FLT-Next FLT-Turn FLT-Is” before it can read **WM** properly with **WM** giving extra weight to the Word that it is holding. This could take a long time if it depended only on imitation, so prompting is used when PP is not predicting the Word held in **WM**. The program automatically warns Teacher of this situation when it occurs.

Figure 9 shows how PP ends up selecting FLT-Mine with the help of **WM** on step 464. As in Figure 8, this starts with imitation on step 103 of robot A’s “A:FORWARD Next m Turn m Is m **Yours** m So m You y Squash y Cake o CQ m” as given in the Interaction. Association 534SD is stored from imitation of the Word “**FLT-Yours**”. On step 164, 534SD is only predicting FLT-Yours but **WM** has FLT-Mine, so Teacher through robot A prompts robot B to say FLT-Mine^, the ^ sign indicating the prompt. Among the many associations (287SA, 286SB, 274SC, 534SD, 265SE, 269SF, 268SG, 251SH, 709SI, 257SJ, 312SK and 100SL) stored as a result of this prompted selection of FLT-Mine, 286SB becomes active in leading to the command on step 464. Following Figure 9, we see that 286SB is prompted to select FLT-Yours^ with the support of **WM** on step 179 and this strengthens the FLT-Yours already being predicted by 534SD. Then on step 199 the unprompted selection of FLT-Mine by proper reading of **WM** leads to the storage, amongst others, of the associations 381SB and 394SA, which will be crucial on step 464.

Continuing with Figure 9, on step 249 the newly stored 381SB, which has acquired only the prediction FLT-Mine, is prompted to say “FLT-Yours^”, but because of failure later in the statement, 381SB is disapproved. The red ✓ **NEG** indicates that although robot A says NEG-Bad at the end, this FLT-Yours^ was correct. It is an example of how not being able to approve or disapprove until the end of the statement causes some correct Words to be disapproved when they are correct. Notice how this disapproved, but correct, FLT-Yours^ is acquired by the association 534SD, which continues to be strengthened in the overall learning, but without making any further contribution.

On step 255, association 286SB, which now has predictions of FLT-Mine and FLT-Yours, enables PP to read **WM** properly without a prompt and to be approved for its complete command (Figure 7 and Interaction) “Next Turn Is Yours So You Squash Cake CQ”. The selected FLT-Yours not only strengthens the weaker 534SD but causes the storage of the equal priority association 583SA.

Figure 9. Choosing FLT-Mine on Step 464.

```

Imitation
103
534SD
FLT-Yours          164
164 ✓ YES ---->286SB
FLT-Mine^          FLT-Mine^
179 <----- 179 <-WM ✓ YES
FLT-Yours^          FLT-Yours^
199 WM ✓ YES -----> 381SB -----> 394SA
FLT-Mine           |          FLT-Mine          FLT-Mine
249 <----- 249 ✓ NEG           |          |
FLT-Yours^         |          FLT-Yours^         |          255
255 <----- 255 <-WM ✓ YES -----> 583SA
FLT-Yours          FLT-Yours          |          |          FLT-Yours
302                302 <-WM ✓ NEG          |          |          |
FLT-Mine           FLT-Mine           |          |          |
369 <----- 369 <-WM ✓ YES <-----> 369
FLT-Mine ub        FLT-Mine ub        |          |          FLT-Mine ub
446 <----- 446 <-WM ✓ YES          |          |
FLT-Yours ub        FLT-Yours ub        |          |
464 <----- 464 <-WM ✓ YES          |          |
FLT-Mine           FLT-Mine           FLT-Mine

```

Abbreviations and Position Code were given in Figure 8.

Associations (cf. Figures 4 and 7.):

```
[534SD: BodyMove:FORWARD VOthrPosn:31 ObPosn:32 Touch:SpCkWl PointFO:-PtMe
HearFO:CQ,FLT-Next,FLT-Turn,FLT-Is >> FLT-Mine, FLT-Yours Nov=4]
[286SB: 31E OShape:Cake ObPosn:32,32 TchF:Ck Touch:SpCkWl PointFO:-PtMe,-PtMe
HearFO:FLT-You,FLT-Push,FLT-Cake,CQ,FLT-Next,FLT-Turn HearOthr:CQ InSSay:FLT-Is >>
FLT-Mine, Yours Nov=4]
[381SB: 31E OShape:Cake ObPosn:23,32 TchF:Sp Touch:SpCkWl PointFO:-PtMe,-PtMe HearFO:FLT-You,
FLT-Move,FLT-Forward,CQ,FLT-Next,FLT-Turn HearOthr:CQ InSSay:FLT-Is >>
FLT-Mine,FLT-Yours Nov=4]
[394SA: BodyMove:FORWARD VOthrMove:WAIT VOthrPosn:31 ObPosn:32 Touch:BkSpWl,SpCkWl VBrown:38
VBlack:U PointFO:-PtMe HearFO:FLT-So,FLT-You,FLT-Move,FLT-Forward,CQ,FLT-Next,FLT-Turn
HearOthr:CQ InSSay:FLT-Is >> FLT-Mine Nov=4]
[583SA: BodyMove:FORWARD VOthrMove:FORWARD VOthPosn:31 ObPosn:32 Touch:BkCkWl,SpCkWl VBrown:38
VBlack:U PointFO:-PtMe HearFO:FLT-So,FLT-You,FLT-Push,FLT-Cake,CQ,FLT-Next,FLT-Turn
HearOthr:CQ InSSay:FLT-Is >> FLT-Mine,Flt-Yours Nov=5]
```

Contexts of associations:

(Parts of context specified by associations are shown in orange.)

534SD	286SB	381SB	394SA	583SA
---eC	---eC	---eC	---eC	---eC
PP:F -#--N etc	---C -> -#--N etc	---C -> -#--N etc	A:W -#-- PP:F -#--N	A:F -#--C PP:F -#--N
---	---	---	---	---
CQ,Next,..Is	You,Push,..CQ/Is	You,Move,..CQ/Is	So,You,Move,..CQ/Is	So,You,Push,..CQ/Is

On step 302, association 286SB again reads **WM** properly to select FLT-Mine without prompt, but is disapproved because of failure later in PP's response (PP says Squash too soon). Because of this disapproval, the FLT-Mine required by **WM** on step 369 has to be unblocked before the predictions of FLT-Yours and FLT-Mine by 286SB and the FLT-Yours by 583SA can be weighted in favour of FLT-Mine by **WM** so as to lead PP to another successful command (See Figure 7 and the Interaction for step 369). We have now seen **WM** used successfully for PP's commands on steps 255 and 369. It should be admitted that the inclusion of association 583SA in Figure 9 wasn't necessary for explaining PP's command on step 464 but did show how the associations networked together to produce the overall learning.

On step 446, association 381SB uses **WM** and the unblocking of the FLT-Yours disallowed on step 249 to select FLT-Yours which enables PP to lead on to another successful command (See Figure 7 and the Interaction on step 446).

Finally, on step 464, PP can access FLT-Mine from **WM** without prompting or unblocking to lead on to PP's last successful command of the Interaction. The next section will mention a fly in the ointment!

As with Figure 8, the bottom of Figure 9 lists the associations and displays graphically the contexts. Because Figure 9 started with a higher priority association 534SD than Figure 8's 309SK, the contexts are more specific. Indeed, the association 534SD can be seen as useful in a wider range of situations than the SB associations because it requires a smaller number of Speech Words to match. Also, the SB associations will apply in a wider range than the SA associations because the latter fix the relative positions of the Stumps. Unfortunately, the contexts of the SD and SB associations cannot specify that the Cake must be in a corner, as can be seen by the associations 534SD and 381SB being activated on step 249 when the situation is nowhere near a Squash (see listing of Interaction). Only the SA associations can do that.

18. Making the Right Command on Step 464

Depending on whose turn it is to Squash the Cake and the relative positions of the robots (Figure 6), PP needs to tell robot A to Wait, to move Forward, to Push the Cake or to Squash the Cake. Figure 6 includes these options as well as listing the stimulus events pertaining to the different configurations. Needless to say, this is far more than can be learned in fewer than 500 steps. However some progress is made as is shown by the 19 commands in column 8 of Figure 7, coloured red to say that the command was appropriate to the situation.

Figure 10 shows how associations end up giving the command Wait on step 464. Again, we start with imitation on step 103, this time giving association 537SD and the prediction FLT-Squash. On step 179, 537SD gives a correct FLT-Squash command and stores the lower priority association 302SG. The latter's FLT-Squash on step 302 earns a disapproval, as can be seen from the Interaction, but the context of the association 705SB stored on that step matches STM on step 369. Because it has been disapproved on step 302, its FLT-Squash is announced as **blocked**, giving Teacher through robot A the options of (i) leaving it blocked, (ii) unblocking it, or (iii) prompting a different Word. From the listing of the Interaction it can be seen that the situation on step 369 calls for a FLT-Wait command by PP so it is prompted accordingly.

The need for prompting as a mechanism for learning is dramatically obvious here because robot A hasn't told robot B even once to Wait when a Squash was imminent: for robot B to learn to give this Wait command by imitation without prompting could take hundreds of steps.

As a result of the prompt, the association 886SC is stored and the association 1675SD, first stored with the disapproved FLT-Squash on step 302 is now given the additional prediction FLT-Wait and approved. On step 464, these two associations combine to select FLT-Wait for the almost successful command on step 464. "Almost successful" because PP fails to end with the command intonation CMD-Quiet (CQ), the default DRP-Quiet (Q) taking its place. How did this happen?

The first time PP produced a command without the CQ ending was on step 369 (see list of Interaction). PP was prompted with FLT-Wait^ and because robot A hadn't made a "So You Wait" command up till then, there was no association by imitation providing the terminating CQ. The default Q, as well as the default Hand Pointing NoPoint, are **not stored** as predictions of associations. They would swamp memory!! So Q and NoPoint cannot be approved, disapproved, blocked, or unblocked.

Figure 10. Choosing the FLT-Wait Command on Step 464.

```

Imitation
103
537SD
179      FLT-Squash
302SG <----- 179  ✓ YES
FLT-Squash      FLT-Squash      302      302
302  ✗ NEG -----> 1675SD -----> 705SB
FLT-Squash      FLT-Squash      369      FLT-Squash
369 <----- 886SC <----- 369  ✓ YES
FLT-Wait^      FLT-Wait^      FLT-Wait^
464 <-----> 464  ✓ YES
FLT-Wait      FLT-Wait

```

Abbreviations and Position Code were given in Figure 8.

Associations (cf. Figures 4 and 7.):

```

[302SG: VOthPos:31E ObPos:32 VBN/k:U/38 -y HearFO:FLT-Is,So,You >> FLT-Squash Nov=4]
[537SD: F VOthPos:31 ObPos:32 SpCkWL -y HearFO:FLT-Is,Yours,So,You >> FLT-Squash Nov=4]
[1675SD: F VOthPos:31 ObPos:32 SpCkWL -y HearFO:FLT-Is,Mine,So,You >> FLT-Wait Nov=4,FLT-Squash Dis=2]
[886SC: 31E ObPos:32 VBN/k:38/U -m -y HearFO:FLT-Turn,Is,Mine,So CQ/You >> FLT-Wait Nov=4]
[705SB: VOth31E Cake ObPos32,32 TchF:Ck SpCkWL -m -y HearFO:CQ,FLT-Next,Turn,Is,Mine,So CQ/FLT-You >>
                                           FLT-Wait Nov=5,Squash Dis=2]

```

Contexts of associations:

(Parts of context specified by associations are shown in orange.)

302SG	537SD	1675SD	886SC	705SB
-----	-----	-----	---eC	---C ---eC
-#---	PP:F -#---	PP:F -#---	-#--N	-#--N -> -#--N
S--#-	S--#-	S--#-	---#-	---#- ---#-
Cw---	Co---	Co---	-----	-----
Is,So,You	Is,Yours,..You	Is,Mine,..You	Turn,Is,..You	CQ,Next,..You

=====

Looking back at the earlier part of the Interaction, we can see that robot A did command FLT-Wait on steps 126 to 130, so why are those commands not supplying the associations that would predict CQ after FLT-Wait? Imitation on steps 126 to 130 produced the associations 683SD, 687SD, 691SD, 695SD, 535SI, 540SI, 544SI, 386SK, 390SK, 394SK and 398SK, all predicting CQ. We can disregard the SD associations because their contexts included the last 4 Speech Words and on steps 126 to 130 the commands were “Now You Wait” which couldn’t match “So You Wait”. The contexts of the SI associations are particular about the positions of the robots and the Cake, which makes them inapplicable. We are left with the much more promising SK associations that require only the last Body Move, Touch and the last Speech Word’s sound to match. There hasn’t been a match so far, but one was quite close (association 398SK from step 130 and 682SK from step 464) and it shouldn’t be long before PP learns to end these FLT-Wait commands with CQ.

19. Other Ways of Implementing Working Memory

In the extension of the Interaction, I will be showing how the same kind of **WM** can be used to remember numbers (recall the quotation from Pinker given at the beginning of this account). Robot A will be telling robot B what number to remember and then asking it what number it is currently remembering.

When describing how associations are stored I pointed out how every association provided a memory of its last prediction stored as this was always at the head of its list of predictions. Any method of using these head-of-the-list predictions could be a form of working memory.

In thinking about how I form relative clauses in sentences, I have the impression that it is done as a kind of diversion from which I return when the diversion is completed. This is similar to the way PP makes plans, but I haven’t yet worked out in detail how this might be done.

20. Planning

My earliest learning machine, STeLLA, [Andrae, 1963] had a crude form of planning, which was called dreaming at that time. It used crude matrix predictors which predicted a series of actions and their consequences. This was refined in the PP system [Andrae, 1998], where a copy of STM is made and predictions from this STM generate actions and stimuli alternately to take the STM copy into the imagined future. The prediction of actions is done in the same way as it normally selects actions, but the prediction of stimuli, that show how the World is expected to react to the predicted actions, uses associations from the stimulus-predicting associations (35 in the current implementation). The path of a predicted plan is remembered by marks placed on the predictions of associations in LTM that were used to predict the plan. When the plan reaches one of PP’s own novelty goals or an approved goal, or if predictions fail, it is terminated; the copy of STM is then discarded and operation continues from the main STM. Now, if the plan was successful in reaching a goal, PP tries to follow its plan, by favouring predictions that are marked in LTM. In [Andrae, 2011], predictions confirmed by plan-following were transferred to a Belief Memory in a form where they could be generalized so as to give a compact form of what the system had found to be reliable information. Also in [Andrae, 2011], a Trail Memory gave PP an extended present. Neither Belief Memory nor Trail Memory are included in the current implementation, which has been kept simple. Also, the Interaction here is so full of reinforcement by Teacher, that very short plans find goals. However, after the 997 step interaction was completed, a separate 149-step interaction was run with no approval being given by robot A (Teacher) so that fewer goals were formed and longer plans could be made. This interaction is discussed in the Appendix A5.

The process of planning, which was introduced to enable PP to look ahead and find good paths to goals which it could then follow, has wider implications. The essential idea of the planning is to have a separate STM that starts from the main STM and then propagates itself through LTM until it finds a goal. I can remember reading Fauconnier’s [1985] book on Mental Spaces and being very impressed, but seeing those spaces as very distant possibilities for a learning system. Recently, Fauconnier and Turner [2002] have taken the idea further and identified most of human thinking with double scope blending of mental spaces, an amazingly powerful concept, which they illustrate in boundless detail. If one identifies a mental space with a floating STM moving through LTM, the ideas of Fauconnier and Turner become much more reachable. To start with, we would need to see the launching of a floating STM by, for example, a question such as “Do

Figure 11. The Sentences Being Learned.

Note. The numbers are steps, taken from the listed Interaction. Parentheses show items to be incorrect.
 "u" added to a step number means the Body Move was unblocked.
 PP is allowed to start sentences of Groups 2 and 3 with YES-Good or NEG-Bad.

Group 1: Responding to robot A's commands:

You Move Forward CQ. 34, 42, 43, 44, 45, (49), 51, 52, 54, 55, (62), (63), 65, 72, 73, 76, 78, 92, 93, 95, 97, 98, 99, 101, 102, 111, 112, 113, 115, 119, 132, 142, 155, 156, 158, 159, 160, 161, 163, 174, 175, 176, 181, 190, 194, 195, (197), 198, (204), 205, 215, 231, 247u, 249, 263, 265, 270, 272, 273, 275, 279, 281, 293, 308, 310, 311, 312, 313, 315, 355, 356u, 373, 375, 376, 378, 394, 396, 397, 399, 409, 412, 413, 416, 428, 429, 443, 445, 454, 460, 461, 463, 472, 473, 484, 485, 487, 488, 490
 You Turn Left CQ. (46), 48, 70, 71, 77, 80, 90, 91, 118, 157, 162, 177, 188u, 196, 203, (207), 208, 210, 230, 232, 248, 264, 274u, 297, 300, 347, 360, 362, 367, 395, 410, 411, 444, 462, 483
 You Turn Right CQ. 15, 39, (67), (94), (95), 96, 100, 114, 141, 147, 148, (152), 153, (182), (183), 218, 221, 225, 236, 239, 269, 271, 276, 280, 282, 286, 292, 309, 314, 327, 331, 337, 338, 354, 357, 372, 374, 379, 382, 386, 387, 398, 401, 414, 415, 431, 442u, (450), 451, (452), 453, (457), 458, 459, 471, 480, 481, 486, 489
 You Push Cake CQ. 11, 16, 56, 57, 81, 82, 83, 86, 137, 149, 178, 216, 220, 222, 223, 224, 227, 233, 234, 237, 238, 240, 254, 277, 283, 284, 285, 288, 295, 298, 299, 301, 325, 326, 328, 329, 330, 332, 333, 334, 339, 348, 349, 358, 361, 363, 364, 365, 366, 368, 380, 383, 388, 389, 400, 402, 420, 430, 432, 433
 You Squash Cake CQ. doesn't occur outside Group 3.
 You Squeeze Cake CQ. 235, 296, 359, 381
 Now You Wait CQ. 127u, 128, 129, 130, 131

Group 2: Imitating robot A's Speech (unless group 3 takes precedence)

I Moved Forward Q. 26, 29, 76, 78, 93, 94, 97, 98, 99, (100), 101, 102, (103), (110), 111, 112, 113, 115, (116), 119, 123, (125), 132, (134), 142, 155, 156, 158, 159, 160, 161, 163, 173, 174, 175, 176, 181, 190, 194, 195, 198, (201), (202), 206, 207, (209), 215, (216), 231, 245, 246, 247, (252), 257, 258, (260), 262, 263, 265, 270, 272, 273, 275, (279), 281, 291, (296), 306, 308, 310, 311, 312, 313, 315, (316), (318), (321), 323, 324, (330), (336), 344, (346), 353, 355, 356, 373, 375, 376, (377), 378, (385), 394, 396, 397, 407, 408, 409, 412, 413, 416, 417, 424, 425, 428, 438, 439, 440, 445, 449, 460, 461, 463, 468, 472, 473, (481), 484, 485, 487, 488, 490
 I Turned Left Q. 70, 80, 84, 90, 146, 177, 188, 189, 196, 203, 208, 210, (211), 230, 232, 248, 253, 261, 264, 274, 278, (293), 294, 297, 300, 347, 352, 360, 362, 367, (392), 395, 410, 411, 418, 441, 444, 450, 456, 457, 462, (469), 479, (482), 483
 I Turned Right Q. (109), (120), 268, 276, 280, 282, 286, 304, 309, 314, 322, 327, 331, 338, 342, 357, 371, 379, 382, 387, 393, 398, 401, 405, 414, 415, 427, 431, 436, 442, 451, (452), 453, 458, 459, 466, (471), 480, 486, 489, 493
 I Pushed Cake Q. 233, 234, 251, 277, 283, 284, 287, 295, 298, 299, 301, (320), 325, (328), 333, 334, 339, (340), (350), 361, 365, 366, 380, 383, 388, (399), 400, (429), 430
 I Squashed Cake Q. doesn't occur outside Group 3.
 I Squeezed Cake Q. (27), (31), (107)
 I Waited Q. Robot A didn't show robot B what to say after WAIT. (197)

Group 3: Imitating robot A's Speech (after a Squash)

I Squashed Cake So Next Turn Is Yours Q. (88), 104, 139, 165, 200, 242, 267, 303, 341, 370, 404, 435, 465, 492
 You Squashed Cake So Next Turn Is Mine Q. 61, 117, 151, 180, 229, 256, 290, 317, 319, 351, 391, 422, 447, 475, 477
Responding (r) to and Imitating (i) (just before a Squash)
 Next Turn Is Yours So You Squash Cake CQ. 36r, 88r, 104r, 139r, 165r, 179i, 200r, 228i, 242r, (244i), (249i), 255i, 267r, 289i, 303r, 341r, 370r, 390i, 404r, 421i, 435r, 446i, 465r, 474i
 Move Forward CQ. (49i), 103r, 199r, (219i), 227i, 254i, (288i), 316r, 349i, 420i, 464r, 491
 Push Cake CQ. 35r, 87r, 138r, 164r, 228r, 241r, 266r, 289r, 302r, 340r, 369r, 403r, (149i) 434r
 Wait CQ.
 Next Turn Is Mine So You Move Forward CQ. 116r, 368i, 433i, 474r
 Push Cake CQ. 17r, 60r, 150r, 179r, 255r, 350r, 390r, 421r, 491r, (164r), 369i, 403i, 432i, (434i), 464i
 Wait CQ.
 Next Turn ... failures to complete. 92, 109, 110, 133, 136, 137, 144, 145, 149, 164, 191, 192, 193, 199, 220, 223, 224, 226, 235, 238, 240, 241, 266, 285, 302, 307, 326, 329, 332, 335, 345, 348, 358, 381, 384, 389, 402, 419, 455.
 =====

you like chocolate?” The floating STM would then drive a mental space through LTM to induce memories of chocolate leading to an answer. There are so many directions in which this research can be pursued.

In my current computer program, plans are made in gaps between the main steps of robot B. This is largely due to my incompetence as a computer programmer rather than the serial nature of modern computers, as my computer has 4 processors. If I had the skills and the time, it would be sensible to run plans in parallel with the main steps of the robot, using a separate Java thread. But what about the speech in the plans? Does it become inner speech? My impression is that I myself never have two streams of speech at the same time, be they inner or external. If I am carrying out a familiar manual task while talking to someone about something else, the manual task becomes subconscious. Speech seems to be the one activity we can't become unaware of. There is much to sort out.

21. Prompting and Unblocking

The speed with which PP learns to use the sentences in the Interaction from a blank slate start is surprising and is due largely to my attempts to keep the Interaction short. As it is, the Interaction is too long to read through comfortably. The sentences themselves (statements and commands listed in Figure 11 with the steps where they occur.) were what came naturally to me with the possible exception of the omission of “the”. Understanding the short 3-word Do-As-You-Are-Told sentences (You Move Forward, etc) by robot A and saying the short 3-word Say-What-Your-Are-Doing sentences (I Turned Left etc) by robot B do not require prompting. In fact, 17 of the 18 prompts were for “Mine” or “Yours” in PP's learning to access **WM**. The 18th was to introduce “Wait” as a command on step 369. For PP to access a Word from **WM** it has to be predicting the alternatives so that **WM** can strengthen the alternative that is in **WM**. There are so many different World configurations for which the alternatives need to be learned that the prompting has reduced the length of the Interaction enormously. The prompting provides the alternative when it is needed and PP adds it to the predictions in its associations. I find this prompting fits well with how I think children are helped to learn new words, but advice from psychologists would be helpful. Without the addition of the “Wait” command by a prompt on step 369, PP would have had to wait for robot A to say a similar command so that PP could learn it by imitation. Again, the main justification for the prompting is to reduce the length of the interaction, while hoping that there is some psychological justification too.

Unblocking cannot be justified as a shortening of the Interaction. As explained above, when robot A disapproves of a sentence by robot B (with NEG-Bad), it will usually be because one Word was wrong in a sentence of up to 10 Words plus the accompanying hand pointing. This will cause disapproval marks to be put on all predictions of associations supporting those Words and pointings. When a context matching one of those associations recurs, PP has the prediction blocked, even for those Words and pointings that were correct at the time of the disapproval. To avoid the resulting mass disapproval of correct actions, robot A is given the chance to unblock blocked predictions as they become available for use. My view is that this is similar to helping a child to say a word s/he is hesitating to say and I haven't thought of another way of dealing with the situation.

22. Future Research

Not much more can be done with MCAL on a personal computer with one elderly programmer.

The system needs to be put into a robot so that the world doesn't have to be simulated and long interactions can be realized. The robot's effectors and sensors will increase the number of event-types and this will increase the number of templates. PP was designed for parallel processing with each template having its own processor, so that the speed of the system isn't reduced by increasing the number of templates.

As the system grows in complexity, we can expect a need for new kinds of template. I have done some experiments with re-entrant templates that have their own previous context as an event-type in their current context. These would be equivalent to a context going back to the beginning of the interaction so there has to be some attenuating factor to control their effective length. If computational ANNs (CANNs) can be designed with the computational strength of templates, these can replace templates and research can focus on developing the CANNs. Many aspects of cognitive processing, such as the segmentation of speech, will require ordinary statistical ANNs, so we can look forward to systems in which ANNs

and CANNs operate together. In the meantime, PP's ability to learn from single exposures to events and the ease with which its operation can be analysed offer significant advantages over ANNs in learning a language.

One last thought: if the hierarchies of templates in MCAL, with their established ability for recursion, could be seen as a realization of UG, the current arguments between those for and against UG could vanish as completely as Fodor and Pylyshyn's 'scientific revolution'.

23. Conclusion

Multiple Context Associative Learning can support working memory so Pinker's claim does not apply to all associative learning. Multiple Context Associative Learning is computational so Fodor and Pylyshyn's scientific revolution disappears. Some Artificial Neural Networks need to have a computational base like PP in order to process conversational language with learning from single exposures of words and phrases.

Associative learning is unlikely to meet all the challenges of language and thought, sketched out by Herbert Clark's *Using Language* [1996], Fauconnier and Turner's *The Way We Think* [2002] and Steven Pinker's [2007] *The Stuff of Thought*, but it should be a major contributor.

1. Appendix

Extension of the Interaction and Additional Interaction.

A1. Steps 494-596: Slot and Filler.

In this short section of about 100 steps, the Cake is replaced by a Roll and we see how PP accepts the change.

The templates BD, BE, SE, SF, SG, PF and PG were designed to accept an unknown Speech Word by having a gap in their sequence of HearFO event-types. Thus, SE omits HearFO with zero delay (HearFO,0), SF omits HearFO with one step delay (HearFO,1) and SG omits HearFO with 2 steps delay (HearFO,2). These prevent the system from refusing to make associations from Speech sequences having an unknown Word. The system is also protected from rejecting a seen new object, because only 5 of the action-predicting templates (Figures 4,18,21) have the object shape as an event-type, all the others have just object position as an event-type or no object event-type. Touch distinguishes the Cake and Roll objects but only when they are being touched, and 16 action-predicting templates have no Touch event-type. Hand pointing doesn't distinguish Cake and Roll because it just points to the object.

There is no mention of the Word "Roll" by robot A up to step 505 so PP says "Next Turn Is Yours So You Squash Cake CQ" on that step. Robot A Squashes and says "Bad", which is a bit unfair but enables robot A to prompt with "Roll" later on step 527 when the situation recurs and it all has to be unblocked. Robot A's "I Squashed Roll So Next Turn Is <Yours Q" on step 505 doesn't stop PP from immediately saying "You Squashed Cake So Next Turn Is <Mine Q" and receiving another "Bad". PP does however store 3 associations predicting FLT-Roll by imitation of robot A's statement (1979SD, 422SI and 1084SK) and these are then predicting both FLT-Cake and FLT-Roll. By step 596, PP has 113 associations predicting FLT-Roll alone and 51 predicting FLT-Cake and FLT-Roll. **It is acquiring the ability to distinguish between Cake and Roll as well as the ability to treat them as equivalent.** The contexts of the stronger associations will be determining the structural correspondencies for when the two are to be treated as equivalent or different. (c.f. the discussion by Tomasello [2003, p.165] of how a child might align *The car is towing the boat* and *The truck is towing the car* by matching the functional roles of *the car* in the first and *the truck* in the second.)

On step 510 in the Interaction, PP responds to "You Push Roll" using the template BE (mentioned above) with a FORWARD but it hasn't yet heard robot A say "I Pushed Roll" so it says "I Pushed Cake" and is disapproved. This is repeated on step 511 and association 1199SE is one of the associations disapproved. On step 514, PP finds Cake is blocked by association 1199SE and robot A is given the chance to prompt with Roll. Unfortunately, PP's pointing is also blocked and PP is out-of-reach to help with that, so robot A doesn't give approval. However, on step 516, when Cake is blocked

again but this time by association 969SH, which was disapproved on step 513, robot A is now within reach, so robot A unblocks the pointing and the “I Pushed”, robot A prompts with Roll, and robot A approves the statement. (All these details are available from the data files produced by the computer program during the Interaction.)

PP is not quick to start saying Roll, when the Cake is switched to Roll, but in other ways it takes the switch in its stride. PP fails to select the Body Move 6 times in the 100 steps from 500 to 600, compared with 5 times from 400 to 500, and 6 times for 300 to 400, so its selection of Body Moves isn’t upset by the switch from Cake to Roll. The full step numbers in the Interaction, which are 300-3164, 400-4373, 500-5612 and 600-6831 at steps 300, 400 and 500, show that the number of fine steps between steps 300 and 400 is 1209, between 400 and 500 is 1239, and between 500 and 600 is 1219, indicating very similar activity in the three intervals, which one wouldn’t expect if PP’s speech and pointing was upset by the switch from Cake to Roll. In the interval from 494 to 596 while the object is the Roll, PP says Roll only 7 times, the first 4 being with prompting, but PP says Cake 15 times. It would take several hundred steps with Cake and Roll being swapped for PP to begin using the correct name.

A2. Steps 597-717: Remembering Numbers.

In this section of 120 steps, Working Memory (**WM**) is used in a somewhat different way to remember numbers.

Because I don’t want the remembering to be dependent on a varying environment and because I can’t have the robots just looking up into the sky or at each other’s faces in the way that we might if we were thinking and didn’t want to be distracted by things around us, I will get the robots to stand side-by-side and look at the Wall. To enable learning by imitation, this arrangement of the robots will have to be with robot A on the left of robot B (cAB) and robot B on the left of robot A (cBA). If robot B sees robot A act in a cAB configuration, it can imitate robot A’s action when it is in the cBA configuration. To imitate robot A, robot B must be in the same position as robot A was in when it saw robot A act. And vice-versa from cBA to cAB. The listing of the Interaction shows that the robots are in a cAB configuration from step 605 to step 620 and from step 688 to step 716. The robots are in a cBA configuration from step 644 to step 673.

The object of the exercise is to show robot B how to set its current number and how to recall the last number it set. When robot A says “Make Your Number Three” we want robot B to say “My Number Is <Three” (with stress < on the word Three), thereby putting a Three into **WM**. When robot A asks “What Is Your Number?”, we want robot B to say the number that is in its **WM**, but without the stress. There are two difficulties.

The first difficulty is with robot A showing robot B how to respond to the command “Make Your Number Three CMD-Quiet”. Robot A has to set up the context with the command and follow it with the response “My Number Is <Three DRP-Quiet”. If robot B interjects with any Speech after the command, the context will be spoiled, so robot B has to be taught to keep quiet! This takes quite a bit of disapproval. Looking at steps 606 and 607 of the Interaction we see:

606-6894		
PP:WAIT Q n		
A:WAIT Make y Your y Number y Three y CQ m	Command sets context.	
607-6902		
PP:WAIT Q n	Robot B keeps quiet.	
A:WAIT My m Number m Is m <Three m Q m	Response to be imitated by robot B.	

The second difficulty is more of a problem and my solution may not be approved by the reader! When robot A asks the question “What Is Your Number RIS-Quiet” the RIS-Quiet hands over the conversation to robot B. I can imagine a human just **barging on** with the answer without waiting for the other person to give an inappropriate answer. My solution realizes the **barging on** with RIS-Quiet being replaced by FLT-Quiet, the FLT-Quiet being interpreted as RIS-Quiet by imitation. The intonation FLT means keep going, so perhaps it isn’t so far from **barging on!!** Looking at step 609 of the Interaction we see:

609-6922	
PP:WAIT Q n	
A:WAIT What y Is y Your y Number y FLT-Quiet m Now m My m Number m Is m Three m Q m	

Steps 606 and 607 are repeated on steps 611 and 612 with the number Two, and on steps 616 and 617 with the number One. Step 609 is repeated on step 614 with the number Two and on step 619 with the number One. All of this has been done with robot A on the left of robot B (cAB), so they should lead to imitation when the robots find themselves with robot B on the left (cBA) from steps 644 to 673. Of course, when in cBA, all of this has to be repeated so it can be imitated in cAB. Repeats of steps 606 and 607 with the three numbers can be seen on steps 652 and 652 (One), 656 and 657 (Two), and 660 and 661 (Three).

As soon as PP in robot B finds itself facing the Wall with robot A on its right on step 642, the imitation associations enable it to imitate “My Number Is <Three” without a command from robot A. Although not what was wanted and disapproved, it is valid and sets **WM** to Three. On step 645, PP imitates the question “What Is Your Number?”, which is again valid but not wanted, so robot A answers the question. Robot A then asks the question itself, which receives a correct answer with PP accessing **WM** properly using the imitation association 3376SD. Recall that the reading of **WM** properly requires the prediction of the alternatives (here One, Two and Three) so that **WM** can strengthen the alternative that it is holding. Association 3376SD is the strongest imitation association stored on steps 609, 614 and 619, which gave it the three alternatives, with FLT-Three picked out by **WM**:

```
[3376SD: BodyMove:WAIT VOthrPosn:42 ObPosn:U Touch:WlWlRb PointFO:-PtMe
HearFO:FLT-Now, FLT-My, FLT-Number, FLT-Is >> FLT-One, FLT-Two, FLT-Three]
```

WM is held by associations of template SW, in this case:

```
[1SW: FLT-My, FLT-Number, FLT-Is >> FLT-Three]
```

Looking at step 645 in Figure 12, we see that PP’s correct answer of FLT-Three results in the storing of 3 associations stronger than 3376SD, namely 1945SA, 1755SB and 1699SC. The two strongest, 1945SA and 1755SB, are listed in Figure 13.

Remembering Numbers shows a different use of **WM** and introduces the questioning intonation RIS. The teaching has been carried out in a systematic fashion, summarized in Figures 12 and 13. Answering questions without the FLT-Quiet “trick” is shown in section A4.

Figure 12. Learning To Remember The Numbers.

cAB (Steps with robot A on robot B’s left, both facing the Wall)

```
Step 606: A:Make Your Number FLT-Three. Step 607: A:My Number Is FLT<Three.
FLT-My:3354SD,977SI,1343SK FLT<Three:3357SD,508SI,1349SK (imitation associations)
Step 611: A:Make Your Number FLT-Two. Step 612: A:My Number Is FLT<Two.
FLT-My:3382SD,977SI,1343SK FLT<Two:3357SD,508SI,1349SK (imitation associations)
Step 616: A:Make Your Number FLT-One. Step 617: A:My Number Is FLT<One.
FLT-My:3389SD,977SI,1343SK FLT<One:3357SD,508SI,1349SK (imitation associations)
Step 609: A:What Is Your Number F? Now My Number Is FLT-Three.
FLT-Now:3372SD,2715SI,1343SK FLT-Three:3376SD,508SI,1349SK (imitation associations)
Step 614: A:What Is Your Number F? Now My Number Is FLT-Two.
FLT-Now:3372SD,2715SI,1343SK FLT-Two:3376SD,508SI,1349SK (imitation associations)
Step 619: A:What Is Your Number F? Now My Number Is FLT-One.
FLT-Now:3372SD,2715SI,1343SK FLT-One:3376SD,508SI,1349SK (imitation associations)
```

cBA (Steps with robot A on robot B’s right, both facing the Wall)

```
Step 642: PP:WAIT My. m. Number. m. Is. m. <Three. m. CQ m. PP sets WM=Three unasked.
Step 645: A:What Is Your Number R? PP: Now My Number Is FLT-Three. (One,Two,Three predicted)
FLT-Three:1945SA,1755SB,1699SC,3376SD (learned associations)
Step 649: A:What Is Your Number F? Now My Number Is FLT-Three.
FLT-Now:3512SD,2816SI,1326SK FLT-Three:3516SD,2813SI,1333SK (imitation associations)
Step 652: A:Make Your Number FLT-One. Step 653: A:My Number Is FLT<One.
FLT-My:3539SD,2776SI,1326SK FLT<One:3542SD,2813SI,1333SK (imitation associations)
Step 656: A:Make Your Number FLT-Two. Step 657: A:My Number Is FLT<Two.
FLT-My:3555SD,2776SI,1326SK FLT<Two:3542SD,2813SI,1333SK (imitation associations)
Step 658: A:What Is Your Number F? Now My Number Is FLT-Two.
FLT-Now:3512SD,2816SI,1326SK FLT-Two:3516SD,2813SI,1333SK (imitation associations)
Step 660: A:Make Your Number FLT-Three. Step 661: A:My Number Is FLT<Three.
FLT-My:3566SD,2776SI,1326SK FLT<Three:3542SD,2813SI,1333SK (imitation associations)
Step 662: A:What Is Your Number F? Now My Number Is FLT-One.
FLT-Now:3512SD,2816SI,1326SK FLT-One:3516SD,2813SI,1333SK (imitation associations)
Step 663: A:What Is Your Number R? PP: Now My Number Is FLT-Three. (Three predicted)
FLT-Three:1945SA,1755SB,1699SC,3376SD (learned associations)
Step 664: A:Make Your Number FLT-One. Step 665: PP:My Number Is FLT<One. WM=One
FLT<One:1976SA,1784SB,1721SC,3357SD (learned associations)
Step 666: A:What Is Your Number R? PP:Now My Number Is FLT-One^. (Three predicted)
FLT-One^:1945SA,1755SB,1699SC,3376SD (learned associations)
Step 668: A:Make Your Number FLT-Two. Step 669: PP:My Number Is FLT<Two^. WM=Two
FLT<Two^:1989SA,1796SB,1732SC,3357SD (learned associations)
```

```

Step 670: A:What Is Your Number R?  PP:Now My Number Is FLT-Two^.      (One and Three predicted)
                                           FLT-Two:1945SA,1755SB,1699SC,3376SD  (learned associations)
Step 672: A:Make Your Number FLT-Three. Step 673: PP:My Number Is FLT<Three.      WM=Three
                                           FLT<Three:1993SA,1801SB,1736SC,3357SD  (learned associations)
cAB (Steps with robot A on robot B's left, both facing the Wall)
Step 688: A:What Is Your Number R?  PP: Now My Number Is FLT-Three.
                                           FLT-Three:2042SA,1846SB,1780SC,3516SD  (learned associations)
Step 698: A:Make Your Number FLT-Two. Step 699:PP:My Number Is FLT<Three.      WM=Three
                                           FLT<Three:2070SA,1874SB,1807SC,3542SD  (disallowed associations)
Step 700: A:What Is Your Number R?  PP: Now My Number Is FLT-Three. (Three predicted)
                                           FLT-Three:2042SA,1846SB,1780SC,3516SD  (learned associations)
Step 702: A:Make Your Number FLT-Two. Step 703:PP:My Number Is FLT<One.      WM=One
                                           FLT<One:2070SA,1874SB,1807SC,3542SD  (disallowed associations)
Step 704: A:What Is Your Number R?  PP: Now My Number Is FLT-One^. (Three predicted)
                                           FLT-One:2042SA,1846SB,1780SC,3516SD  (learned associations)
Step 706: A:Make Your Number FLT-Two. Step 707:PP:My Number Is FLT<Two.      WM=Two
                                           FLT<Two:2070SA,1874SB,1807SC,3542SD  (learned associations)
Step 708: A:What Is Your Number R?  PP: Now My Number Is FLT-Two^. (One and Three predicted)
                                           FLT-One:2042SA,1846SB,1780SC,3516SD  (learned associations)
Step 710: A:Make Your Number FLT-One. Step 711:PP:My Number Is FLT<One.      WM=One
                                           FLT<One:2080SA,1885SB,1818SC,3542SD
Step 712: A:What Is Your Number R?  PP: Now My Number Is FLT-One. (One, Two and Three predicted)
                                           FLT-One:2042SA,1846SB,1780SC,3516SD  (learned associations)
Step 714: A:Make Your Number FLT-Three. Step 715:PP:My Number Is FLT<Three.      WM=Three
                                           FLT<Three:2084SA,1889SB,1822SC,3542SD
Step 716: A:What Is Your Number R?  PP: Now My Number Is FLT-Three. (One, Two and Three predicted)
                                           FLT-Three:2042SA,1846SB,1780SC,3516SD  (learned associations)
=====

```

Figure 13. Associations Of Templates SA and SB Learned To Remember Numbers.

These are the associations as they were on step 717 after the learning was completed.

What Is Your Number?

cBA

```

[1945SA: BodyMove:WAIT VOthrMove:WAIT VOthPosn:42 ObPosn:U Touch:WlWlRb, WlWlRb VBrown:U
VBlack:U PointFO:-PtMe HearFO:FLT-Is, FLT-Your, FLT-Number, RQ, FLT-Now, FLT-My, FLT-Number
HearOthr:RQ InSSay:FLT-Is >> FLT-Two Nov=5, FLT-One Dis=2, FLT-Three Nov=4]
[1755SB: 42N OShape:Cake ObPosn:U, U TchF:Wl Touch:WlWlRb PointFO:-PtMe, -PtMe HearFO:FLT-Your,
FLT-Number, RQ, FLT-Now, FLT-My, FLT-Number HearOthr:RQ InSSay:FLT-Is
>> FLT-Two Nov=5, FLT-One Dis=2, FLT-Three Nov=4]

```

cAB

```

[2042SA: BodyMove:WAIT VOthrMove:WAIT VOthPosn:40 ObPosn:U Touch:RbWlSp, RbWlSp VBrown:U
VBlack:U PointFO:-PtMe HearFO:FLT-Is, FLT-Your, FLT-Number, RQ, FLT-Now, FLT-My, FLT-Number
HearOthr:RQ InSSay:FLT-Is >> FLT-Three FLT-One Nov=4 FLT-Two Nov=5]
[1846SB: 40N OShape:Cake ObPosn:U, U TchF:Wl Touch: RbWlSp PointFO:-PtMe, -PtMe HearFO:FLT-Your,
FLT-Number, RQ, FLT-Now, FLT-My, FLT-Number HearOthr:RQ InSSay:FLT-Is
>> FLT-Three FLT-One Nov=4 FLT-Two Nov=5]

```

Make Your Number One:

cBA

```

[1976SA: BodyMove:WAIT VOthrMove:WAIT VOthPosn:42 ObPosn:U Touch:WlWlRb, WlWlRb VBrown:U
VBlack:U PointFO:-PtMe HearFO:FLT-Make, FLT-Your, FLT-Number, FLT-One, CQ, FLT-My, FLT-Number
HearOthr:CQ InSSay:FLT-Is >> FLT<One Nov=5]
[1784SB: 42N OShape:Cake ObPosn:U, U TchF:Wl Touch:WlWlRb PointFO:-PtMe, -PtMe HearFO:FLT-Your,
FLT-Number, FLT-One, CQ, FLT-My, FLT-Number HearOthr:CQ InSSay:FLT-Is
>> FLT<One Nov=5]

```

cAB

```

[2080SA: BodyMove:WAIT VOthrMove:WAIT VOthPosn:40 ObPosn:U Touch:RbWlSp, RbWlSp VBrown:U
VBlack:U PointFO:-PtMe HearFO:FLT-Make, FLT-Your, FLT-Number, FLT-One, CQ, FLT-My, FLT-Number
HearOthr:CQ InSSay:FLT-Is >> FLT<One Nov=5]

```

```
[1885SB: 40N OShape:Cake ObPosn:U,U TchF:Wl Touch: RbWlSp PointFO:-PtMe,-PtMe HearFO:FLT-Your,
FLT-Number,FLT-One,CQ,FLT-My,FLT-Number HearOthr:RQ InSSay:FLT-Is
>> FLT<One Nov=5]
```

Make Your Number Two:

cBA

```
[1989SA: BodyMove:WAIT VOthrMove:WAIT VOthPosn:42 ObPosn:U Touch:WlWlRb, WlWlRb VBrown:U
VBlack:U PointFO:-PtMe HearFO:FLT-Make,FLT-Your,FLT-Number,FLT-Two,CQ,FLT-My,FLT-Number
HearOthr:CQ InSSay:FLT-Is >> FLT<Two Nov=5]
```

```
[1796SB: 42N OShape:Cake ObPosn:U,U TchF:Wl Touch:WlWlRb PointFO:-PtMe,-PtMe HearFO:FLT-Your,
FLT-Number,FLT-Two,CQ,FLT-My,FLT-Number HearOthr:CQ InSSay:FLT-Is
>> FLT<Two Nov=5]
```

cAB

```
[2070SA: BodyMove:WAIT VOthrMove:WAIT VOthPosn:40 ObPosn:U Touch:RbWlSp, RbWlSp VBrown:U
VBlack:U PointFO:-PtMe HearFO:FLT-Make,FLT-Your,FLT-Number,FLT-Two,CQ,FLT-My,FLT-Number
HearOthr:CQ InSSay:FLT-Is >> FLT<Two Nov=5, FLT<One FLT<Three Dis=2]
```

```
[1874SB: 40N OShape:Cake ObPosn:U,U TchF:Wl Touch: RbWlSp PointFO:-PtMe,-PtMe HearFO:FLT-Your,
FLT-Number,FLT-Two,CQ,FLT-My,FLT-Number HearOthr:RQ InSSay:FLT-Is
>> FLT<Two Nov=5, FLT<One FLT<Three Dis=2]
```

Make YourNumber Three:

cBA

```
[1993SA: BodyMove:WAIT VOthrMove:WAIT VOthPosn:42 ObPosn:U Touch:WlWlRb, WlWlRb VBrown:U
VBlack:U PointFO:-PtMe HearFO:FLT-Make,FLT-Your,FLT-Number,FLT-Three,CQ,FLT-My,FLT-Number
HearOthr:CQ InSSay:FLT-Is >> FLT<Three Nov=1]
```

```
[1801SB: 42N OShape:Cake ObPosn:U,U TchF:Wl Touch:WlWlRb PointFO:-PtMe,-PtMe HearFO:FLT-Your,
FLT-Number,FLT-Three,CQ,FLT-My,FLT-Number HearOthr:CQ InSSay:FLT-Is
>> FLT<Three Nov=1]
```

cAB

```
[2084SA: BodyMove:WAIT VOthrMove:WAIT VOthPosn:40 ObPosn:U Touch:RbWlSp, RbWlSp VBrown:U
VBlack:U PointFO:-PtMe HearFO:FLT-Make,FLT-Your,FLT-Number,FLT-Three,CQ,FLT-My,FLT-Number
HearOthr:CQ InSSay:FLT-Is >> FLT<Three Nov=5]
```

```
[1889SB: 40N OShape:Cake ObPosn:U,U TchF:Wl Touch: RbWlSp PointFO:-PtMe,-PtMe HearFO:FLT-Your,
FLT-Number,FLT-Three,CQ,FLT-My,FLT-Number HearOthr:RQ InSSay:FLT-Is
>> FLT<Three Nov=5]
```

=====

A3. Counting and Recursion.

This section can be seen as a sample of my current thinking.

In the last section A2, WM was used to remember just three numbers, One, Two and Three. This may seem a long way from being able to count to indefinitely large numbers, for which we need to know the names Zero to Nine to Nineteen to Twenty to Ninety, a Hundred, a Thousand, and a Million. Much above ten million we have trouble remembering the more than 7 digits we have reached so we need paper and pencil or some equivalent external storage to proceed. To go from one number to the next, we need to be able to carry a One from Nine to Ten, Nineteen to Twenty, and so on. This is a lot of detail which misses the essential nature of counting. If we count in binary, things are simpler but we get long strings of digits, 0 and 1, that we fail to remember much sooner. To teach PP to count in binary in the World we have been using would need some help from Teacher. If Teacher held the number and PP learned to tell Teacher what changes to make to the number for counting, PP would have to learn the following rules:

If digit is a 0, tell Teacher to change it to 1 and announce new number. Ask Teacher for rightmost digit.

If digit is a 1, tell Teacher to change it to 0 and ask Teacher for next digit to the left.

If digit is empty, tell Teacher to make it a 1 and announce new number. Ask Teacher for rightmost digit.

Teacher would say it had an empty digit both at the start and if it was asked for a digit to the left of its leftmost digit.

Compare this with the rules being taught to PP for Remembering Numbers:

If What question and WM has number N, say N.

If Make N command, set WM to N.

In order to show that a Multipl Context system could emulate a UTM (MacDonald & Andrae, 1981], we had to teach it the rules (quintuples) of the UTM, as well as remembering, manipulating and extending the tape. The essential recursive nature of the UTM is in the quintuples.

The associations of PP are all of the form:

If context then predict or don't predict, where actions or stimuli are being predicted.

The hierarchy of templates are designed to make a wide range of contexts available so that any rules can be learned, be they recursive or not.

My current program for simulating PP and its World is written in BlueJ Java, so I am probably limited to an interaction of about 1000 steps. After that, forgetting will keep the total memory approximately constant but the limited speed of a serial processor will make teaching even more tedious. As it is, checking that Teacher hasn't made errors or failed to notice aspects of PP's learning is a demanding task, mainly because it is an unnatural World for Teacher. The cost of missing a mistake is usually a return to where the mistake was made as the smallest change can affect the random number sequences and lead to quite different behaviour by PP. If PP is put into a robot, the world won't need to be simulated and teaching should be more natural, but there will need to be more parallel processing to handle the larger number of event types and templates.

Michael Corballis [2011] has argued convincingly that Mental Time Travel and Theory of Mind were the driving forces behind the evolutionary transition from manual and facial gestures to clicks and vocalization and finally to sound-based language. Mental Time Travel enables humans to plan the future using experience from the past. Language enables this to be shared within a group so that cooperation can exploit the experiences of individuals. The other factor essential for cooperation is the ability of individuals to understand the intentions and emotions of others in their group, that is Theory of Mind. What would PP require to be a brain that could support Mental Time Travel and Theory of Mind? The recursion that Corballis sees as a common feature of these two abilities doesn't seem to be a problem for PP, as explained above, but these abilities do present their own difficulties.

For PP to acquire Theory of Mind it will need a more complex world with at least 2 agents (robotic or human) other than itself, so that PP can observe interactions between the other two agents as well as its own interactions with them. At the moment, PP has templates with contexts containing mirror neuron events that predict stimuli, but it would need more such templates to predict both stimuli and actions in order to react to intentions and emotions. PP's robot body would need appropriate expressions of emotion. At present, the only states of PP that could be seen as emotional are called **boredom** and **frustration**. Boredom prevents PP from staying in a trapping state or limit cycle. Frustration prevents PP from keeping on making an impossible plan. These are features introduced for engineering reasons, rather than to make PP's body more compatible with a human's body.

PP already has Mental Time Travel in its planning ability which has required a major structural addition in the form of an extra STM (short term memory). To make a plan, PP's STM is copied into the extra STM and PP uses this STM in the same way as its main STM, choosing actions by selecting from its predictions. However, its stimuli are obtained, not from the World, but from its own stimulus-predicting associations. When the plan terminates, either because a goal is reached or it fails to predict an action or stimulus, the extra STM is wiped, ready for another plan, and PP continues with its main STM. The plan is recorded by marks on those associations in LTM that were used to predict the actions and stimuli of the plan. PP then tries to follow the plan in the World by favouring marked associations. This is Mental Time Travel into the future and has been quite successful. Another form of Mental Time Travel has been proposed but not fully implemented, in which PP would respond to a question by diving into LTM with an STM primed somehow (! the sticking point!) by the question. Recalling a past sequence of events would need something similar using some clue relevant to the time of the happening. Apart from the planning, this is very tentative and must wait for further research. The idea of extra STMs does have merit, however, as a form of **WM**, especially for centre-embedded sentences, where each embedding would be carried by an extra STM. To me, this feels more like the way I do centre-embedding on the rare occasions that I need it. Tail-recursion, or end-embedding, seems to be quite adequately handled by the kind of **WM** discussed in the main part of the report. Another way that extra STMs might be used could be in realizing Fauconnier's **mental spaces** [1985, and see discussion in Evans, 2015].

Andrea Moro's *The Boundaries of Babel* has been a delight to read. He starts off describing step by step the basic arguments for developing a theory of syntax in a way that even an engineer, like me, could follow. On page 21 he argues why syntax isn't completely reducible to semantics. His examples are the 2 sentences *A circle is square.* and *A circle is red*", from which he deduces "a sentence that is well-formed from the syntactic point of view may not be well formed from the semantic point of view, at least to the extent that a contradiction is not well formed semantically. This simple example allows him to conclude that semantics and syntax are not completely reducible one to the other." *A circle is square.* cannot be shown to be well-formed syntactically by any semantic arguments. But isn't he assuming that syntax exists beyond being just a formal description of current conventions in the use of a constantly changing language? Isn't he assuming a UG to argue for it?

Moro [2015] uses neuroimaging experiments to argue that Corballis' suggestion that speech derived from gestures is untenable and that a neo-behaviourist explanation of negation won't work. I don't find the argument convincing. First, I doubt that Corballis expected gestures to account for all the structure of language and although negation in general would not have been a problem for gestures, sentential negation could well have been a later development when speech was dominant. I presume that by a neo-behaviourist explanation Moro means something like my associative learning.

Do I need a separate Lexicon? How should it work? Pointers into LTM? Pointers to prediction events or context events? A lexicon for all event-types or just speech? What would be a good reason for having a lexicon. Would a phonological multiple context that assembled phonemes into words be a lexicon?

It is interesting that Vyvyan Evans [2015] in his book *The Crucible of Language* suggests that meaning comes from language and concepts, where concepts (e.g. space and time) come from experience of the body in the world. In PP, this could be seen as meaning coming from the Speech-predicting hierarchy of templates (for language) and the Body Move-predicting hierarchy of templates (for concepts), both extended for a realistic robot body in the real world.

A4. Steps 718-997: Talking about Touching.

The last 279 steps of the Interaction were spent trying to get PP to ask and answer questions about touching the Stumps. By 'touching', I mean that a Stump must be immediately in front of the robot. Figure 14 lists all the steps where robot A or robot B said something about touching. Robot A's statements are shown in black, while robot B's (PP's) are coloured. On the right side of the figure, the World configuration is indicated for each step, by showing a new configuration when it changes. Notice that for step 733 only 2 rows of the configuration are shown because they are all that are needed to show where the two robots and the Cake are positioned. Figure 15 shows more compactly the steps when the 4 kinds of sentence occur, first for robot A and then for robot B. The steps are grouped into the 4 directions (North, East, South and West) from which the Stumps can be touched, and which Stump is involved. It can be seen that by step 997 PP has still got a lot to learn.

The learning has to be through imitation, but the FLT-Quiet "trick", which was used for Remembering Numbers, isn't used here (just to show that it is not essential). Also the variety of context, which was severely limited in the Remembering Numbers case, is so great here that PP manages to say it is touching only twice in the first 100 steps. For imitation to work, robot B must be in the same context as A was in when imitation associations were stored. Getting a bit desperate, I (robot A) got robot B to push the Cake into the NW corner (step 826) and leave it there so that changes to the position of the Cake wouldn't disturb the imitation process. PP then started to say "Look I Am Touching .." quite frequently and answered robot A's "What Am I Touching?" with "Look You Are Touching .." correctly. There are only two cases of PP asking a What question. The one on step 846 is all right, but the one on step 866 is bad because robot A isn't touching anything. To say a 'What' question, PP already has the problem of having learned to use 'What' with Remember Numbers. This is not the case with 'Look' which was a word introduced for the asking and answering.

Saying "Look I Am Touching Brown/Black Stump" is relatively easy because Touch-Front (TchF) is an event-type in 6 of the Speech action-predicting templates, SA, SB, SD, SH, SJ and SK, of which SD and SK are imitation templates (Fig. 4). Saying "Look You Are Touching Brown/Black Stump" is more difficult because PP needs to know where the other robot is in relation to a Stump and whether its direction is towards the Stump. Again, there are 6 templates that do this, SB, SC, SE, SF, SG and SI, but only SI is an imitation template.

Figure 14. Statements and Questions about Touching Stumps.

Step 723 A:WAIT Good y Look j I j Am j Touching j Black j Stump j Q m	S----
	-#--C
Step 728 A:RIGHT Look j I j Am j Touching j Black j Stump j Stump j Q m	---#- --#--C
	---n- --e#-
	-E----
Step 733 A:RIGHT Look j I j Am j Touching j Black j Stump j Q m	-#-sC
Step 740 A:WAIT Good y What y Are y You y Touching i Q? i	---#N CS----
	-#----
Step 741 A:WAIT Good y Look j I j Am j Touching j Black j Stump j Q m	CE---- --#w
	-#----
Step 742 A:WAIT Look j I j Am j Touching j Black j Stump j Q m	---#w C-E--
	-#----
Step 748 A:WAIT Look i I i Am i Touching i Brown i Stump i Q m	C---- --#w
	-#w--
Step 749 A:WAIT Look i I i Am i Touching i Brown i Stump i Q m	---#- C----
	--N-- -#w--
	--N#-
Step 750 A:LEFT Bad y Look j You j Are j Touching j Black j Stump j Q m	C----
Step 754 A:WAIT Look i I i Am i Touching i Brown i Stump i Q m	-#s-- C----
Step 758 A:WAIT What y Are y You y Touching i Q? I	--E#- -#w--
PP: Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m.	-N-#-
Step 761 A:WAIT Bad y Look i You i Are i Touching i Brown i Stump i Q m	
Step 762 A:WAIT Look i I i Am i Touching i Brown i Stump i Q m	C----
Step 763 A:LEFT Look j You j Are j Touching j Black j Stump j Q m	-#w-- C----
	-E-#- -#s--
	--E#-
Step 774 A:PAT Bad y Look i I i Am i Touching i Brown i Stump i Q m	-SC--
Step 776 A:WAIT Look i You i Are i Touching i Brown i Stump i Q m	-#----
Step 778 A:WAIT What y Are y You y Touching i Q? I	-n-#-
Step 781 A:WAIT What m Am m I m Touching i Q? i	
Step 789 A:WAIT Look i You i Are i Touching i Brown i Stump i Q m	--C--
Step 791 A:WAIT What y Are y You y Touching i Q? I	E#----
Step 792 PP:WAIT Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m.	-n-#-
A:WAIT Good y Look i You i Are i Touching i Brown i Stump i Q m	
Step 793 A:WAIT Look i I i Am i Touching i Brown i Stump i Q m	--C-
Step 806 A:FORWARD Good y Look j You j Are j Touching j Black j Stump j Q m	-#-Ss S#----
	---#C -n-#-
Step 812 A:WAIT What y Are y You y Touching j Q? j	-#-S-
Step 813 A:WAIT Look j You j Are j Touching j Black j Stump j Q m	---#w
Step 816 A:WAIT What m Am m I m Touching j Q? j	----C
Step 822 PP:WAIT I. i. Am. i. Touching i Brown i Stump i Q m	-#W--
Step 831 PP:WAIT I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m.	---#- C----
A:WAIT Good y Look i I i Am i Touching i Brown i Stump i Q m	-Cw-- e#----
Step 833 A:WAIT Look i You i Are i Touching i Brown i Stump i Q m	-N-#-
Step 835 A:WAIT What y Are y You y Touching i Q? i	
Step 836 PP:WAIT Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m.	
A:WAIT Good y What y Are y You y Touching i Q? i	
PP: Look. i. Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m.	
Step 841 A:LEFT Good y Look i You i Are i Touching i Brown i Stump i Q m	C----
Step 843 A:WAIT Look i I i Am i Touching i Brown i Stump i Q m	-#W--
Step 846 PP:WAIT What y Are y You y Touching. i. Q? m. (cf. step 758)	-n-#-
A: Good y Look i I i Am i Touching i Brown i Stump i Q m	
A:WAIT Look i You i Are i Touching i Brown i Stump i Q m	
Step 858 A:LEFT Look i I i Am i Touching i Brown i Stump i Q m	Cs----
Step 859 PP:WAIT Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m.	-#W--
A:WAIT Good y What y Are y You y Touching i Q? i	
PP: Look. i. Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m.	
Step 860 PP:WAIT Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q y.	
A:WAIT What m Am m I m Touching i Q? i	
PP: Look. i. Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m.	

```

Step 861 PP:WAIT Look i I i Am i Touching i Brown i Stump i Q y.
Step 866 PP:WAIT What. y. Are. y. You. y. Touching. i. Q? m.
A: Bad y I m Am m Not m Touching m Anything m Q m
A:PAT Look j You j Are j Touching j Black j Stump j Q m
Step 869 A:LEFT Look j I j Am j Touching j Black j Stump j Q m
Step 870 A:WAIT What m Am m I m Touching j Q? j
Step 872 A:WAIT What m Am m I m Touching j Q? j
Step 877 A:WAIT Look j You j Are j Touching j Black j Stump j Q m
Step 879 A:WAIT What y Are y You y Touching j Q? j
Step 880 A:WAIT Good y Look j I j Am j Touching j Black j Stump j Q m

Step 887 A:WAIT Look j You j Are j Touching j Black j Stump j Q m
Step 889 A:WAIT Bad y Look j I j Am j Touching j Black j Stump j Q m
Step 891 A:WAIT Good y What m Am m I m Touching j Q? j
Step 893 A:WAIT Good y What y Are y You y Touching j Q? j
Step 897 A:WAIT Look j I j Am j Touching j Black j Stump j Q m
Step 901 A:WAIT What y Are y You y Touching j Q? j
PP: Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q j.
Step 905 PP:WAIT Look j I j. Am. j. Touching. j. Black. j. Stump. j. Q m
Step 906 PP:WAIT Look j I j. Am. j. Touching. j. Black. j. Stump. j. Q m.
A:WAIT Good y What y Are y You y Touching j Q? j
PP: Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q j.
Step 909 PP:WAIT Look j I j. Am. j. Touching. j. Black. j. Stump. j. Q m.
Step 910 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
A:WAIT Good y What m Am m I m Touching j Q? j
PP: Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q j.
Step 913 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
A:WAIT Good y What m Am m I m Touching j Q? j
Step 914 PP:WAIT I. j. Am. j. Touching. j. Black. j. Stump. j. Q y.
A:WAIT Good y What m Am m I m Touching j Q? j
Step 915 PP:WAIT Look j You j Are y Touching. j. Black. j. Stump. j. Q y.
A:WAIT Good y What m Am m I m Touching j Q? j
PP: Look j You j Are y Touching. j. Black. j. Stump. j. Q m
Step 929 PPu:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
Step 930 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
A:FORWARD Good y What y Are y You y Touching j Q? j
PP: Look j I j Am j Touching j Black. j Stump. j Q j

Step 933 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
A:WAIT Good y Look j You j Are j Touching j Black j Stump j Q m
Step 936 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
A:WAIT What m Am m I m Touching j Q? j
PP: Look. j. You y Are. y. Touching. j. Black. j. Stump. j. Q j.
Step 939 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
A:WAIT What m Am m I m Touching j Q? j
PP: Look. j. You. y. Are. y. Touching. j. Black. j. Stump. j. Q j.
Step 947 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
Step 948 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
A:WAIT What m Am m I m Touching j Q? j
PP: Look j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q j.
Step 950 A:WAIT What m Am m I m Touching j Q? j
PP: Look j You. j Are. y. Touching. j Black j. Stump j Q j
Step 952 A:WAIT What m Am m I m Touching j Q? j
PP: Look. j. You. j. Are. y. Touching. j. Black. j. Stump. j. Q j.
Step 955 PP:WAIT Look j I j Am j Touching j Black j Stump j Q m
A:WAIT What y Are y You y Touching j Q? j
PP: Look j I j Am j Touching j Black j Stump j Q j
Step 958 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
Step 965 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
Step 966 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
A:WAIT What m Am m I m Touching j Q? j
PP: Look. j. You. y. Are. y. Touching. j. Black. j. Stump. j. Q j.
Step 969 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
A:WAIT Look j I j Am j Touching j Black j Stump j Q m

```

Step 972 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.
A:WAIT Look j You j Are j Touching j Black j Stump j Q m

Abbreviations: Good for YES-Good; Bad for NEG-Bad; Q for DRP-Quiet, CQ for CMD-Quiet, RQ for RIS-Quiet.
Other words: Xyz for FLT-Xyz;
m for PointMe; y for PointYou; i for PointBrownStump; j for PointBlackStump
=====

The easiest way to see the relevance of templates to a task, when they haven't been designed for the task, is to design an ideal template for the task and see where the existing templates fall short.

When PP is saying "Look I Am Touching X" or "Look You Are Touching Y" without having been asked, the only requirements are that in the first case robot B is touching X and that in the second case robot B can see that robot A is touching Y. SL is the only template (see Fig. 4) that doesn't have TOUCH or all of VOtherPosn, ObPosn, VBrown and Vblack, so the requirement in the first case is fully satisfied. In the second case, PP must know the position and direction of robot A, which are given in templates SB, SC, SE, SF, SG and SI. It must also know whether robot A is touching Y. If Y is a Stump, as it is in the interaction shown, then PP must also be given VBrown or VBlack, which knocks out template SB, leaving SC, SE, SF, SG and SI. If Y is the Cake, then SB is all right. There is plenty of support from the templates for PP saying "Look I Am Touching X" or "Look You Are Touching Y" 'out of the blue'. These aren't well-defined tasks, so there are no ideal templates.

Figure 15. Steps where Correct Statements and Questions occur.

Robot A		From direction (N North, E East, S South, W West):			
Brown stump					
Look I am touching:	N:858,	E:748-9,754,762,	S:774,793,843,846,	W:831,	
What are you touching?	N:740,778,	E:859,	S:758,835-6,	W:791,	
Look You are touching:	N:776,789,	E:841,846,	S:761,833,	W:792,	
What am I touching:	N:860,	E:	S:781,	W:	
Black Stump					
Look I am touching:	N:733,889,897,	E:741-2,	S:723,897,969,	W:728,869,880,	
What are you touching?	N:812,930,	E:879,955,	S:893,901,906,	W:	
Look You are touching:	N:806,813,866,915,	E:877,	S:887,	W:750,763,	
	N:933,972,	E:	S:	W:	
What am I touching:	N:891,910,913-5,	E:816,	S:936,939,966,972,	W:870,872,948,950,	
	N:	E:	S:	W:952,	
Robot B					
Brown stump					
Look I am touching:	N:	E:(822),859-61,	S:758,(831),836(),	W:792,	
What are you touching?	N:	E:	S:846,	W:	866
Look You are touching:	N:	E:	S:	W:	
What am I touching:	N:	E:	S:	W:	
Black Stump					
Look I am touching:	N:929-30,933,936,	E:947-8,955,958,	S:723,901,905-6,	W:	
	N:939,965-6,969,	E:	S:909-10,913-4	W:	
	N:972,	E:	S:	W:	
What are you touching?	N:	E:	S:	W:	
Look You are touching:	N:915,	E:	S:936,939,966,	W:950,952	
What am I touching:	N:	E:	S:	W:	
=====					

If PP is answering one of the questions "What Are You Touching?" or "What Am I Touching?", the requirements are stronger because the question itself must be recognized in addition to the requirements for the 'out of the blue' statements. Unless the interaction becomes much more complicated, it is probably sufficient for PP to hear "You Touching?" or "I Touching?", as is provided by templates SA, SB, SC, SD, SH and SL. SA and SB are clearly not ideal because they include Speech from before the questions, with SA having the last 8 Speech events and SB having the last 7 Speech events (including the RQ or RIS-Quiet for the question mark). SL was useless even for the 'out of the blue' statements. SD is not

ideal because it includes the irrelevant Body Move. Can we find ideal templates for the “What Are You Touching?” and “What Am I Touching?” questions from the remaining SC and SH?

The template SH is very close to being an ideal template for answering the “What Are You Touching?” question because it has the last Body Move, the last 3 Speech events and the last 3 Touch events. (See association 1645SH in Figure. 16.) The ideal template would be SH without the Body Move and with just the last TchF (Touch Front) event.

The template SC is the best template that PP has for answering the “What Am I Touching?” question, but when robot A is touching a Stump, associations of template SC (see association 2255SC in Figure 17) don’t allow PP to disregard the irrelevant position of the Cake object. Also, the hand pointing should be PointO and not PointFO so that PP can see what robot A is pointing at. The ideal template for answering the “What Am I Touching?” question would be SC without OShape and ObPosn, and with PointO replacing PointFO. With MCAL, we can expect templates to be non-ideal because there are always so many possible tasks that ideal templates can’t be provided for all of them.

In setting up the templates, I made the mistake of treating PointFO and PointOF like HearFO and HearOF (see Figure 18), but then used PointMe (instead of NoPoint) as the default Hand-pointing, while DRP-Quiet was the default Speech. As a result, Point FO was always the same as PointF and PointOF was always the same as PointO. In Figure 19, the associations with PointMe (-m) should have had PointBlackStump (-j). The usefulness of Hand-Pointing was largely lost. Unfortunately I didn’t discover this mistake until analysing the talking about touching results.

If a similar interaction is ever to be run again, “PointFO 0,1” should be replaced by “PointF 0 and PointO 0” in all templates where it occurs. “PointOF 0,1” should be replaced by “PointO 0 and PointF 0”. “PointFO 0” in SD should be replaced by “PointO 0”. “PointOF 0” in SOD should be replaced by “PointF 0”. These changes are made for the separate interaction discussed in section A5.

Further discussion of the details of the talking about touching would be tedious, so this section will conclude with a summary of what robot B (i.e. PP) can and could learn from this part of the interaction and its continuation. The need to respond to questions is built into robot B’s conversational protocol with the RIS intonation. Two questions have been presented to robot B: “What Are You Touching?” and “What Am I Touching.” PP will learn to say what it is itself touching in answer to the first question. In extensions of the interaction, it could learn to say that it is not touching anything if that is the case. In answering the second question, PP needs to see that robot A is touching something and what that is. Answers could be learned for cases where robot A is not touching anything or PP can’t see robot A. PP could learn to answer other questions like “Are You Touching X?” or “Am I Touching X?”

Bare statements like “Look I Am Touching X” and Look You Are Touching X” can be made when the statements are true, but would be disapproved if made when they were not. Similarly, PP can itself ask the questions “What Are You Touching?” and “What Am I Touching?” just to imitate what it has heard robot A saying. Perhaps a game or activity could be devised in which the answers to these questions were needed.

In none of this conversation is there anything that we could call “understanding” by PP. Take the simplest case that I can think of. When robot B does a FORWARD Body Move and pushes the Cake, PP says “I Pushed Cake”. What needs to be learned for PP to understand that it has pushed the Cake? Is it just a matter of being able to answer more and more questions about pushing the Cake? Do you have to touch the Cake to push it? Does the Cake have to be in front of you to push it? Do you have to move the Cake to push it? etc. etc. How about making a plan to push the Cake from A to B and carrying it out? What if PP sees that if robot A pushes the Cake into the corner, PP can squash the Cake and get approved, so PP tells robot A to push the Cake? None of this is obviously beyond what might be achieved in a very long extension of the interaction that has just been terminated. Would it have to be able to answer its own questions about pushing as I suggested in Andreae [1998, p.186]? Would there still be something missing, such as the double-scope blending required by Fauconnier and Turner [2002], or would even that appear in a sufficiently rich multiple context in a human-like robot in the real world?

Having sets my sights to end the interaction by step 1000, it was a bonus to see PP end the interaction with a flourish on steps 993-996, especially as it had been particularly uncooperative from steps 984 to 992!

Figure 16. Associations for Saying ‘Look’ in ‘Look I Am Touching Black Stump’

	Steps
[1502SJ:W SpBkSp SpBkSp -m -m HearFO:Wait CQ/Q	>> Look Nov=4, I Dis=2] 929,933,947,
[1503SJ:W SpBkSp SpBkSp -m -m HearFO:Touching RQ/Q	>> Look Nov=4, Good Dis=2] 910,930,
[3733SI:23S OP11 VBn/k:21/32 RQ/Q	>> Look Nov=4] 910,
[3807SI:24W OP:U VBn/k:43/32 CQ/Q	>> Look Nov=4, I Nov=5] 929,
[3838SI:23S OP:U VBn/k:43/32 CQ/Q	>> Look,I Nov=4] 933,
[1529SH:W SpBkSp SpBkSp SpBkSp HearFO:You,Wait,CQ	>> Look Nov=4, I Dis=2] 929,933,947,
[1645SH:W SpBkSp SpBkSp SpBkSp HearFO:You,Touching,RQ	>> Look Nov=4] 930,
[4838SD:W VOP23 OP11 SpBkSp -m HearFO:Are,You,Touching,RQ	>> Look Nov=4] 906,
[4848SD:W VOP23 OP11 SpBkSp -m HearFO:Now,You,Wait,CQ	>> Look Nov=4] 905,
[4952SD:W VOP24 OP:U SpBkSp -m HearFO:Now,You,Wait,CQ	>> Look Nov=4] 930,
[4987SD:W VOP23 OP:U SpBkSp -m HearFO:Now,You,Wait,CQ	>> Look Nov=4] 965,966,
[5049SD:W VOP23 OP07 SpBkSp -m HearFO:Now,You,Wait,CQ	>> Look Nov=4] 948,
[2283SC:Cake 23S OP07 VBn/k:15/32 -m -m HearFO:What,Are,You,Touching RQ/Q	>> Look Nov=4] 955
[2318SC:Cake 23S OP11 VBn/k:21/32 -m -m HearFO:What,Are,You,Touching RQ/Q	>> Look Nov=4] 901,906
[2332SC:Cake 23S OP11 VBn/k:21/32 -m -m HearFO:Good,Now,You,Wait CQ/Q	>> Look Nov=4] 906
[2397SC:Cake 24W OP:U VBn/k:43/32 -m -m HearFO:Good,Now,You,Wait CQ/Q	>> Look Nov=4] 930
[2415SC:Cake 23S OP:U VBn/k:43/32 -m -m HearFO:Good,Now,You,Wait CQ/Q	>> Look Nov=4] 966
[2449SC:Cake 23S OP07 VBn/k:15/32 -m -m HearFO:Good,Now,You,Wait CQ/Q	>> Look Nov=4] 955
[2446SB:W 23S Cake OP11,11 TchF:Bk SpBkSp -m -m HearFO:Left,CQ,Good,Now,You,Wait CQ/Q	>> Look Nov=4] 913
[2457SB:W 23S Cake OP11,11 TchF:Bk SpBkSp -m -m HearFO:Stump,CQ,Good,Now,You,Wait CQ/Q	>> Look Nov=4] 910
[2552SB:W 23S Cake OP:U,U TchF:Bk SpBkSp -m -m HearFO:Right,CQ,Good,Now,You,Wait CQ/Q	>> Look Nov=4] 936,939,969,972
[2622SB:W 23S Cake OP07,07 TchF:Bk SpBkSp -m -m HearFO:Right,CQ,Good,Now,You,Wait CQ/Q	>> Look Nov=4] 958
[2668SA:W P VOP23 OP11 SpBkSp SpBkSp VBn/k:21/32 -m HearFO:Turned,Left,CQ,Good,Now,You,Wait CQ/Q	>> Look Nov=4] 909,913
[2679SA:W P VOP23 OP11 SpBkSp SpBkSp VBn/k:21/32 -m HearFO:Black,Stump,CQ,Good,Now,You,Wait CQ/Q	>> Look Nov=4] 910,
[2783SA:W P VOP23 OP:U SpBkSp SpBkSp VBn/k:43/32 -m HearFO:Turned,Right,CQ,Good,Now,You,Wait CQ/Q	>> Look Nov=4] 936,939,969,972
[2859SA:W P VOP23 OP07 SpBkSp SpBkSp VBn/k:15/32 -m HearFO:Turned,Right,CQ,Good,Now,You,Wait CQ/Q	>> Look Nov=4] 958
Abbreviations used in Figures 16, 17 and 19:	
BodyMove: W Wait; F Forward; L Left; R Right; P Pat; S Slap.	
Hand Pointing: PointMe -m, PointYou -y, PointBrownStump -i, PointBlackStump -j.	
Speech: Good for YES-Good; Bad for NEG-Bad; Q for DRP-Quiet, CQ for CMD-Quiet, RQ for RIS-Quiet.	
Other words: HearFO:XYZ for HearFO:FLT-XYZ. X/Y for HearSFO:X/InSSay:Y .	
Touch Left: TchL; Touch Front: TchF; Touch Right: TchR. Touch: TchL TchF TchR	
In Touch and TchF: Sp Space, Bn Brown Stump, Bk Black Stump, Ck Cake, Wl Wall, Rb Robot.	
Position of other robot: VOthrPosn: VOP23, VOP24 etc; VOthrPosn and VOthrDirn: 23S, 24W, UU etc.	
Object shape: Oshape: Cake for Cake.	
Object position: ObPosn: OP07, OP11, OPU etc (U for Unknown).	
Positions of Brown and Black Stumps: VBrown, VBlack: VBn/k:21/32, VBn/k:43/32, etc.	

Figure 17. Associations for Saying 'Look' in 'Look You Are Touching Black Stump'

	Steps
[1503SJ:W SpBkSp SpBkSp -m -m HearFO:Touching RQ/Q	>> Look Nov=4, Good Dis=2] 936
[3733SI:23S OP11 VBn/k:21/32 RQ/Q	>> Look Nov=4] 915
[1530SH:W SpBkSp SpBkSp SpBkSp HearFO:I,Touching,RQ	>> Look Nov=4, Good Dis=2] 936
[2455SC:Cake 23S OP07 VBn/k:15/32 -m -m HearFO:What,Am,I,Touching RQ/Q	>> Look Nov=4] 950
[2563SB:W 23S Cake OP:U,U TchF:Bk SpBkSp -m -m HearFO:Stump,CQ,What,Am,I,Touching RQ/Q	>> Look Nov=4] 939,966
[2611SB:R 23S Cake OP07,07 TchF:Bk SpBkSp -m -m HearFO:Right,CQ,What,Am,I,Touching RQ/Q	>> Look Nov=4] 952
[2705SA:W W VOP23 OP11 SpBkSp SpBkSp VBn/k:21/32 -y HearFO:Stump,Bad,Good,What,Am,I,Touching RQ/Q	>> Look Nov=4] 915
[2795SA:W W VOP23 OP:U SpBkSp SpBkSp VBn/k:43/32 -m HearFO:Black,Stump,CQ,What,Am,I,Touching RQ/Q	

```

>> Look Nov=4] 939,966
[2847SA:R W VOP23 OP07 SpBkSp SpBkSp VBn/k:15/32 -m HearFO:Turned,Right,CQ,What,Am,I,Touching RQ/Q
>> Look Nov=4] 952

```

Figure 18. Event-Types and Delays of the Hand-Pointing-Predicting Templates.

Template: PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	POD	POI
Event-type	Delays									Event-type	
BodyMove	0	-	0	0	-	-	-	0	-	-	-
VOthrMove	0	-	-	-	-	-	-	-	-	VOthrMove	0 0
VOthrDirn	-	0	0	-	0	0	0	-	-	E0thrDirn	- -
VOthrPosn	0	0	0	-	0	0	0	-	-	E0thrPosn	0 -
OShape	-	0	0	-	-	-	-	-	-	-	-
ObPosn	0	0,1	0	0	-	0	0	-	-	EObPosn	0 -
VBrown	0	-	0	-	0	0	0	-	-	EBrown	- -
VBlack	0	-	0	-	0	0	0	-	-	EBlack	- -
TchF	-	1	-	-	-	-	-	1	-	ETchF	- 1
Touch	0,1	0	-	0	1,2	-	-	0	-	ETouch	0 0
PointFO	1	1,2	1,2	1	1,2	1	1	-	1,2	PointOF	1 -
HearFO	1-7	1-6	1-4	0-3	1	1,2,3	0,2,3	-	0-4	HearOF	0-3 -
HearOthr	0	0	0	-	0	-	-	0	-	HearOthr	- -
InSSay	0	0	0	-	0	-	-	0	-	InSSay	- -
HearSFO	-	-	-	-	-	-	-	0	-	HearSOF	- 0
Twin templates:				POD				POI			
								PD			

Figure 19. Associations Causing Robot B to Point at a Stump after Saying "Look".

```

Steps
[1550PI:W TchF:Bn SpBnSp HearSFO:Look >> -PtBrown Nov=4] 758,836,859
[2035PH:VBn/k:32/43 -m RQ/Look >> -PtBrown Nov=4] 836
[2121PH:VBn/k:32/U -y RQ/Look >> -PtBrown Dis=2] 859
[1529PE:W SpBkSp SpBkSp -m -m HearFO:RQ RQ/Look >> -PtBlack Nov=4] 910,930,936,948,955
[4777PD:W VOP23 OP11 SpBkSp -m HearFO:You,Touching,RQ,Look >> -PtBlack Nov=4] 906
[2625PC:23S OP11 VBn/k:21/32 -m -m HearFO:Are,You,Touching,RQ RQ/Look >> -PtBlack Nov=4] 901,906
[2791PC:23S OP07 VBn/k:15/32 -m -m HearFO:Am,I,Touching,RQ RQ/Look >> -PtBlack Nov=4] 950
[2970PB:W 23S Ck OP:U,U TchF:Bk SpBkSp -m -m HearFO:CQ,What,Am,I,Touching,RQ RQ/Look >> -PtBlack Nov=4] 939,966
[3028PB:R 23S Ck OP07,07 TchF:Sp SpBkSp -m -m HearFO:CQ,What,Am,I,Touching,RQ RQ/Look >> -PtBlack Nov=4] 952
[3042PA:W W VOP23 OP11 VBn/k:21/32 SpBkSp SpBkSp -y HearFO:Bad,Good,What,Am,I,Touching,RQ RQ/Look >> -PtBlack Nov=4] 915
[3146PA:W W VOP23 OP:U VBn/k:43/32 SpBkSp SpBkSp -m HearFO:Stump,CQ,What,Am,I,Touching,RQ RQ/Look >> -PtBlack Nov=4] 939,966
[3207PA:R W VOP23 OP07 VBn/k:15/32 WlSpBk SpBkSp -m HearFO:Right,CQ,What,Am,I,Touching,RQ RQ/Look >> -PtBlack Nov=4] 952

```

A5. Planning and Additional Interaction without Approval.

Planning is organized in PP for plans to terminate if they reach a Novelty or an Approval goal. The main interaction of 997 steps is so full of approval that, of the 73 plans formed in the first 200 steps, only one is longer than 1 step. To give planning a chance, another interaction was started with Teacher (robot A) giving no approval and not very much

disapproval. Automatic approval was still given if robot B Squashed the Cake. The criteria for a successful plan were extended to include plans that reached a Body Move with more than 40 fine steps.

In the new 149-step interaction, PP attempts to make a plan on step 18, but after 18 fine steps it fails to predict the Touch stimuli. It is a fairly severe restriction on plans that they have to predict all stimuli at each step. The plan on step 18 is shown in the additional Interaction, but shorter attempts to make a plan are omitted.

From step 124, Teacher (through robot A) leads Robot B around the World to encourage it to make a plan. Fortunately, robot B follows robot A and by step 141 it is back in the situation it was in at the end of step 124. A complete plan is made, but when it tries to follow the plan, a mistake in the plan is revealed. In the plan, robot A says “Moved” instead of “Pushed” so the following is abandoned. Two steps later, another complete plan is made and it is followed correctly for all its 41 fine steps. Figure 20 takes the reader through the first 10 fine steps of the plan, with each association used listed. It is only in planning that PP uses its stimulus-predicting templates, so this Figure is an opportunity to see the action-predicting and stimulus-predicting templates in use. Details of the templates not described above are given in Figures 21-23. Figure 24 gives all the abbreviations used in this account.

In addition to showing the formation of plans, the additional Interaction demonstrates PP learning without approval.

Figure 20. Plan Constructed on step 143 of the Additional Interaction.

```

98-889
143-1335
PP:RIGHT I. m. Turned. m. Right. m. Q m.          PP turned Right and says so. 125BA,126BB;
A:FORWARD I m Pushed m Cake o Q m                A didn't see it. 283-5SB
PLAN: 1-1 PP:FORWARD I m Moved m Forward m Q m    122BA,123BB;275-7SA,274-6SB
      1-6 A:RIGHT I m Turned m Right m Q m          240BOA;891-4SOA
      2-11 PP:FORWARD I m Moved m Forward m Q m    123BA,124BB;278-80SA,277-9SB
      2-16 A:FORWARD I m Pushed m Cake o Q m        242BOA;899-902SOA
      3-21 PP:FORWARD I m Moved m Forward m Q m    124BA,125BB;281-3SA,280-2SB
      3-26 A:FORWARD I m Pushed m Cake o Q m        244BOA;907-9SOA,876SOA
      4-31 PP:RIGHT I m Turned m Right m Q m        125BA,126BB;284-6SA,283-5SB
      4-36 A:FORWARD I m Pushed m Cake o Q m        246BOA;914-7SOA
      5-41 PP:FORWARD                               Plan of length 41 completed. 122BA,123BB
144-1345
PP:FORWARD I. m. Moved. m. Forward. m. Q m.       PP moved Forward and says so. 122BA,123BB;
A:RIGHT I m Turned m Right m Q m                   A didn't see it. 275-7SA,274-6SB
----S 144 ----- 144 ----- 145 ----- 145 ----- 146 ----- 146 ----- 147 ----- 147 ----- 148
-#--- PP:F -#---S A:R -#---S PP:F -#--- A:F -#--- PP:F -#--- A:F -#--- PP:R -#--- A:F -#--- PP:F
---#- ---#- ---#- ---#S ---#S ---#- ---#- ---#- ---#- ---#-
---Cs ---Cs ---Cw ---Cw ---Cw ---CwS ---CwS ---Cw-S ---Cw-W Cw--W
|==> Plan (Compare with what actually happened in listing of inteaction)

```

Associations used for the First Step of the Plan 1-1 to 1-10:

Predicting robot B's Body Moves.

```

[122BA:R F VOP:14 OP:15 WlSpSp WlSpSp VBn/k:35/24 m HearFO:I,Turned,Right,Q,I,Pushed,Cake Q/Q
>> BodyMove:FORWARD Nov=0]
[123BB:F R 14N OS:Ck OP:15 WlSpSp WlSpSp VBn/k:35/24 m m HearFO:Q,I,Pushed,Cake Q/Q
>> BodyMove:FORWARD Nov=0]

```

Predicting robot B's Stimuli, including robot A's last Body Move.

```

[239BOA:F F 14N OP:15 VBn/k:35/24 m m HearFO:Q,I,Pushed,Cake Q/Q >> VOthMove:FORWARD]
[6VBN:R F VBn/k:35/24,35/24 >> VBrown:44]
[6VBK:R F VBn/k:35/24,35/24 >> VBlack:33]
[149VP:B F F 14N >> VOthPosn:23]
[7VD:B F F VOthDirn:N >> VOthDirn:N]
[0OS:OShape:Cake >> OShape:Cake]
[236OPP:F 23N WlSpSp OP:14,15 VBn/k:44/33 >> ObjPosn:24]
[226TL:F F 23N OS:Ck OP:24 WlSpSp VBn/k:44/33 >> TchL:TchWall]
[226TF:F F 23N OS:Ck OP:24 WlSpSp VBn/k:44/33 >> TchF:TchSpace]
[226TR:F F 23N OS:Ck OP:24 WlSpSp VBn/k:44/33 >> TchR:TchSpace]

```

```
[10EBN:23N VBrown:44 >> EBrown:Unseen]
[10EBK:23N VBlack:33 >> EBlack:Unseen]
[8EP:23N >> EOthrPosn:Unseen]
[8ED:23N >> EOthrDirn:Unseen]
[0EOS:OShape:Cake >> OShape:Cake]
[155EOP:23N OP:24 >> EOObPosn:42]
[215ETL:F F 23N OS:Ck OP:24 WlWlCk VBn/k:44/33 >> ETchL:TchWall]
[215ETF:F F 23N OS:Ck OP:24 WlWlCk VBn/k:44/33 >> ETchF:TchWall]
[215ETR:F F 23N OS:Ck OP:24 WlWlCk VBn/k:44/33 >> ETchR:TchCake]
```

Predicting robot B's Speech and Pointing.

```
[275SA:F F VOP:23 OP:24 WlSpSp WlSpSp VBn/k:44/33 m HearFO:I,Turned,Right,Q,I,Pushed,Cake Q/Q >> InSSay:FLT-I Nov=0]
[274SB:F 23N OS:Ck OP:15,24 TchF:Sp WlSpSp VBn/k:44/33 m m HearFO:Turned,Right,Q,I,Pushed,Cake Q/Q >> InSSay:FLT-I Nov=0]
[330PA:F F VOP:23 OP15 VBn/k:44/33 WlSpSp WlSpSp o HearFO:Turned,Right,Q,I,Pushed,Cake,Q Q/I >> ESPoint:-PtMe Nov=0]
[330PB:F 23N OS:Ck OP15,24 TchF:Sp WlSpSp m o HearFO:Right,Q,I,Pushed,Cake,Q Q/I >> ESPoint:-PtMe Nov=0]
[276SA:F F VOP:23 OP:24 WlSpSp WlSpSp VBn/k:44/33 m HearFO:Turned,Right,Q,I,Pushed,Cake,Q Q/I >> InSSay:FLT-Moved Nov=0]
[275SB:F 23N OS:Ck OP:15,24 TchF:Sp WlSpSp VBn/k:44/33 m m HearFO:Right,Q,I,Pushed,Cake,Q Q/I >> InSSay:FLT-Moved Nov=0]
[331PA:F F VOP:23 OP15 VBn/k:44/33 WlSpSp WlSpSp m HearFO:Right,Q,I,Pushed,Cake,Q,I Q/Moved >> ESPoint:-PtMe Nov=0]
[331PB:F 23N OS:Ck OP15,24 TchF:Sp WlSpSp m m HearFO:Q,I,Pushed,Cake,Q,I Q/Moved >> ESPoint:-PtMe Nov=0]
[277SA:F F VOP:23 OP:24 WlSpSp WlSpSp VBn/k:44/33 m HearFO:Right,Q,I,Pushed,Cake,Q,I Q/Moved >> InSSay:FLT-Forward Nov=0]
[276SB:F 23N OS:Ck OP:15,24 TchF:Sp WlSpSp VBn/k:44/33 m m HearFO:Q,I,Pushed,Cake,Q,I Q/Moved >> InSSay:FLT-Forward Nov=0]
[332PA:F F VOP:23 OP15 VBn/k:44/33 WlSpSp WlSpSp m HearFO:Q,I,Pushed,Cake,Q,I,Moved Q/Forward >> ESPoint:-PtMe Nov=0]
[332PB:F 23N OS:Ck OP15,24 TchF:Sp WlSpSp m m HearFO:I,Pushed,Cake,Q,I,Moved Q/Forward >> ESPoint:-PtMe Nov=0]
[333PA:F F VOP:23 OP15 VBn/k:44/33 WlSpSp WlSpSp m HearFO:I,Pushed,Cake,Q,I,Moved,Forward Q/Q >> ESPoint:-PtMe Nov=0]
[333PB:F 23N OS:Ck OP15,24 TchF:Sp WlSpSp m m HearFO:Pushed,Cake,Q,I,Moved,Forward Q/Q >> ESPoint:-PtMe Nov=0]
```

Default **DRP-Quiet** here.

Predicting robot A's Body Move and new Stimuli of robot B.

```
[240BOA:F F 23N OP:24 VBn/k:44/33 m m HearFO:Q,I,Moved,Forward Q/Q >> VothMove:Right]
[7VBN:R F VBn/k:35/24,44/33 >> VBrown:44]
[7VBK:R F VBn/k:35/24,44/33 >> VBlack:33]
[150VP:A F R 23N >> VOthrPosn:23]
[9VD:A F R VOthrDirn:N >> VOthrDirn:E]
[237OPP:F 23E WlSpSp OP:15,24 VBn/k:44/33 >> ObjPosn:24]
[227TL:F R 23E OS:Ck OP:24 WlSpSp VBn/k:44/33 >> TchL:TchWall]
[227TF:F R 23E OS:Ck OP:24 WlSpSp VBn/k:44/33 >> TchF:TchSpace]
[227TR:F R 23E OS:Ck OP:24 WlSpSp VBn/k:44/33 >> TchR:TchSpace]
etc.
```

Predicting robot A's Speech and Pointing.

```
[891SOA:R 23E OS:Ck OP:24 VBn/k:44/33 m m HearOF:Cake,Q,I,Moved,Forward Q/Q >> HearOthr:FLT-I]
[895POA:R 23E OS:Ck OP:24 VBn/k:44/33 m m HearOF:Cake,Q,I,Moved,Forward Q/Q >> PointOthr:-PtMe]
[892SOA:R 23E OS:Ck OP:24 VBn/k:44/33 m m HearOF:Q,I,Moved,Forward,Q I/Q >> HearOthr:FLT-Turned]
[896POA:R 23E OS:Ck OP:24 VBn/k:44/33 m m HearOF:Q,I,Moved,Forward,Q I/Q >> PointOthr:-PtMe]
[893SOA:R 23E OS:Ck OP:24 VBn/k:44/33 m m HearOF:I,Moved,Forward,Q,I Turned/Q >> HearOthr:FLT-Right]
[897POA:R 23E OS:Ck OP:24 VBn/k:44/33 m m HearOF:I,Moved,Forward,Q,I Turned/Q >> PointOthr:-PtMe]
[894SOA:R 23E OS:Ck OP:24 VBn/k:44/33 m m HearOF:Moved,Forward,Q,I,Turned Right/Q >> HearOthr:DRP-Quiet]
[898POA: R 23E OS:Ck OP:24 VBn/k:44/33 m m HearOF:Moved,Forward,Q,I,Turned Right/Q
```


>> PointOthr:-PtMe]

Figure 21. Event-Types and Delays of the Body Move-Predicting Templates.

Template:BA	BB	BC	BD	BE	BF	BG	BH	BI	BOH
Event-type	Delays								Event-type
BodyMove	1	2,1	-	-	-	-	1	-	-
VOthrMove	0	-	-	-	-	-	-	-	VOthrMove
VOthrDirn	-	0	0	0	0	0	-	-	EOthrDirn
VOthrPosn	0	0	0	0	0	0	-	-	EOthrPosn
OShape	-	0	-	-	-	-	-	-	-
ObPosn	0	0	0	0	0	0	-	-	EObPosn
VBrown	0	0	0	0	0	0	-	-	EBrown
VBlack	0	0	0	0	0	0	-	-	EBlack
TchF	-	-	-	-	-	-	1	0	ETchF
Touch	0,1	-	-	-	-	0	0	-	ETouch
ESPoint	0	0	0	-	-	0	-	0	PointOF
PointOthr	-	0	0	0	0	0	-	0	PointOF
HearFO	1-7	1-4	1-3	1,2	0,2	0,1	0-3	-	HearOF
HearOthr	0	0	0	-	-	-	-	-	HearOthr
InSSay	0	0	0	-	-	-	-	-	InSSay
HearSFO	-	-	-	-	-	-	0	0	HearSOF
Twin templates:								BOH	BH

Figure 22. Event-Types and Delays of Other-Action-Predicting Templates.

Template:BOA	Predicting VOthrMove				Predicting HearOthr						Predicting PointOther				
Event-type	BOB	BOC	BOG	BOH	SOA	SOB	SOC	SOD	SOI	SOK	POA	POB	POC	POD	POI
Event-type	Delays										Event-type				
BodyMove	0	-	0,1	-	-	-	-	-	-	-	-	-	-	-	-
VOthrMove	1	-	1,2	-	1	0	-	0	-	0	0	-	-	0	0
VOthrDirn	1	1	1	0	-	0	0	0	-	-	0	0	0	-	-
VOthrPosn	1	1	1	0	-	0	0	0	-	-	0	0	0	-	-
OShape	-	-	1	-	-	0	0	0	-	-	0	0	0	-	-
ObPosn	1	1	1	0	-	0	0	0	-	-	0	0	0	-	-
VBrown	1	1	1	0	-	0	0	-	-	-	0	0	-	-	-
VBlack	1	1	1	0	-	0	0	-	-	-	0	0	-	-	-
EOthrDirn	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
EOthrPosn	-	-	-	1	-	-	-	0	0	-	-	-	-	0	-
EObPosn	-	-	-	1	-	-	-	0	0	-	-	-	-	0	-
EBrown	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
EBlack	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
ETchF	-	-	-	-	2	-	-	-	-	1	-	-	-	-	1
ETouch	-	-	-	1	1	-	-	0	-	0	-	-	-	0	0
ESPoint	0	0	-	0	-	0	0	0	0	-	1	1	1	1	-
PointOthr	0	-	-	0	-	0	0	0	-	-	1	1	1	-	-
HearOF	1-4	1	-	0-2	-	2-6	2-4	2	1-4	-	2-6	2-4	2	0-3	-
HearOthr	0	0	-	-	-	1	1	1	-	1	1	1	1	-	-
InSSay	0	0	-	-	-	0	0	0	-	0	0	0	0	-	-
HearSOF	-	-	-	-	0	-	-	-	-	1	-	-	-	-	0
Twin templates:				BH				SD	SI	SK				PD	PI

Figure 23. Event-Types and Delays of Stimulus-Predicting Templates.

Template:	Predicting VOthrMove						Predicting HearOthr						Predicting PointOther						
	VBN	VBK	VP	VD	OS	OPP	OP	TL	TF	TR	EBN	EBK	EP	ED	EOS	EOP	ETL	ETF	ETR
Event-type	Delays						Event-type						Event-type						
BodyMove	0,1	0,1	0	0	-	0	0	0	0	0	-	-	-	-	-	-	0	0	0
VOthrMove	-	-	-	0	-	-	0	0	0	0	-	-	-	-	-	-	0	0	0
VOthrDirn	-	-	-	1	-	0	0	0	0	0	0	0	0	0	-	0	0	0	0
VOthrPosn	-	-	-	-	1	0	0	0	0	0	0	0	0	0	-	0	0	0	0
OShape	-	-	-	-	-	-	-	0	0	0	-	-	-	-	0	-	0	0	0
ObPosn	-	-	-	-	-	2,1	1	0	0	0	-	-	-	-	-	0	0	0	0
VBrown	1,2	1,2	-	-	-	0	-	0	0	0	0	-	-	-	-	-	0	0	0
VBlack	1,2	1,2	-	-	-	0	-	0	0	0	-	0	-	-	-	-	0	0	0
TchF	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Touch	-	-	-	-	-	1	-	1	1	1	-	-	-	-	-	-	-	-	-
ETouch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
BFlag	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 24. Event-Types, Events and their Abbreviations.

Event-type Abbreviations in blue:**Action event-types**

BodyMove	Events are FORWARD F , LEFT L , RIGHT R , WAIT W PAT P , SLAP S .
InSSay	FLT-Word Word , YES-Good Good , NEG-Bad Bad , DRP-Quiet Q , CMD-Quiet CQ , RIS-Quiet RQ? .
Say	Word not abbreviated
Intone	FLT, DRP, CMD and RIS not abbreviated.
Stress	- not used here. Available as an auxiliary action.
ESPoint	"-" and HPoint. Will sometimes be abbreviated further by dropping the "-".
HPoint	PointMe PtMe m , PointYou PtYou y , PointObject o , PointBrownStump i , PointBlackStump j .
EyeBrow	"-" or "+". Not used here, so always "-".

Stimulus event-types

HearOthr	FLT-Word Word , YES-Good Good , NEG-Bad Bad , DRP-Quiet Q , CMD-Quiet CQ , RIS-Quiet RQ? .
HearOStr	- not used here. Available as an auxiliary action.
HearSOF	Word not abbreviated.
HearOF	FLT-Word Word , YES-Good Good , NEG-Bad Bad , DRP-Quiet Q , CMD-Quiet CQ , RIS-Quiet RQ? .
HearSFO	Word not abbreviated.
HearFO	FLT-Word Word , YES-Good Good , NEG-Bad Bad , DRP-Quiet Q , CMD-Quiet CQ , RIS-Quiet RQ? .
PointOthr	"-" and PointOHnd. Will sometimes be abbreviated further by dropping the "-".
PointOHnd	PointMe PtMe m , PointYou PtYou y , PointObject o , PointBrownStump i , PointBlackStump j .
PointOEbr	"-" or "+". Not used here, so always "-".
PointOF	"-" and PointOHnd. Will sometimes be abbreviated further by dropping the "-".
PointFO	"-" and PointOHnd. Will sometimes be abbreviated further by dropping the "-".
VOthrMove	Events are FORWARD F , LEFT L , RIGHT R , WAIT W PAT P , SLAP S .
VBrown	Position. When given with VBlack: Vbn/k:position Brown/position Black eg. VBn/k:16/33
VBlack	Position. When given with VBrown: Vbn/k:position Brown/position Black eg. VBn/k:16/33
VOthrPosn	VOP:position eg VOP:32 or VOP32 . See Figure 8 for position code.
VOthrDirn	VOD:direction eg VOD:E . When given with VOthrPosn VOth:32E or just 32E .
OShape	Cake or Roll.
ObPosn	ObPosn:position eg ObPosn:44 or just OP44 . See Figure 8 for position code.
TchL	TchL:Space Sp , Wall Wl , Robot Rb , Cake Ck , Roll Rl , Brown & Black Stump Bn & Bk .
TchF	TchF:Space Sp , Wall Wl , Robot Rb , Cake Ck , Roll Rl , Brown & Black Stump Bn & Bk .
TchR	TchR:Space Sp , Wall Wl , Robot Rb , Cake Ck , Roll Rl , Brown & Black Stump Bn & Bk .
Touch	eg "Touch:Space,Robot,Wall" is abbreviated to SpRbWl .

Other Robot's Stimulus event-types deduced by this robot, if seen. U = unseen. Wild Wd if partly seen.

EBrown	Position. When given with EBlack: EBn/k:position Brown/position Black eg. EBn/k:16/33
EBlack	Position. When given with EBrown: EBn/k:position Brown/position Black eg. EBn/k:16/33
EOthrPosn	EOP:position eg EOP:32 or EOP32 . See Figure 8 for position code.
EOthrDirn	EOD:direction eg EOD:E . When given with EOthPosn EOth:32E or just 32E .
EOShape	Cake or Roll.

EObPosn EObPosn:position eg EObPosn:44 or just EOP44. See Figure 8 for position code.
ETchL ETchL:Space Sp, Wall Wl, Wild Wd, Robot Rb, Cake Ck, Roll Rl, Brown/Black Stump Bn/Bk.
ETchF ETchF:Space Sp, Wall Wl, Wild Wd, Robot Rb, Cake Ck, Roll Rl, Brown/Black Stump Bn/Bk.
ETchR ETchR:Space Sp, Wall Wl, Wild Wd, Robot Rb, Cake Ck, Roll Rl, Brown/Black Stump Bn/Bk.
ETouch eg "ETouch:Space,Robot,Wall" is abbreviated to SpRbWl.
=====

References

- Andreae, John H. [1963] "STELLA: A Scheme for a Learning Machine," *Proc. 2nd IFAC Congress*, Basel, 1963. In *Automation and Remote Control*, ed. Broida, London: Butterworths, 1969.
- Andreae, John H. [1977]: *Thinking with the Teachable Machine*. London: Academic Press.
- Andreae, John H. [1987]: "Design of a Conscious Robot," *Metascience*, vol. 5, pp. 41-54.
- Andreae, John H. [1998]: *Associative Learning for a Robot Intelligence*. London: Imperial College Press.
- Andreae, John H. [2011] "A Multiple Context Brain for Experiments with Robot Consciousness," *IEEE Trans. on Autonomous Mental Development*, vol 3, no 4, pp. 312-323.
- Andreae, John H. and Cleary, John G [1976]: "A New Mechanism for a Brain," *Int.J.Man-Machine Studies*, vol.8, no. 1, pp. 89-119.
- Andreae, John H. and MacDonald, Bruce A. [1991]: "Expert Control for a Robot Body," *Kybernetes*, vol. 20, pp. 28-54.
- Andreae, John H., Ryan, Shaun W., Tomlinson, Mark L. and Andreae, Peter M. [1979]: "Structure from Associative Learning," *Int. J. Man-Machine Studies*, vol. 39, pp. 301-312.
- Arbib, Michael A. [2006]: *Action to Language Via the Mirror Neuron System*. Cambridge, U.K.: Cambridge University Press.
- Berwick, Robert C. and Chomsky, Noam [2016]: *Why Only Us: Language and Evolution*. Cambridge, Mass.: MIT Press.
- Bloom, Paul [2000]: *How Children Learn the Meanings of Words*. Cambridge, Mass.: MIT Press.
- Chomsky, Noam [1959]: Review of "Verbal Behavior" by B.F.Skinner, *Language*, vol. 35, no. 1, pp. 26-58.
- Chomsky, Noam [1980]: "Rules and Representations," *The Behavioral and Brain Sciences*, vol. 3, no. 1, pp. 1-15.
- Chomsky, Noam [2016]: *What Kind of Creatures Are We?* New York: Columbia University Press.
- Clark, Andy [2016]: *Surfing Uncertainty. Prediction, Action and the Embodied Mind*. Oxford, U.K.: Oxford University Press.
- Clark, Herbert H. [1996]: *Using Language*, Cambridge, UK: Cambridge University Press.
- Corballis, Michael C. [2002]: *From Hand to Mouth. The Origins of Language*. Princeton, N. J.:Princeton University Press.
- Corballis, Michael C. [2011]: *The Recursive Mind*. Princeton, N. J.:Princeton University Press.
- Elman, Jeffrey L., Bates, Elizabeth A., Johnson, Mark H., Karmiloff-Smith, Annette, Parisi,Domenico and Plunkett, Kim [1996]: *Rethinking Innateness*. Cambridge, Mass.: MIT Press.
- Evans, Vyvyan [2014]: *The Language Myth. Why Language is Not an Instinct*. Cambridge, U.K.: Cambridge University Press.
- Evans, Vyvyan [2015]: *The Crucible of Language:How Language and Mind Create Meaning*. Cambridge, U.K.: Cambridge University Press.
- Fauconnier, Gilles [1985]: *Mental Spaces: Aspects of Meaning Construction in Natural Language*. Cambridge, Mass.: MIT Press.
- Fauconnier, Gilles and Turner, Mark [2002]: *The Way We Think. Conceptual Blending and the Mind's Hidden Complexities*. New York: Basic Books.
- Fodor, Jerry A. [1976]: *The Language of Thought*. Hassocks, U. K.: The Harvester Press.
- Fodor, Jerry A. [1983]: *The Modularity of Mind*. Cambridge, Mass.: MIT Press.
- Fodor, Jerry A. [2008]: *LOT 2: The Language of Thought Revisited*. Oxford, U.K.: Oxford University Press.
- Fodor, Jerry A. and Pylyshyn, Zenon W [2015]: *Minds without Meanings*. Cambridge, Mass.: MIT Press.
- Gaines, Brian R. and Andreae, John H. [1966]: "A Learning Machine in the Context of the General Control Problem," *Proc. 3rd IFAC Congress*, London.

- Gathercole, Susan E. and Baddeley, Alan D. [1993]: *Working Memory and Language*. Hove, U.K.:Lawrence Erlbaum Associates Ltd.
- Gogate, L. and Hollich, G. [2013]: *Theoretical and Computational Models of Word Learning*. Hershey PA: Information Science Reference.
- Hayes, Pat [1977]: "Small Brains and Large Minds," *AISB Newsletter*, no.26, April.
- Howard, Ronald A. [1960]: *Dynamic Programming and Markov Processes*, Cambridge, Mass.: MIT Press.
- Hume, David [1740]: *A Treatise on Human Nature*. Ed. L. A. Selby-Bigge. Oxford: Oxford University Press, 1978.
- Jackendoff, Ray [2002]: *Foundations of Language*. New York: Oxford University Press.
- Knott, Alistair [2012]: *Sensorimotor Cognition and Natural Language Syntax*. Cambridge, Mass., MIT Press.
- Locke, John [1690]: *An Essay Concerning Human Understanding*. Ed. R. Wilburn, London: J.M.Dent & Sons, 1947, p.26.
- MacDonald, Bruce A. and Andreae, John H. [1981]: "The Competence of a Multiple Context Learning system," *Int. J. General Systems*, vol. 7, pp. 123-137.
- McCulloch, W. S. and Pitts, W. [1943]: "A Logical Calculus of the Ideas Immanent in Nervous Activity," *Bulletin of Mathematical Biophysics*, vol. 5, pp.115-117.
- Miller, George A. [1956]: "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information," *Psychological Review*, vol. 63, no. 2, pp. 81-96.
- Moro, Andrea [2015]: *Exploring the Boundaries of Babel*. 2nd.Edn. Cambridge, Mass., MIT Press.
- Pinker, Steven [2002]: *The Blank Slate*, London: Penguin Books.
- Pinker, Steven [2007]: *The Stuff of Thought*, New York: Viking Penguin.
- Spaan, M. T. J. [2014]: "Partially Observable Markov Decision Processes" in M. A. Wiering and M. van Otterlo, eds, *Reinforcement Learning: State of the Art*, Berlin: Springer Verlag.
- Sutton, Richard S. and Barto, Andrew G. [1998]: *Reinforcement Learning*. Cambridge, Mass.: MIT Press.
- Tomasello, Michael [2003]: *Constructing a Language: A Usage-Based Theory of Language Acquisition*. Cambridge, Mass.: Harvard Univ.Press.

=====

Programs and data files are available on request. 7 February 2017 JohnHAndreae@gmail.com

First Interaction

© John H Andreac

Conversation

between robot B (baby) with PP brain and
robot A (adult) controlled by Teacher (me).

World configuration	-E--C	Robot B (upper case) facing East in row 1, col 2.
at start:	-#--w	Cake C in row 1 col 5. Object can be Cake or Roll R.
Surrounding Wall	---#-	Robot A (lower case) facing West in row 2, col 5.
not shown.	-----	Brown Stump (#) in 2,2; Black Stump (#) in 3,4.

BodyMove actions are FORWARD, LEFT, RIGHT, WAIT, PAT and SLAP.

If the learning brain PP fails to choose a BodyMove for robot B, the random Reflex-Motion algorithm **RM** selects BodyMoves for robot B. The algorithm may be found in Fig. 5 of the accompanying Report.

If the Object is in front of a robot, a FORWARD BodyMove is described as a Push, Squeeze or Squash according to whether there is one empty square (Space) into which the Object can be Pushed, or two Spaces into one of which the Object can be Squeezed, randomly chosen, or no Space in which case the Object is Squashed and vanishes (is consumed), a new Object (Cake) appearing in one of the other Spaces in the World, randomly selected. The robot that Squashes the Object is automatically approved.

Hand Pointing actions are PointYou y, PointMe m, PointObject o, PointBrownStump i, PointBlackStump j, PointNWcorner nw, PointNEcorner ne, PointSEcorner se, PointSW corner sw.

Speech actions are any Word introduced by teacher through robot A, the first letter being upper case. A Speech action also has Intonation:

FLT flat, DRP drop, CMD command, RIS rise (for questions), YES approve, NEG disapprove.

A Speech action also has Stress: If a Word is stressed it is preceded by <, otherwise -.

Conversation is controlled by intonation:

FLT, YES or NEG when robot is continuing to speak and point.

DRP or CMD when robot is ending its speaking and pointing.

RIS when robot transfers speaking and pointing to other robot.

Examples of Speech and their abbreviations in the Interaction:

DRP-Quiet (abbreviated to **Q**) is last Word of a robot's speaking and pointing.

CMD-Quiet (abbreviated to **CQ**) is last Word of a robot's command sequence.

RIS-Quiet (abbreviated to **RQ**) is last Word of a robot's question sequence.

YES-Good (abbreviated to **Good** in the following listing) for approval.

NEG-Bad (abbreviated to **Bad** in the following listing) for disapproval.

FLT-Word (abbreviated to Word in the following listing).

FLT<Word (abbreviated to <Word) sets up Working Memory **WM** in PP if said by PP.

The pattern of the conversation is BodyMove by Robot B, Speech-Pointing sequence by Robot B, possible alternation of Speech-Pointing sequences by robots, BodyMove by Robot A, Speech-Pointing sequence by Robot A, possible alternation of Speech-Pointing sequences by robots; repeat this "main step cycle."

After 4 steps, the World is displayed for the situation before and after each BodyMove.

A BodyMove by Robot A is shown by "**A:**", while a BodyMove by Robot B is either "**B:**" if the BodyMove is chosen by RM, or "**PP:**" if it is chosen by PP. A full stop "." after a word or pointing by PP shows that PP chose it, without Teacher unblocking or prompting it. "n," is a default NoPoint when no pointing is chosen by PP and robot B is not within reach of robot A. When robot B **is** within reach of robot A and hasn't selected a pointing, robot A can push robot B's arm to point. Teacher can introduce a new Speech Word at any time.

The associations used by robot B to perform its body moves and speech (not pointing) are listed at the end of the row with robot B's body move, but may spill over into the ends of the following rows of the Interaction. They are always the most right justified and are in black. When the body move has been selected by RM (not PP), the random number N used in the RM algorithm is given as Rand=N instead of the numbers of the associations. A semicolon is used to separate the associations for the body move from the associations for the speech.

The comments include whether robot B sees robot A moving and saying what it did, or didn't see, because robot B cannot learn from robot A by imitation unless it can see robot do the BodyMoves.

Comments are right justified.

Colour indications:
Red and Brown are approved.
Blue and Purple are disapproved.
Green is neutral.

Bold for special actions by robot A (controlled by human teacher).

PURR-PUSS in SQUASH-POP world. John H Andreae

Mon Oct 31 09:42:06 NZDT 2016

Random seed for World = 140827 Random seed for PP = 200829

```
1-0
B:FORWARD Q n
A:RIGHT Next m Turn m Is m Yours m So m You y Move y Forward o CQ m
(4i)
2-12
B was told to move Forward and RM did so. A was too busy to Pat.
B:FORWARD Q n
A:WAIT Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m
(4i)
3-24
B was told to Squash Cake. RM did so. B is automatically approved.
B:FORWARD (Squashed) Q n
A:LEFT You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m
(vi)
4-36
A turned Left away from the Wall and shows B how to set up WM.
B:RIGHT Q n
A:FORWARD I m Moved m Forward m Q m
B saw A move.
-E--C 1 --E-C 1 --E-C 2 ---EC 2 ---EC 3 ----E 3 ----E 4 ----S 4
--#--w B:F --#--w A:R --#--n B:F --#--n A:W --#--n B:F --#--n A:L --#--w B:R --#--w A:F
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
----- -----
--C-- --C-- --C--
5-43
B:FORWARD Q n,
A:FORWARD I m Moved m Forward m Q m
B saw A move.
6-50
PP:FORWARD Q n,
A:LEFT You y Move y Forward y CQ m
PP makes its first move. 0BH,3BI
7-57
B:FORWARD Q n
A:PAT You y Turn y Right y CQ m
B was told to move Forward. RM did so. A Pats.
8-64
B:RIGHT Q n
A:PAT You y Move y Forward y CQ m
B was told to turn Right. RM did so. A Pats.
---S 5 ----- 5 ----- 6 ----- 6 ----- 7 ----- 7 ----- 8 ----- 8
--#-w- B:F --#-wS A:F --#-wS PP:F --#-w- A:L --#s-- B:F --#s-- A:P --#s-- B:R --#s-- A:P
---#- ---#- ---#- ---#S ---#S ---#- ---#- ---#-
--C-- --C-- --C-- --C-- --C-- --C-S --C-S --C-W
9-71
B:FORWARD Q n
A:PAT You y Push y Cake o CQ m
B was told to move Forward. RM did so. A Pats.
10-78
B:FORWARD Q n
A:RIGHT You y Push y Cake o CQ m
B was told to Push Cake. RM did so. A was too busy to Pat.
11-85
PP:FORWARD Q n
A:RIGHT I m Turned m Right m Q m
B was told to Push Cake. PP did so. A was too busy to Pat.
12-92
PP:FORWARD Q n,
A:FORWARD I m Moved m Forward m Q m
B didn't see A move.
----- 9 ----- 9 ----- 10 ----- 10 ----- 11 ----- 11 ----- 12 ----- 12
--#s-- B:F --#s-- A:P --#s-- B:F --#s-- A:R --#w-- PP:F --#w-- A:R --#n-- PP:F --#n-- A:F
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
--C-W --CW- --CW- --CW- --CW- --CW- --CW- --W---
13-99
B:LEFT I. n, Turned. n, Right. n, CQ n,
A:LEFT Bad y You y Turn y Right y CQ m
RM turned Left but PP says it turned Right. Rand=19
14-110
B:RIGHT Q n,
A:FORWARD You y Turn y Right y CQ m
A says Bad.
B was told to turn Right and RM did so.
A is out-of-reach to Pat. Rand=4
15-117
PP:RIGHT Q n
A:PAT You y Push y Cake o CQ m
B was told to turn Right and PP did so. A Pats.
16-124
PP:FORWARD Q n
A needs to Wait for imitation so no Pat. 7BI
```

A:WAIT Next m Turn m Is m Mine m So m You y Push y Cake o CQ m
 --n-- 13 --n-- 13 --w-- 14 --w-- 14 --w-- 15 --w-- 15 --w-- 16 --w-- 16
 -#--- B:L -#--- A:L -#--- B:R -#--- A:F -#--- PP:R -#--- A:P -#--- PP:F C#--- A:W
 C--#- C--#- C--#- C--#- C--#- C--#- C--#- C--#- N--#-
 W---- S---- S---- W---- W---- N---- N---- ----
 17-136 B was told to Push Cake and PP did so. A was too busy to Pat. 2BH
PP:FORWARD Q n
A:FORWARD (Squashed) I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m
 18-148
 B:LEFT Q n RM turned Left towards the Wall. A Slaps. Rand=16
 A:SLAP Q n
 19-152
 B:RIGHT Q n Rand=13
 A:LEFT I m Turned m Left m Q m B saw A turn.
 20-159
 B:RIGHT Q n Rand=17
 A:LEFT I m Turned m Left m Q m B saw A turn.
 -w--- 17 Cw--- 17 w--- 18 w--- 18 w--- 19 w--- 19 s--- 20 s--- 20
 C#--- PP:F N#--- A:F N#C-- B:L W#C-- A:S W#C-- B:R N#C-- A:L N#C-- B:R E#C-- A:L
 N--#- ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

 21-166
 B:LEFT Q n Rand=13
 A:FORWARD I m Moved m Forward m Q m B saw A move.
 22-173
 PP:FORWARD Q n, 3BI
 A:FORWARD I m Moved m Forward m Q m B saw A move.
 23-180
 PP:RIGHT Q n, 10BH,9BI
 A:RIGHT I m Turned m Right m Q m B saw A turn.
 24-187
 PP:FORWARD Q n 12BH
 A:FORWARD I m Pushed m Cake o Q m B saw A Push.
 e--- 21 e--- 21 -e--- 22 Ne--- 22 N-e-- 23 E-e-- 23 E-s-- 24 -Es-- 24
 E#C-- B:L N#C-- A:F N#C-- PP:F -#C-- A:F -#C-- PP:R -#C-- A:R -#C-- PP:F -#C-- A:F
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

 25-194
 B:FORWARD Q n, Rand=8
 A:FORWARD I m Pushed m Cake o Q m B saw A Push.
 26-201
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. A didn't see it. 0BH,17BI
 A:FORWARD I m Squeezed m Cake o Q m B didn't see A Squeeze.
 27-211
 PP:FORWARD I. n, Squeezed. n, Cake. n, Q n, PP moved Forward but says it Squeezed Cake. 0BH
 A:RIGHT I m Turned m Right m Q m A didn't see it. B didn't see A turn.
 28-221
 PP:RIGHT Q n, 10BH
 A:RIGHT I m Turned m Right m Q m B saw A turn.
 -E--- 25 --E-- 25 --E-- 26 ---E- 26 ---E- 27 ----E 27 ----E 28 ----S 28
 -#s-- B:F -#s-- A:F -#--- PP:F -#--- A:F -#--- PP:F -#--- A:R -#--- PP:R -#--- A:R
 -C#- -C#- -C#- -C#- -C#- -C#- -C#- -C#- -C#-

 29-228
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. A says Good. 12BH,16BI
 A:FORWARD Good y I m Moved m Forward m Q m B saw A move.
 30-239
 PP:FORWARD Q n 0BH
 A:LEFT I m Turned m Left m Q m B saw A turn.
 31-246
 PP:FORWARD I. n, Squeezed. n, Cake. n, Q n, PP moved Forward, says it Squeezed Cake. A didn't see 8BH
 A:FORWARD Bad m I m Moved m Forward m Q m move but Cake unmoved. A says Bad. B didn't see A move.
 32-257
 PP:RIGHT Q n, 10BH
 A:FORWARD I m Moved m Forward m Q m B saw A move.
 ----S 29 ----S 29 ----S 30 ----S 30 ----S 31 ----S 31 ----S 32 ----S 32
 -#--- PP:F -#---S A:F -#---S PP:F -#--- A:L -#--- PP:F -#--- A:F -#--- PP:R -#--- A:F
 ---#- ---#- ---n#- ---n#S ---w#S ---w#- ---w#- ---w#-
 -Cn-- -Cn-- -C--- -C--- -C--- -C--- -C--- -C---
 33-264
 PP:FORWARD Q n, 12BH,3BI

A:LEFT You y Move y Forward y CQ m
34-271 B was told to move Forward and PP did so.
PP:FORWARD Q n A must do a Wait for imitation so no Pat. 8BH,4BI
A:WAIT Next m Turn m Is m Yours m So m You y Push y Cake o CQ m
35-283 B was told to Push Cake and PP did so.
PP:FORWARD Q n A was too busy to Pat. 15BG,2BH,11BI
A:WAIT Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m
36-295 B was told to Squash the Cake and PP did so. Automatically approved.
PP:FORWARD (Squashed) Q n A turned away from the Wall and shows PP how to set up WM. 1BG,2BH,1BI
A:LEFT You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m
----- 33 ----- 33 ----- 34 ----- 34 ----- 35 ----- 35 ----- 36 -C--- 36
-#--- PP:F -#--- A:L -#--- PP:F -#--- A:W -#--- PP:F -#--- A:W -#--- PP:F -#--- A:L
w--#- w--#- s--#- s--#- s--#- s--#- s--#- s--#-
-C-W -C-W- -C-W- -CW-- -CW-- CW-- CW-- W----
37-307
PP:RIGHT Q n 2BA,1BB
A:WAIT You y Turn y Right y CQ m
38-314 B was told to turn Right but RM turned Left. A Slaps.
B:LEFT Q n Rand=14
A:SLAP You y Turn y Right y CQ m
39-321 B was told to turn Right and PP did so. A Pats.
PP:RIGHT Q n 5BI
A:PAT You y Turn y Right y CQ m
40-328 B was told to turn Right but RM Waited. A Slaps.
B:WAIT Q n Rand=14
A:SLAP You y Turn y Right y CQ m A is aiming for a cAB Squash in the SW corner.
-C--- 37 -C--- 37 -C--- 38 -C--- 38 -C--- 39 -C--- 39 -C--- 40 -C--- 40
-#--- PP:R -#--- A:W -#--- B:L -#--- A:S -#--- PP:R -#--- A:P -#--- B:W -#--- A:S
e--#- e--#- e--#- e--#- e--#- e--#- e--#- e--#-
W---- N---- N---- W---- W---- N---- N---- N----
41-335 B was told to turn Right and RM did so. A Pats.
B:RIGHT Q n Rand=0
A:PAT You y Move y Forward y CQ m
42-342 B was told to move Forward and PP did so. A Pats.
PP:FORWARD Q n 6BI
A:PAT You y Move y Forward y CQ m
43-349 B was told to move Forward and PP did so.
PP:FORWARD Q n A needs to move Forward to keep within reach so no Pat. 6BI
A:FORWARD You y Move y Forward y CQ m
44-356 B was told to move Forward and PP did so.
PP:FORWARD Q n A needs to move Forward to keep within reach so no Pat. 51BH,6BI
A:FORWARD You y Move y Forward y CQ m
-C--- 41 -C--- 41 -C--- 42 -C--- 42 -C--- 43 -C--- 43 -C--- 44 -C--- 44
-#--- B:R -#--- A:P -#--- PP:F -#--- A:P -#--- PP:F -#--- A:F -#--- PP:F -#--- A:F
e--#- e--#- e--#- e--#- e--#- e--#- e--#- e--#-
N---- E---- E---- -E---- -E---- -E---- -E----
45-363 B was told to move Forward and PP did so. A Pats.
PP:FORWARD Bad. n You. m Turn. m Right. m CQ m PP tells A to turn Left when out of sight. 6BI
A:PAT Bad y You y Turn y Left y CQ m A says Bad.
46-375 B was told to turn Left but PP turned Right. A Slaps.
PP:RIGHT Bad. n You. n Turn. n Left. n Q n PP tells A to turn Left when out of sight. 12BE
A:SLAP Bad y You y Turn y Left y CQ m A says Bad.
47-387 B was told to turn Left and RM did so. A Pats.
B:LEFT I m Turned m Q m Incomplete sequence. Rand=18
A:PAT You y Turn y Left y CQ m
48-396 B was told to turn Left and PP did so. A Pats.
PP:LEFT You. y. Move. y. Forward. y. CQ m. PP tells A to move Forward when against Stump. 41BD,
A:PAT Bad y You y Move y Forward y CQ m A says Bad. 12BE,41BF;108-10SK
-C--- 45 -C--- 45 -C--- 46 -C--- 46 -C--- 47 -C--- 47 -C--- 48 -C--- 48
-#--- PP:F -#--- A:P -#--- PP:R -#--- A:S -#--- B:L -#--- A:P -#--- PP:L -#--- A:P
--e#- --e#- --e#- --e#- --e#- --e#- --e#- --e#-
---E- ---E- ---E- ---S ---S ---E- ---E- ---N
49-407 B was told to move Forward. PP Waited and tells nonsense.
PP:WAIT Next. m. Turn. m. Is. m. Yours. m. So. m. You. y Move y Forward y CQ m A Slaps 41BH;
A:SLAP Bad y You y Move y Forward y CQ m and says Bad. 112-17SK,167-9SIub
50-423 B was told to move Forward and RM did so. A Pats.
B:FORWARD Q n Rand=6
A:PAT You y Move y Forward y CQ m
51-430 B was told to move Forward and PP did so. A Pats.
PP:FORWARD Q n
52BH,6BI

A: PAT You y Move y Forward y CQ m
52-437 B was told to move Forward and PP did so. A Pats. 51BH, 6BI
PP: FORWARD Q n
A: PAT You y Turn y Left y CQ m
-C--- 49 -C--- 49 -C--- 50 -C--- 50 -C--- 51 -C--- 51 -C--- 52 -C---N 52
-#--- PP:W -#--- A:S -#--- B:F -#--- A:P -#--- PP:F -#---N A:P -#---N PP:F -#--- A:P
--e#- --e#- --e#- --e#N --e#N --e#- --e#- --e#-
---N ---N ---N ---N ---N ---N ---N ---N
53-444 B was told to turn Left and RM did so. A Pats. 54BH
B: LEFT Q n
A: PAT You y Move y Forward y CQ m
54-451 B was told to move Forward and PP did so. A was too busy to Pat. 6BI
PP: FORWARD Q n
A: LEFT You y Move y Forward y CQ m
55-458 B was told to move Forward and PP did so. A was too busy to Pat. 51BH, 6BI
PP: FORWARD Q n
A: LEFT You y Push y Cake o CQ m
56-465 B was told to Push the Cake and PP did so. A was too busy to Pat. 7BI
PP: FORWARD Q n
A: FORWARD You y Push y Cake o CQ m
-C--N 53 -C--W 53 -C--W 54 -C--W- 54 -C--W- 55 -CW-- 55 -CW-- 56 CW--- 56
-#--- B:L -#--- A:P -#--- PP:F -#--- A:L -#--- PP:F -#--- A:L -#--- PP:F -#--- A:F
--e#- --e#- --e#- --e#- --n#- --n#- --w#- --w#-
---N ---N ---N ---N ---N ---N ---N ---N
57-472 B was told to Push the Cake and PP did so. 7BI
PP: FORWARD Q n
A: LEFT I m Turned m Left m Q m B didn't see A turn.
58-479 Rand=19
B: LEFT Q n, B saw A move.
A: FORWARD I m Moved m Forward m Q m
59-486 Rand=4
B: FORWARD Q n,
A: RIGHT Next m Turn m Is m Mine m So m You y Push y Cake o CQ m
60-498 B was told to Push the Cake and PP did so. A was too busy to Pat. 69BH
PP: FORWARD Q n
A: FORWARD (Squashed) I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m
CW--- 57 W--- 57 W--- 58 S--- 58 S--- 59 --- 59 --- 60 --- 60
-#--- PP:F C#--- A:L C#--- B:L C#--- A:F C#--- B:F S#--- A:R S#--- PP:F -#--- A:F
-w#- -w#- -s#- -s#- ---#- C--#- C--#- S--#-
---N ---N ---N ---N ---N ---N ---N ---N
61-510 With unblocking, PP turned Left away from the Wall and sets up WM for the next Squash.
PPu: LEFT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 12BI; 18-25SK
A: PAT Good y You y Move y Forward y CQ m A Pats and says Good.
62-526 B was told to move Forward but PP Waited. PP tells. A was too busy to Slap. 5BH; 121-3SK
PP: WAIT You. y. Turn. y. Right. y. CQ m.
A: RIGHT You y Move y Forward y CQ m
63-536 B was told to move Forward but PP Waited. A Slaps. PP tells. 53BG; 288-91SD
PP: WAIT You. y. Turn. y. Right. y. CQ m.
A: SLAP You y Move y Forward y CQ m
64-546 B was told to move Forward and RM did so. A Pats. Incomplete sequence. Rand=19
B: FORWARD You. no! Q n
A: PAT You y Move y Forward y CQ m
----- 61 ----- 61 ----- 62 ----- 62 ----- 63 ----- 63 ----- 64 ----- 64
-#--- PP:L -#--- A:P -#--- PP:W -#--- A:R -#--- PP:W -#--- A:S -#--- B:F -#--- A:P
S--#- E--#- E--#- E--#- E--#- E--#- E--#- E--#-
w---C w---C w---C w---C n---C n---C n---C n---C
65-554 B was told to move Forward and PP did so. A Pats. 6BI
PP: FORWARD Q n
A: PAT You y Turn y Right y CQ m
66-561 B was told to turn Right but RM turned Left. A Slaps. PP tells but can't see A. A says Bad. Rand=9
B: LEFT You. no! Move. no! Forward. no! CQ m.
A: SLAP Bad y You y Turn y Right y CQ m
67-572 B was told to turn Right but PP turned Left.
A Slaps.
PP: LEFT You. y. Push. y. Cake. no! CQ m. PP tells A to Push Cake. 66BH; 102SK, 169-71SK
A: SLAP You y Turn y Left y CQ m
68-582 B was told to turn Left but RM moved Forward. A Slaps.
B: FORWARD Q n
Rand=2
A: SLAP You y Turn y Left y CQ m
----- 65 ----- 65 ----- 66 ----- 66 ----- 67 ----- 67 ----- 68 ----- 68

-#--- PP:F -#--- A:P -#--- B:L -#--- A:S -#--- PP:L -#--- A:S -#--- B:F -#--- A:S
 -E-#- --E#- --E#- --N#- --N#- --W#- --W#- --W#-
 n---C n---C n---C n---C n---C n---C n---C
 69-589 B was told to turn Left but RM moved Forward. A Slaps.
 B:FORWARD Q n Rand=9
 A:SLAP You y Turn y Left y CQ m
 70-596 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 29BI;71-3SK,26SL
 A:PAT Good y You y Turn y Left y CQ m
 71-607 B was told to turn Left and PP did so. A Pats.
 PP:LEFT You. y. Turn. m. Right. y. CQ m. PP tells A to turn Right. 27BH;18SK,240-1SI
 A:PAT You y Move y Forward y CQ m
 72-617 B was told to move Forward and PP did so. A Pats.
 PP:FORWARD You. no! Q n Incomplete sequence. 57BC;56SB
 A:PAT You y Move y Forward y CQ m
 ----- 69 ----- 69 ----- 70 ----- 70 ----- 71 ----- 71 ----- 72 ----- 72
 -#--- B:F -#--- A:S -#--- PP:L -#--- A:P -#--- PP:L -#--- A:P -#--- PP:F -#--- A:P
 -W-#- W--#- W--#- S--#- S--#- E--#- E--#- E--#-
 n---C n---C n---C n---C n---C n---C n---C
 73-625 B was told to move Forward and PP did so. A Pats.
 PP:FORWARD Q n 62BA
 A:PAT You y Turn y Right y CQ m
 74-632 B was told to turn Right but RM Waited. A Slaps.
 B:WAIT Q n Rand=10
 A:SLAP You y Turn y Right y CQ m
 75-639 B was told to turn Right and RM did so. A Pats.
 B:RIGHT Q n Rand=9
 A:PAT You y Move y Forward y CQ m
 76-646 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 6BI
 A:PAT Good y You y Turn y Left y CQ m
 ----- 73 ----- 73 ----- 74 ----- 74 ----- 75 ----- 75 ----- 76 ----- 76
 -#--- PP:F -#--- A:P -#--- B:W -#--- A:S -#--- B:R -#--- A:P -#--- PP:F -#--- A:P
 -E-#- --E#- --E#- --E#- --E#- --S#- --S#- --S#-
 n---C n---C n---C n---C n---C n---C n---C n-S-C
 77-657 B was told to turn Left and PP did so. A was too busy to Pat.
 PP:LEFT Q n Robot B is now facing the right way to go to the NW corner. 40BH
 A:RIGHT You y Move y Forward y CQ m
 78-664 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 41BH,6BI;16SL,
 A:FORWARD Good y You y Push y Cake o CQ m 66-7SL
 79-675 B was told to Push the Cake and RM did so. A Pats.
 B:FORWARD Q n Rand=10
 A:PAT You y Turn y Left y CQ m
 80-682 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 70BH,29BI;61-2SL,26SL
 A:PAT Good y You y Push y Cake o CQ m
 ----- 77 ----- 77 ----- 78 ----- 78 ----- 79 ----- 79 ----- 80 ----- 80
 -#--- PP:L -#--- A:R -#--- PP:F -#--- A:F -#--- B:F -#--- A:P -#--- PP:L -#--- A:P
 ---#- ---#- ---#- ---#- ---#- ---#C ---#C ---#C
 n-S-C n-E-C e-E-C e--EC -e-EC -e--E -e--E -e--N
 81-693 B was told to Push the Cake and PP did so. A is out-of-reach to Pat.
 PP:FORWARD Q n 72BH,40BI
 A:LEFT You y Push y Cake o CQ m
 82-700 B was told to Push the Cake and PP did so.
 PP:FORWARD Q n, A was too busy to Pat. 96BH,7BI
 A:FORWARD You y Push y Cake o CQ m
 83-707 B was told to Push the Cake and PP did so.
 PP:FORWARD Q n, A was too busy to Pat. 67BH,7BI
 A:LEFT I m Turned m Left m Q m B didn't see A turn.
 84-714 PP turned Left and says so. A didn't see it. 55BA,54BB;
 PP:LEFT I m Moved m Forward m Q m B saw A move. 232-4SK,14SL
 A:FORWARD I m Moved m Forward m Q m
 ----- 81 ----- 81 ----- 82 -----C 82 -----C 83 ---CN 83 ---CN 84 ---CW 84
 -#--- PP:F -#---C A:L -#---C PP:F -#---N A:F -#---N PP:F -#--- A:L -#--- PP:L -#--- A:F
 ---#C ---#N ---#N ---#- -n-#- -n-#- -w-#- -w-#-
 -e--N -e--- -n--- -n--- -----
 85-724
 PP:FORWARD Q n, 72BH,31BI
 A:RIGHT You y Push y Cake o CQ m
 86-731 B was told to Push the Cake and PP did so.

PP:FORWARD Q n A was too busy to Pat. 67BH
A:FORWARD Next m Turn m Is m Yours m So m You y Push y Cake o CQ m
87-743 B was told to Push the Cake and PP did so.
PP:FORWARD Q n A was too busy to Pat. 67BH,11BI
A:WAIT Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m
88-755 B was told to Squash the Cake and PP did so.
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m.
A:RIGHT Bad y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 69BH,1BI;63-70SK,46SL
---CW 85 ---CW- 85 ---CW- 86 -CW-- 86 -CW-- 87 CW--- 87 CW--- 88 W---- 88
-#--- PP:F -#--- A:R -#--- PP:F -#--- A:F n#--- PP:F n#--- A:W n#--- PP:F n#--- A:R
w--#- w--#- n--#- n--#- ---#- ---#- ---#- C--#-

89-776 PP says it Squashed Cake but reads WM as <Mine instead of setting it to <Yours. A says Bad.
PP:SLAP Q n PP Slaps so A Slaps to stop it. 23BH,2BI
A:SLAP You y Turn y Left y CQ m
90-783 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 25BH;71-3SK,26SL
A:PAT Good y You y Turn y Left y CQ m
91-794 B was told to turn Left and PP did so. A Pats.
PP:LEFT You. y. Turn. m. Right. y. CQ m. PP tells. 27BH,38BI;74SK,63SL,28SL,64SL
A:PAT You y Move y Forward y CQ m
92-804 B was told to move Forward and PP did so. A Pats.
PP:FORWARD Next. m. Q m. Incomplete sequence. 29BH,33BI;77SK
A:PAT You y Move y Forward y CQ m
W---- 89 W---- 89 W---- 90 S---- 90 S---- 91 E---- 91 E---- 92 -E--- 92
e#--- PP:S e#--- A:S e#--- PP:L e#--- A:P e#--- PP:L e#--- A:P e#--- PP:F e#--- A:P
C--#- C--#- C--#- C--#- C--#- C--#- C--#- C--#-

93-812 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 31BH,33BI;80-2SK,52SL,66-7SL
A:PAT Good y You y Turn y Right y CQ m
94-823 B was told to turn Right but PP moved Forward. A Slaps.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP says it moved Forward. A says Good. 0BH;80-2SK
A:SLAP Good y You y Move y Forward y CQ m
95-834 B was told to move Forward and PP did so with unblocking. A is out-of-reach to Pat.
PPu:FORWARD I. m. Turned. m. Right n, CQ n, PP says it turned Right with unblocking. 0BH;
A:WAIT Bad y You y Turn y Right y CQ m A says Bad. 54SI,165SI,2SG
96-845 B was told to turn Right and PP did so. A is out-of-reach to Pat.
PP:RIGHT You. y. Push. y. Cake. o. CQ m. PP tells the impossible. A says Bad. 12BC;176SK,182-4SK,
A:WAIT Bad y You y Move y Forward y CQ m 58-9SL
-E--- 93 -E--- 93 -E--- 94 -E--- 94 -E--- 95 -E--- 95 -E--- 96 -E--- 96
e#--- PP:F e#--- A:P e#--- PP:F e#--- A:S e#--- PP:F e#--- A:W e#--- PP:R e#--- A:W
C--#- C--#- C--#- C--#- C--#- C--#- C--#- C--#-

97-856 B was told to move Forward. PP did so and says so.
PP:FORWARD I. n, Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 12BH,28BI;
A:WAIT Good y You y Move y Forward y CQ m 80SK,31SL,99-100SJ,101SH
98-867 B was told to move Forward. PP did so and says so.
PP:FORWARD I n, Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 0BH,32BI;
A:RIGHT Good y You y Move y Forward y CQ m 48SL,66-7SL
99-878
PP:FORWARD I n, Moved. n, Forward. m. Q m. B was told to move Forward. PP did so and says so.
A:WAIT Good y You y Turn y Right y CQ m A says Good but is out-of-reach to Pat. 8BH,32BI;106SC,
100-889 B was told to turn Right and PP did so. A is out-of-reach to Pat. 66-7SL
PP:RIGHT I. m. Moved. m. Forward. m. Q n, PP says it moved Forward. A says Bad. 12BD,12BE,12BF;
A:WAIT Bad y You y Move y Forward y CQ m 77-9SL
---S 97 ---S 97 ---S 98 ---S 98 ---S 99 ---S 99 ---S 100 ---S 100
e#--- PP:F e#---S A:W e#---S PP:F e#--- A:R s#--- PP:F s#--- A:W s#--- PP:R s#--- A:W
C--#- C--#- C--#- C--#S C--#S C--#- C--#- C--#-

101-900 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 12BH;112-4SH,
A:WAIT Good y You y Move y Forward y CQ m 111-2SJ
102-911 B was told to move Forward. PP did so and says so. A says Good.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Waits to help imitation. 8BH,32BI;80-2SK,48SL,66-7SL
A:WAIT Good y Next m Turn m Is m Yours m So m You y Move y Forward y CQ m
103-927 B was told to move Forward. PP did so but A was too busy to Pat.
PP:FORWARD I. m Moved. m. Forward. m. Q m. Not what A wanted PP to say. 0BH;110-1SH,
A:FORWARD Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 101SH,99-100SJ
104-942 B was told to Squash Cake. PP did so, says so and sets up WM with <Yours. A says Good.
PP:FORWARD (Squashed) I. m. Squashed m. Cake m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.

A:LEFT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 34BD,34BE,34BF;185-7SK,
 ----- 101 ----- 101 ----- 102 ----- 102 ----- 103 ----- 103 ----- 104 ----- 104 71-2SL,270-4SD
 s#--- PP:F s#--- A:W s#--- PP:F s#--- A:W s#--- PP:F s#--- A:F s#--- PP:F s#--- A:L
 C--#- C--#- C--#- C--#- C--#- C--#- C--#- s--#- sC--#-
 ---W- ---W- ---W- ---W- ---W- ---W- CW--- W---
 105-963
 PP:RIGHT You. y. Move. y. Forward. y. CQ m. PP tells the impossible(must be Push). 2BA,1BB,2BC;
 A:FORWARD Bad m I m Moved m Forward m Q m B saw A move. 198-200SK
 106-974
 PP:FORWARD Q n, 6BH
 A:FORWARD I m Squeezed m Cake o Q m B partly saw A Squeeze.
 107-981
 PP:FORWARD I. m. Squeezed. n, Cake. no! CQ m. PP moved Forward but says it Squeezed the Cake. 0BH;
 A:RIGHT I m Turned m Right m Q m A didn't see it but can see Cake. B didn't see A turn. 77-8SK 8-9SL
 108-991
 PP:FORWARD You. n, Turn. n, Right. n, CQ m. PP tells A when neither seeing each other. 31BH;36-8SI,
 A:FORWARD I m Squeezed m Cake o Q m B didn't see A Squeeze. 33SI
 ----- 105 ----- 105 ----- 106 ----- 106 ----- 107 ----- 107 ----- 108 N--- 108
 --#--- PP:R --#--- A:F --#--- PP:F --#--- A:F --#--- PP:F N#--- A:R N#--- PP:F --#--- A:F
 eC--#- eC--#- eC--#- NeC--#- N-e#- --e#- --s#- --s#-
 W--- N--- N--- --C-- --C-- --C-- --C--
 109-1001
 PP:RIGHT Next. m. Turn. m. Is. m. Yours^ m. Q n, PP reads WM with prompt;incomplete sequence. 10BH;
 A:LEFT I m Turned m Left m Q m B saw A turn. 176-9SK
 110-1012
 PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. Q m. WM supports PP's Yours. 12BH,21BI;
 A:LEFT You y Move y Forward y CQ m A couldn't see to unblock rest. 77SK,13SL,240-4SK
 111-1024
 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 31BH;96-8SH,95-7SJ
 A:PAT Good y You y Move y Forward y CQ m
 112-1035
 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 0BH,32BI;110-1SH,101SH,123SJ,
 A:PAT Good y You y Move y Forward y CQ m
 99-100SJ
 N--- 109 E--- 109 E--- 110 -E--- 110 -E--- 111 --E-- 111 --E-- 112 ---E- 112
 --#--- PP:R --#--- A:L --#--- PP:F --#--- A:L --#--- PP:F --#--- A:P --#--- PP:F --#--- A:P
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 --sC- --sC- --eC- --eC- --nC- --nC- --nC- --nC-
 113-1046
 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. n, Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 0BH,32BI;
 A:RIGHT Good y You y Turn y Right y CQ m 106-7SC,470-1SD,120SC,496SD
 114-1057
 B was told to turn Right and PP did so. A is out-of-reach to Pat.
 PP:RIGHT I n, Q n, Incomplete sequence. 94BA,94BB;106SH
 A:FORWARD You y Move y Forward y CQ m
 115-1065
 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 12BH,6BI;110-1SH,
 A:WAIT Good y Next m Turn m Is m Mine m So m You y Move y Forward y CQ m 101SH,99-100SJ
 116-1081
 B was told to move Forward. PP did so but A was too busy to Pat.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. Not what A wanted B to say. 0BH,46BI;85SL,66-7SL
 A:FORWARD (Squashed) I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m
 ---E- 113 ---E 113 ---E 114 ---S 114 ---S 115 ---S 115 ---S 116 ---S 116
 --#--- PP:F --#--- A:R --#--- PP:R --#--- A:F --#--- PP:F --#--- A:W --#--- S PP:F --#--- A:F
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#S
 --nC- --nC- --eC- --eC- ---eC ---eC ---eC ---eC
 117-1096
 PP turned Left towards the Wall. A Slaps.
 PP:LEFT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine m. Q m. 12BI;40-7SL
 A:SLAP Good y You y Turn y Left y CQ m PP says it Squashed and sets up WM with unblocked <Mine.
 118-1112
 B was told to turn Left and PP did so. A was too busy to Pat.
 PP:LEFT You. no! Q n Incomplete sequence. 24BH,39BI;63SL
 A:LEFT You y Move y Forward y CQ m
 119-1120
 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 6BI;16SL,66-7SL
 A:LEFT Good y I m Turned m Left m Q m B didn't see A turn.
 120-1131
 PP:FORWARD I. m. Turned. m. Right. m Q m PP moved Forward but says it turned. A says Bad. 51BH;
 A:FORWARD Bad m I m Moved m Forward m Q m B didn't see A move. 32SI,51-2SI
 ----- 117 ----- 117 ----- 118 ----- 118 ----- 119 ----- 119 ----- 120 ---N 120
 --#--- PP:L --#--- A:S --#--- PP:L --#--- A:L --#--- PP:F --#--- N A:L --#--- N PP:F --#--- A:F
 -C-#S -C-#E -C-#E -C-#N -C-#N -C-#- -C-#- -C-#-
 ---e ---e ---e ---e ---n ---n ---w ---w
 121-1142
 Robot A has to get the Cake next to the Wall for the next Squash.

PP:LEFT Q n, 22BI
 A:FORWARD I m Moved m Forward m Q m B saw A move.
 122-1149
 PP:FORWARD Q m. 41BH, 3BI
 A:RIGHT I m Turned m Right m Q m B saw A turn.
 123-1156
 PP:FORWARD I. m Moved. m. Forward. m. Q m. PP moved Forward and says so. A says Good. 51BH, 16BI;
 A:FORWARD Good y I m Moved m Forward m Q m B saw A move. 369-71SK, 10-2SL
 124-1167
 PP:FORWARD Q m. 51BH, 20BI
 A:LEFT I m Turned m Left m Q m B didn't see A turn.
 ----N 121 ----W 121 ----W 122 ---W- 122 ---W- 123 --W-- 123 --W-- 124 -W--- 124
 -#--- PP:L -#--- A:F -#--- PP:F -#--- A:R -#--- PP:F -#--- A:F -#--- PP:F -#--- A:L
 -C-#- -C-#- -C-#- -C-#- -C-#- -C-#- -Cn#- -Cn#-
 ---w- ---w- ---w- ---w- ---n- ---n- ----
 125-1174
 PP:FORWARD I m Moved. m Forward. m CQ m PP moved Forward and says so but 21BI; 652SD, 51SI, 53SI, 35SI
 A:FORWARD Bad y I m Pushed m Cake o Q m with CQ instead of Q so A says Bad. B didn't see A Push.
 126-1185 Robot A must get robot B to Wait so it can get to SE corner in time for a Squash.
 PP:LEFT Q n 54BH
 A:RIGHT Now y You y Wait y CQ m
 127-1192 B was told to Wait and PP did so with unblocking. A Pats.
 PPu:WAIT Q n 41BH
 A:PAT Now y You y Wait y CQ m
 128-1199 B was told to Wait and PP did so. A Pats.
 PP:WAIT Q n 112BC
 A:PAT Now y You y Wait y CQ m
 -W--- 125 W---- 125 W---- 126 S---- 126 S---- 127 S---- 127 S---- 128 S---- 128
 -#--- PP:F -#--- A:F -#--- PP:L -#--- A:R -#--- PP:W -#--- A:P -#--- PP:W -#--- A:P
 -Cw#- -Cw#- Cw-#- Cw-#- Cn-#- Cn-#- Cn-#- Cn-#-

 129-1206 B was told to Wait and PP did so. A was too busy to Pat.
 PP:WAIT Q n 120BA
 A:RIGHT Now m You m Wait m CQ m A can't see B so it can't point at B.
 130-1213 B was told to Wait and PP did so while
 PP:WAIT Q n, A hurries on to the corner without Patting. 60BH
 A:FORWARD Now m You m Wait m CQ m
 131-1220 B was told again to Wait and PP did so.
 PP:WAIT Q n, 60BH, 57BI
 A:LEFT You y Move y Forward y CQ m
 132-1227 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but can't stop to Pat. 60BH, 6BI;
 A:FORWARD Good y I m Moved m Forward m Q m B saw A move. 16SL, 66-7SL
 S---- 129 S---- 129 S---- 130 S---- 130 S---- 131 S---- 131 S---- 132 ---- 132
 -#--- PP:W -#--- A:R -#--- PP:W -#--- A:F -#--- PP:W -#--- A:L -#--- PP:F S#--- A:F
 Cn-#- Cn-#- Ce-#- Ce-#- C-e#- C-e#- C-n#- C-n#-

 133-1238
 PP:FORWARD Next. m. Turn. m. Is. m. Mine^ n, Q m. PP reads WM correctly with a Prompt. 69BH;
 A:RIGHT I m Turned m Right m Q m B didn't see A turn. 309-12SK
 134-1249
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP Pushed Cake but says it moved Forward. 67BH; 10-2SL
 A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A's move.
 135-1259
 PP:LEFT Q m. 70BH, 9BI
 A:FORWARD I m Moved m Forward m Q m B saw A move.
 136-1266
 PP:FORWARD Next. m. Turn. m. Is. m. Mine. n, Q m. PP reads WM properly. 69BG, 72BH, 31BI;
 A:RIGHT You y Push y Cake o CQ m 110-2SL, 309-12SK
 ---- 133 ---- 133 ---- 134 ---- 134 ---- 135 ---- 135 ---- 136 ---- 136
 S#n- PP:F -#n- A:R -#e- PP:F -#e- A:F -#e- PP:L -#e- A:F -#e- PP:F -#e- A:R
 C-#- S-#- S-#- -#- -#- -#- -#- -#- -#-
 ---- C---- C---- SC--- SC--- EC--- EC--- -EC---
 137-1277 B was told to Push Cake and PP did so. A was too busy to Pat.
 PP:FORWARD Next. m. Turn. m. Is. m. Mine. m Q m. WM supports but PP fails to complete. 67BH;
 A:WAIT Next m Turn m Is m Yours m So m You y Push y Cake o CQ m 309-11SK, 191SH
 138-1293 B was told to Push Cake and PP did so. PP's statement not wanted. A says Bad.
 PP:FORWARD You. y. Move. y. Forward. y. CQ m. 67BH; 338-41SK
 A:FORWARD Bad y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m
 139-1309 B was told to Squash Cake. PP did so, says so and sets up WM with <Yours.
 PP:FORWARD (Squashed) I m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.

A:RIGHT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 96BH,47BI;63-5SK,86SL,
 140-1330 71-2SL,84-88SD
 PP:RIGHT Q n 2BI
 A:WAIT You y Turn y Right y CQ m B didn't see A turn.
 ----- 137 ----- 137 ----- 138 ----- 138 ----- 139 ----- 139 ----- 140 ----- 140
 -#--s PP:F -#--s A:W -#-- PP:F -#-- A:F -#-- PP:F -#-- A:R -#-- PP:R -#-- A:W
 ---#- ---#- ---#s ---#s ---#s ---#s ---#w ---#w
 -EC-- -EC- -EC- -EC- -EC- --C-E --C-E --C-S
 141-1337 B was told to turn Right and PP did so. A Pats. 14BH
 PP:RIGHT Q n 6BC
 A:PAT You y Move y Forward y CQ m
 142-1344 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 6BI;352-4SK,16SL,
 A:RIGHT Good m I m Turned m Right m Q m B didn't see A turn. 66-7SL
 143-1355
 PP:FORWARD Q n, 14BH
 A:FORWARD I m Moved m Forward m Q m B didn't see A move.
 144-1362
 PP:FORWARD Next. m. Turn. m. Is. m. Yours^ m. So. m. Q m. PP reads WM with prompt. 2BH,31BI;0SL,
 A:FORWARD I m Moved m Forward m Q m B didn't see A move. 110-2SL,104SL
 ----- 141 ----- 141 ----- 142 ----- 142 ----- 143 ----- 143 ----- 144 ----- 144
 -#-- PP:R -#-- A:P -#-- PP:F -#-- A:R -#-- PP:F -#-- A:F -#--n PP:F -#--n A:F
 ---#w ---#w ---#w ---#w ---#n ---#n ---#- ---#-
 --C-S --C-W --C-W --CW- --CW- -CW-- -CW-- CW--
 145-1374
 PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. Q m. PP reads WM properly. 122BG,2BH,31BI;
 A:LEFT I m Turned m Left m Q m B didn't see A turn. 0SL,110-2SL,104SL
 146-1386
 PP:LEFT I n, Turned n, Left. n, Q n, A is out-of-reach to unblock Pointing. 15BH;193SC,
 A:FORWARD You y Turn y Right y CQ m 188SC,52SI
 147-1396 B was told to turn Right and PP did so. No Pat as A was
 PP:RIGHT Q n, in too much of a hurry to get to corner. 12BD,12BE,12BF
 A:FORWARD You y Turn y Right y CQ m
 148-1403 B was told to turn Right and PP did so.
 PP:RIGHT Q n, A was in too much of a hurry to Pat. 13BA,12BB
 A:FORWARD You y Push y Cake o CQ m
 ----n 145 ----n 145 ----w 146 ----w 146 ---w- 147 ---w- 147 --w-- 148 --w-- 148
 -#-- PP:F -#-- A:L -#-- PP:L -#-- A:F -#-- PP:R -#-- A:F -#-- PP:R -#-- A:F
 ---#- C--#- C--#- C--#- C--#- C--#- C--#- C--#- C--#-
 CW-- W--- W--- S--- S--- W--- W--- N---
 149-1410 B was told to Push Cake and PP did so. A has to WAIT for imitation so no Pat.
 PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. You y. Q m. PP reads WM but incomplete. 13BB;
 A:WAIT Good y Next m Turn m Is m Mine m So m You y Push y Cake o CQ m 439-41SK,114-5SL,213-4SH,36SL
 150-1429 B was told to Push Cake and PP did so. A was too busy to Pat.
 PP:FORWARD Q n 15BA
 A:FORWARD (Squashed) I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m
 151-1441 RM turned Right away from the Wall and PP sets up WM with <Mine.
 B:RIGHT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. Rand=0;40-7SL
 A:PAT Good y You y Turn y Right y CQ m A Pats and says Good.
 152-1457 B was told to turn Right but PP turned Left. A Slaps. 28BH
 PP:LEFT Q n
 A:SLAP You y Turn y Right y CQ m
 -w--- 149 -w--- 149 -w--- 150 Cw--- 150 w--- 151 w--- 151 w--- 152 w--- 152
 -#-- PP:F C#-- A:W C#-- PP:F N#-- A:F N#--C B:R E#--C A:P E#--C PP:L N#--C A:S
 C--#- N--#- N--#- ---#- ---#- ---#- ---#-
 N--- ---#- ---#- ---#- ---#-
 153-1464 B was told to turn Right and PP did so. A Pats. 24BI
 PP:RIGHT Q m.
 A:PAT You y Turn y Right y CQ m
 154-1471 B was told to turn Right and RM did so. A Pats. Rand=0
 B:RIGHT Q n
 A:PAT You y Move y Forward y CQ m
 155-1478 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 6BI;647-9SD
 A:LEFT Good y You y Move y Forward y CQ m
 156-1489 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 51BH,32BI;
 A:LEFT Good y You y Turn y Left y CQ m 106-7SC,120SC,187SD
 w--- 153 w--- 153 w--- 154 w--- 154 w--- 155 w--- 155 s--- 156 s--- 156
 N#--C PP:R E#--C A:P E#--C B:R S#--C A:P S#--C PP:F -#--C A:L -#--C PP:F -#--C A:L
 ---#- ---#- ---#- ---#- ---#- S--#- S--#- ---#-

----- S-----
157-1500 B was told to turn Left and PP did so. A Pats. 43BC
PP:LEFT Q n
A:PAT You y Move y Forward y CQ m
158-1507 B was told to move Forward. PP did so and says so. 41BH,6BI
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 369-71SK,16SL,66-7SL.
A:FORWARD Good y You y Move y Forward y CQ m
159-1518 B was told to move Forward. PP did so and says so. 51BH,32BI;
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 240-2SH,245-6SJ
A:FORWARD Good y You y Move y Forward y CQ m
160-1529 B was told to move Forward. PP did so and says so. 51BH,32BI,48SL,
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 66-7SL
A:FORWARD Good y You y Move y Forward y CQ m
e---- 157 e---- 157 e---- 158 e---- 158 -e--- 159 -e--- 159 --e-- 160 --e-- 160
--C PP:L --C A:P --C PP:F --C A:F --C PP:F --C A:F --C PP:F --C A:F
--#- --#- --#- --#- --#- --#- --#- --#- --#- --#-
S---- E---- E---- E---- E---- E---- E---- E---- E----
161-1540 B was told to move Forward. PP did so and says so. 52BH,32BI,137SK,48SL,
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 66-7SL,372SK,381SK
A:PAT Good y You y Turn y Left y CQ m
162-1551 B was told to turn Left and PP did so. A Pats. 54BH,39BI
PP:LEFT Q n
A:PAT You y Move y Forward y CQ m
163-1558 B was told to move Forward. PP did so and says so. 41BH,6BI;
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was to busy to Pat. 71-3SH,70-2SJ
A:WAIT Good y Next m Turn m Is m Yours m So m You y Push y Cake o CQ m
164-1574 B was told to Push the Cake and PP did so. No Pat because of imitation. 96BH,61BI;
PP:FORWARD Next. m. Turn. m. Is. m. Mine^ m. Q m. PP reads WM with prompt but no more. 309-11SK,116SL,114-5SL,
A:WAIT Good y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 534SD
--e- 161 --e- 161 --e- 162 --e- 162 --e- 163 --e- 163 --e- 164 --e- 164
--C PP:F --C A:P --C PP:L --C A:P --C PP:F --C A:W --C PP:F --C A:W
--#- --#- --#- --#- --#- --#- --#N --#N --#N --#N
--E- --E- --E- --N- --N- --N- --N- --N- --N- --N-
165-1591 B was told to Squash Cake. PP did so, says so and sets up WM with <Yours. 67BH,47BI,71SD,
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m. PP turned Right out-of-sight, then 225-31SB
A:RIGHT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m tried to point and tell. A says Bad. 131BA,132BB;
166-1612 B didn't see A move. 32-3SI,37-8SI
PP:RIGHT You. no! Turn. n Right. n CQ m
A:FORWARD Bad m I m Moved m Forward m Q m
167-1623 PP turned Left and tells A to do the impossible. 102BD;
PP:LEFT You. n, Move. n, Forward. n, CQ n, B didn't see A turn. A says Bad. 36SI,33-5SI
A:RIGHT Bad m I m Turned m Right m Q m
168-1634 PP tells but can't see A. A doesn't see it. 26BD,12BF;
PP:RIGHT You. n, Turn. n, Right. n, CQ n, B didn't see A move. 142SE,145SF,144SG,150-2SC
A:FORWARD I m Moved m Forward m Q m
--eC 165 --eN 165 --sN 166 --sE 166 ----E 167 ----N 167 ----N 168 ----E 168
--N PP:F C#--- A:R C#--- PP:R C#--- A:F C#-s- PP:L C#-s- A:R C#-w- PP:R C#-w- A:F
--#- --#- --#- --#- --#- --#- --#- --#- --#- --#-
169-1644 PP turned Left and tells A to do impossible. 144BC;
PP:LEFT Good. n, You. n, Push. n, Cake. n, CQ n, B didn't see A turn. A says Bad. 36SI,288SI,33SI,289-90SI
A:LEFT Bad m I m Turned m Left m Q m
170-1656 138BE,41BF
PP:LEFT Q n, B saw A move.
A:FORWARD I m Moved m Forward m Q m
171-1663 41BH,3BI
PP:WAIT Q n, B saw A move.
A:FORWARD I m Moved m Forward m Q m
172-1670 60BH,3BI
PP:WAIT Q n, B saw A turn.
A:RIGHT I m Turned m Right m Q m
----E 169 ----N 169 ----N 170 ----W 170 ----W 171 ----W 171 ----W 172 ----W 172
C#w-- PP:L C#w-- A:L C#s-- PP:L C#s-- A:F C#--- PP:W C#--- A:F C#--- PP:W C#--- A:R
--#- --#- --#- --#- --s#- --s#- --s#- --s#- --s#- --s#-
173-1677 PP moved Forward and says so. 60BH,16BI;
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A didn't see it. 171-3SH,173-5SJ
A:RIGHT You y Move y Forward y CQ m
174-1687 B was told to move Forward. PP did so and says so. 51BH,52BI;240-2SH,247SJ,245-6SJ
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good.
A:PAT Good y You y Move y Forward y CQ m

175-1698 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 51BH,32BI;449SK,48SL,66-7SL
A:PAT Good y You y Move y Forward y CQ m

176-1709 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 125BH,32BI;
A:LEFT Good y You y Turn y Left y CQ m 48SL,66-7SL

---W 173 ---W- 173 ---W- 174 --W-- 174 --W-- 175 -W--- 175 -W--- 176 W---- 176
C#--- PP:F C#--- A:R C#--- PP:F C#--- A:P C#--- PP:F C#--- A:P C#--- PP:F C#--- A:L
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
--w-- --w-- --n-- --n-- --n-- --n-- --n-- --n--

177-1720 B was told to turn Left. PP did so and says so. A says Good but needs to
PP:LEFT I. m. Turned. m. Left. m. Q m. WAIT for imitation so no Pat. 67BD,66BE,67BF;74-6SH,
A:WAIT Good y You y Push y Cake o CQ m 74-5SJ

178-1731 B was told to Push Cake and PP did so. A was too busy to Pat.
PP:FORWARD Q n 116BG,72BH,40BI
A:FORWARD Next m Turn m Is m Mine m So m You y Push y Cake o CQ m

179-1743 B was told to Push Cake. PP did so and with prompt for WM tells A to Squash Cake.
PP:FORWARD Next. m. Turn. m. Is. m. Yours^ m. So. m. You. y. Squash. y. Cake. o. CQ m. 56BB;884-5SD,
A:FORWARD (Squashed) Good y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m 285-6SB,
180-1764 PP turned Left away from Wall, then sets up WM with <Mine. A Pats and says Good. 535-9SD
PP:LEFT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 74BH;144-6SI,
A:PAT Good y You y Move y Forward y CQ m 162-6SD

W--- 177 S--- 177 S--- 178 ---- 178 ---- 179 ---- 179 -C--- 180 -C--- 180
C#--- PP:L C#--- A:W C#--- PP:F S#--- A:F S#--- PP:F -#--- A:F -#--- PP:L -#--- A:P
---#- ---#- ---#- C--#- C--#- S--#- S--#- E--#-
--w-- --w-- --w-- --w-- --w-- Cw--- W--- w---

181-1780 B was told to move Forward. PP did so and moved out-of-sight of A.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. 5BH,32BI;206SK,48SL,403-4SK,66-7SL
A:RIGHT You y Turn y Right y CQ m

182-1790 B was told to turn Right but PP moved Forward and tells the unseen A.
PP:FORWARD Now. m. You. m. Wait. m. CQ m. 80BH;395-7SK,695SD
A:SLAP Bad y You y Turn y Right y CQ m

183-1801 B was told to turn Right but PP turned Left. A Slaps.
PP:LEFT Q m. 81BH
A:SLAP You y Turn y Right y CQ m

184-1808 B was told to turn Right but RM Waited. A Slaps.
B:WAIT Q m. Rand=14
A:SLAP You y Turn y Right y CQ m

-C--- 181 -C--- 181 -C--- 182 -C--- 182 -C--- 183 -C--- 183 -C--- 184 -C--- 184
---#- PP:F ---#- A:R ---#- PP:F ---#- A:S ---#- PP:L ---#- A:S ---#- B:W ---#- A:S
E--#- -E--#- -E--#- --E#- --E#- --N#- --N#- --N#-
w--- w--- n--- n--- n--- n--- n--- n---

185-1815 B was told to turn Right but RM turned Left and PP tells the impossible.
B:LEFT You. y. Push. y. Cake. o. CQ m. A Slaps and says Bad. Rand=15;57-60SH,57-8SJ
A:SLAP Bad y You y Turn y Left y CQ m

186-1826 B was told to turn Left but RM Waited. A Slaps.
B:WAIT Q n Rand=15
A:SLAP You y Turn y Left y CQ m

187-1833 B was told to turn Left but RM turned Right. PP says it turned Left.
B:RIGHT I. m. Turned. m. Left. m. Q m. A Slaps and says Bad. Rand=7;61SL,26SL,62SL
A:SLAP Bad y You y Turn y Left y CQ m

188-1844 B was told to turn Left and PP unblocked did so and says so.
PPu:LEFT I. m. Turned m. Left m. Q m A Pats and says Good. 150BE;102-4SK,26SL,62SL
A:PAT Good y You y Turn y Left y CQ m

-C--- 185 -C--- 185 -C--- 186 -C--- 186 -C--- 187 -C--- 187 -C--- 188 -C--- 188
---#- B:L ---#- A:S ---#- B:W ---#- A:S ---#- B:R ---#- A:S ---#- PP:L ---#- A:P
--N#- --W#- --W#- --W#- --W#- --N#- --N#- --W#-
n--- n--- n--- n--- n--- n--- n--- n---

189-1855 B was told to turn Left. RM did so and PP says so.
B:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. Rand=11;63SL,26SL,62SL
A:PAT Good y You y Move y Forward y CQ m

190-1866 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 32BI;68-70SH,
A:FORWARD Good m I m Moved m Forward m Q m B didn't see A move. 68-9SJ

191-1877 PP read WM properly. 106BC; 109-12SL
A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A move.

192-1888 Single prediction, WM not read properly. 41BH,3BI;
PP:WAIT Next. m. Turn. m. Is. m. Mine. m. Q n, B didn't see A move. 331SE,335SF,336SG,346-8SC
A:FORWARD I m Moved m Forward m Q m
-C--- 189 -C--- 189 -C--- 190 -C--- 190 -C--- 191 -C--- 191 -C--- 192 -C--- 192

-#---- B:L -#---- A:P -#---- PP:F -#---- A:F -#---- PP:L -#---- A:F n#---- PP:W n#---- A:F
 --W#- --S#- --S#- --#- n--#- n--#- --#- --#-
 n---- n---- n---- n-S-- --S-- --E-- --E-- --E--
 193-1899
 PP:WAIT Next. m. Turn. m. Is. m. Mine. n, Q n, Single prediction so WM not read properly. 165BC;
 A:RIGHT You y Move y Forward y CQ m 372-5SA,362-5SB
 194-1910 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 39BC;243-5SH,
 A:FORWARD Good y You y Move y Forward y CQ m 249-50SJ
 195-1921 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but out-of-reach to Pat. 40BD,40BE,40BF;
 A:FORWARD Good y You y Turn y Left y CQ m
 196-1932 B was told to turn Left. PP did so and says so. 265-7SB
 PP:LEFT I. m. Turned. m. Left. m. Q n, A says Good but is out-of-reach to Pat. 146BA,147BB;
 A:WAIT Good y You y Move y Forward y CQ m 108SK,63SL,26SL,62SL
 nC--- 193 nC--- 193 eC--- 194 eC--- 194 -eC-- 195 -eC-- 195 --eC- 196 --eC- 196
 -#--- PP:W -#--- A:R -#--- PP:F -#--- A:F -#--- PP:F -#--- A:F -#--- PP:L -#--- A:W
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 --E-- --E-- --E-- --E-- --E-- --E-- --E-- --N
 197-1943 B was told to move Forward but PP Waited and says it turned Left.
 PP:WAIT I. m. Turned. m. Left. m. Q n, A says Bad but is out-of-reach to Slap. 41BH;821-3SI
 A:FORWARD Bad y You y Move y Forward y CQ m
 198-1954 B was told to move Forward. PP did so and says so. A says Good
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. but Waits for imitation so no Pat. 60BH,45BI;243-5SH,
 A:WAIT Good y Next m Turn m Is m Yours m So m You y Move y Forward y CQ m 327SJ,249-50SJ
 199-1970 B was told to move Forward. PP did so and says its turn is next. A says Good
 PP:FORWARD Next. m. Turn. m. Is. m. Mine. m. Q m. but must Wait for imitation so no Pat. 52BH,46BI;
 A:WAIT Good y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 706-7SI,533-4SD
 200-1987 B was told to Squash Cake. PP did so, says so and sets up WM with <Yours. A says Good.
 PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.
 A:RIGHT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 154BA,155BB;288-95SA,
 --eC- 197 --eC- 197 ---eC 198 ---eC 198 ---eC 199 ---eC 199 ---eC 200 ---eN 200 287SB,225-31SB
 -#--- PP:W -#--- A:F -#--- PP:F -#--- A:W -#--- PP:F -#---N A:W -#---N PP:F -#--- A:R
 ---#- ---#- ---#- ---#N ---#N ---#- ---#- ---#- ---#-
 ---N ---N ---N ---N ---N ---N ---N ---N
 201-2008
 PP:RIGHT I. m Moved. m Forward. m Q n 131BA,132BB;32SI,51SI,53SI
 A:FORWARD Bad m I m Moved m Forward m Q m B didn't see A move.
 202-2019
 PP:LEFT Bad. n, I. n, Moved. n, Forward. n, CQ n, PP turned Left but says it moved Forward. 106BC;
 A:LEFT You y Turn y Left y CQ m A didn't see it. 32SI,121SI,51SI,53SI,35SI
 203-2030 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q n A Pats and says Good. 41BD,12BE,1BF;27SH,315-6SH,328-9SJ
 A:PAT Good y You y Move y Forward y CQ m
 204-2041 B was told to move Forward but PP Waited. A Slaps.
 PP:WAIT Q n 41BH,77BI;
 A:SLAP You y Move y Forward y CQ m
 ---sN 201 ---sE 201 ----E 202 ----N 202 ----N 203 ----W 203 ----W 204 ----W 204
 -#--- PP:R -#--- A:F -#-s- PP:L -#-s- A:L -#-e- PP:L -#-e- A:P -#-e- PP:W -#-e- A:S
 --C#- --C#- --C#- --C#- --C#- --C#- --C#- --C#-

 205-2048 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 60BH,6BI;
 A:FORWARD Good m I m Moved m Forward m Q m B didn't see A move. 16SL,66-7SI
 206-2059
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. A says Good. 51BH,20BI;
 A:LEFT Good y You y Turn y Left y CQ m 369SK,109SL,174-5SJ
 207-2070 B was told to turn Left but PP moved Forward. A Slaps.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP says it moved Forward. A says Good. 51BH,75BI;
 A:SLAP Good y You y Turn y Left y CQ m 449SK,63SL,283-4SJ,278SH
 208-2081 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 125BH,75BI;63SL,26SL,62SL
 A:PAT Good y You y Turn y Left y CQ m
 ----W 205 ----W- 205 ----W- 206 --W-- 206 --W-- 207 -W--- 207 -W--- 208 -S--- 208
 -#-e- PP:F -#-e- A:F -#-e- PP:F -#-e- A:L -#-n- PP:F -#-n- A:S -#-n- PP:L -#-n- A:P
 --C#- --C#- --C#- --C#- --C#- --C#- --C#- --C#-

 209-2092 B was told to turn Left but RM turned Right and
 B:RIGHT I. m. Moved. m. Forward. m. Q m. PP says it moved Forward. A Slaps and says Bad. Rand=19;
 A:SLAP Bad y You y Turn y Left y CQ m 382-4SC
 210-2103 B was told to turn Left. PP did so and says so.

PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 174BC,1134-6SD,386-7SC
A:PAT Good y You y Turn y Left y CQ m
211-2114 B was told to turn Left but RM Waited and PP says it turned Left.
B:WAIT I. m. Turned. m. Left. m. Q m. A Slaps and says Bad. Rand=17; 385-7SC
A:SLAP Bad y You y Turn y Left y CQ m
212-2125 B was told to turn Left. RM did so and PP says so.
B:LEFT I. m. Turned m. Left m. Q m. A Pats and says Good. Rand=4;21SL,26SL,62SL
A:PAT Good y You y Move y Forward y CQ m
-S--- 209 -W--- 209 -W--- 210 -S--- 210 -S--- 211 -S--- 211 -S--- 212 -E--- 212
-#--n B:R -#--n A:S -#--n PP:L -#--n A:P -#--n B:W -#--n A:S -#--n B:L -#--n A:P
--C#- --C#- --C#- --C#- --C#- --C#- --C#- --C#-

213-2136 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but needs to turn so no Pat. 32BI;96-8SH,
A:LEFT Good y You y Turn y Right y CQ m 95-7SJ
214-2147 B was told to turn Right and PP did so. A Pats.
PP:RIGHT You. y. Move. y. Forward. y. CQ m. PP tells and it is possible. 0BH,43BI;374SK,510-2SK
A:PAT You y Move y Forward y CQ m 52SL,66-7SL
215-2157 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but needs to turn so no Pat. 33BI;
A:LEFT Good y You y Push y Cake o CQ m
216-2168 B was told to Push Cake and PP did so. A Pats.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP says it moved Forward. A says Bad.
A:PAT Bad y You y Squeeze y Cake o CQ m
-E--- 213 --E-- 213 --E-- 214 --S-- 214 --S-- 215 ----- 215 ----- 216 ----- 216
-#--n PP:F -#--n A:L -#--w PP:R -#--w A:P -#--w PP:F -#S-w A:L -#S-s PP:F -#--s A:P
--C#- --C#- --C#- --C#- --C#- --C#- --C#- --C#-

217-2179 B was told to Squeeze Cake and PP did so. A Pats.
PP:FORWARD Q n 66BF;
A:PAT You y Turn y Right y CQ m
218-2186 B was told to turn Right and PP did so. A Pats.
PP:RIGHT Q m. 13BC;
A:PAT You y Push y Cake o CQ m
219-2193 B was told to Push Cake and PP did so. A was too busy to Pat.
PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. You. no! Move. no! Forward. no! CQ m. 19BH;
A:FORWARD Bad y You y Push y Cake o CQ m PP tells A but not seeing A. A says Bad. 222-5SH, 225-7SJ,
220-2209 B was told to Push Cake and PP did so. A is out-of-reach to Pat. 213SH,778SD,229SJ,549-51SK
PP:FORWARD Next. n, Q m. Incomplete sequence. 176BG,2BH;444SK
A:RIGHT You y Turn y Right y CQ m
----- 217 ----- 217 ----- 218 ----- 218 ----- 219 ----- 219 ----- 220 ----- 220
-#--s PP:F -#--s A:P -#--s PP:R -#--s A:P -#--s PP:F -#--s A:F -#--s PP:F -#--s A:R
--S#- --S#- --S#- --S#- --S#- --S#- --S#- --S#-
--C-- --CS-- --CS-- --CW-- --CW-- --CW-- --CW-- --CW--
221-2217 B was told to turn Right and PP did so. A is out-of-reach to Pat.
PP:RIGHT Q m. 13BD,13BE,13BF;
A:WAIT You y Push y Cake o CQ m
222-2224 B was told to Push Cake and PP did so. A is out-of-reach to Pat.
PP:FORWARD Bad. y. You. y. Q n, Incomplete sequence. 19BH,81BI;439SK,548SK
A:RIGHT You y Push y Cake o CQ m
223-2233 B was told to Push Cake and PP did so. A is out-of-reach to Pat.
PP:FORWARD Next. m. Q n, Incomplete sequence. 2BH,7BI;120SL
A:WAIT You y Push y Cake o CQ m
224-2241 B was told to Push Cake and PP did so. A is out-of-reach to Pat.
PP:FORWARD Next. m. Q m. Incomplete sequence. 7BI;1208SD
A:WAIT You y Turn y Right y CQ m
----- 221 ----- 221 ----- 222 ----- 222 ----- 223 C--- 223 C--- 224 NC--- 224
-#--- PP:R -#--- A:W -#--- PP:F C#--- A:R C#--- PP:F N#--- A:W N#--- PP:F -#--- A:W
C--#w C--#w C--#w N--#w N--#w N--#w N--#w
W--- N--- N---
225-2249 B was told to turn Right and PP did so. A is out-of-reach to Pat.
PP:RIGHT Q m. 205BA,206BB;
A:WAIT You y Push y Cake o CQ m
226-2256 B was told to Push Cake and PP did so. A is out-of-reach to Pat.
PP:FORWARD Next. n, Q m. Incomplete sequence. 19BH,81BI;365SH
A:WAIT You y Push y Cake o CQ m
227-2264 B was told to Push Cake. PP did so, reads WM and tells A to move with unblocking.
PP:FORWARD Next m Turn m Is m Yours m So m You y. Move y. Forward y. CQ m 184BH,81BI;439-43SK,
A:FORWARD Good y Next m Turn m Is m Mine m So m You y Push y Cake o CQ m 453SK,549-51SK
228-2285 B was told to Push Cake. PP did so, reads WM and tells A to Squash with unblocking.
PP:FORWARD Next m Turn m Is m Yours m So m You y. Squash. y. Cake. o. CQ m. A says Good. 124BG,2BH,

A:FORWARD (Squashed) Good y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m 61BI;
 NC--- 225 EC--- 225 EC--- 226 -EC-- 226 -EC-- 227 --EC- 227 --EC- 228 ---EC 228 222-5SH,
 -#--- PP:R -#--- A:W -#--- PP:F -#--- A:W -#--- PP:F -#--- A:F -#---n PP:F -#---n A:F 213-4SH,
 ---#n ---#n ---#n ---#n ---#n ---#n ---#n ---#n 549SK,
 ----- 37SL,135-6SL
 229-2306 PP turned Left towards the Wall. A Slaps. PP sets up WM with <Mine. A says Good.
 PP:LEFT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 71BI;168SE,
 A:SLAP Good y You y Turn y Left y CQ m 172SF,172SG,504SI,634-7SD,180-2SC
 230-2322 B was told to turn Left. PP did so and says so.
 PP:LEFT I m. Turned. m. Left. m. Q m A says Good but was too busy to Pat. 110BA,110BB;
 A:LEFT Good y You y Move y Forward y CQ m 63SL,542-3SK,26SL,62SL
 231-2333 B was told to move Forward.PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 32BI;48SL,66-7SL
 A:PAT Good y You y Turn y Left y CQ m
 232-2344 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 75BI;63SL,26SL,62SL
 A:PAT Good y You y Push y Cake o CQ m
 ---En 229 ---Nn 229 ---Nn 230 ---Wn 230 ---Ww 231 --W-w 231 --W-w 232 --S-w 232
 -#C-- PP:L -#C-- A:S -#C-- PP:L -#C-- A:L -#C-- PP:F -#C-- A:P -#C-- PP:L -#C-- A:P
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

 233-2355 B was told to Push Cake. PP did so and says so.
 PP:FORWARD I m. Pushed. m. Cake. o. Q m. A Pats and says Good. 40BI;86-8SK,159-60SL
 A:PAT Good y You y Push y Cake o CQ m
 234-2366 B was told to Push Cake. PP did so and says so.
 PP:FORWARD I m Pushed. m. Cake. o. Q m A Pats and says Good. 35BH,40BI;402SC,90-1SK,
 A:PAT Good y You y Squeeze y Cake o CQ m 160SL,168SL
 235-2377 B was told to Squeeze Cake and PP did so.
 PP:FORWARD Next. n, Q m. A is out-of-reach to Pat. Incomplete sequence. 180BC;400SG
 A:FORWARD You y Turn y Right y CQ m
 236-2385 B was told to turn Right and PP did so. A Pats.
 PP:RIGHT Q m. 206BB;
 A:PAT You y Push y Cake o CQ m
 --S-w 233 ---w 233 ---w 234 ---w 234 ---w 235 ---w 235 ---w- 236 ---w- 236
 -#C-- PP:F -#S-- A:P -#S-- PP:F -#--- A:P -#--- PP:F -#--- A:F -#--- PP:R -#--- A:P
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

 237-2392 B was told to Push Cake and PP did so. A is out-of-reach to Pat.
 PP:FORWARD Bad. no! You. no! Squash. no! Cake. o. CQ n, PP tells A but can't see A. 203BA,204BB;
 A:FORWARD Bad y You y Push y Cake o CQ m A says Bad. 372SJ,364SH,549SK,630SK,377SH
 238-2404 B was told to Push Cake and PP did so. A is out-of-reach to Pat.
 PP:FORWARD Next. m. Turn. m. Is. m. Mine^ m. So. m. Q m. Incomplete sequence. 169BD,168BE,168BF;
 A:WAIT You y Turn y Right y CQ m 1208SD,445-6SK,114-5SL,218SH,229SE
 239-2416 B was told to turn Right and PP did so. A is out-of-reach to Pat.
 PP:RIGHT Q m. 206BB;
 A:WAIT You y Push y Cake o CQ m
 240-2423 B was told to Push Cake and PP did so. A must Wait so no Pat.
 PP:FORWARD Next. m. Turn. m. Is. m. Mine^ m. So. m. You. y. Squash. y. Cake. o. CQ m. 19BH,81BI;
 A:WAIT Bad y Next m Turn m Is m Yours m So m You y Push y Cake o CQ m A says Bad. 1235-6SD,446-7SB,
 ---w- 237 ---w- 237 ---w- 238 ---w- 238 ---w- 239 ---w- 239 ---w- 240 ---w- 240 175SL,453SK,
 -#--- PP:F -#--- A:F -#--- PP:F -#--- A:W -#--- PP:R -#--- A:W -#--- PP:F C#--- A:W 391-2SJ,
 ---#- ---#- ---#- ---#- C--#- C--#- C--#- C--#- N--- N--- N---
 -CW-- CW-- CW-- W--- W--- N--- N---
 241-2444 B was told to Push Cake and PP did so. A was too busy to Pat.
 PP:FORWARD Next. m Turn m Is m Mine m So m You y Q m. PP reads WM properly. 2BH,61BI;365SH,114-5SL,
 A:FORWARD Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 100SL,175-7SL
 242-2462 B was told to Squash Cake. PP did so and sets up WM with <Yours. A says Good.
 PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.
 A:LEFT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 184BH,47BI;135-42SB
 243-2483 Incomplete sequence. 2BA,1BB;87SL
 PP:RIGHT I m. Q n B saw A turn.
 A:LEFT I m Turned m Left m Q m PP makes bad statement. A says Bad.
 244-2491 14BI;13SL,
 PP:RIGHT Next. m. Turn. m. Is. m. Yours. m. So. m. You. y. Squash. y. Cake. o. CQ m. B saw A move. 101-4SL,36-7SL,135-6SL
 A:FORWARD Bad m I m Moved m Forward m Q m
 --w-- 241 C-w-- 241 Cw--- 242 Nw--- 242 Ns--- 243 Es--- 243 Ee--- 244 Se--- 244
 C#--- PP:F N#--- A:F N#--- PP:F -#--- A:L -#--- PP:R -#--- A:L -#--- PP:R -#--- A:F
 N--#- --#- --#- --#- --C#- --C#- --C#- --C#-

 245-2507 PP moved Forward and says so. 48BI;449SK,124SL,518-9SK
 PP:FORWARD I. m. Moved. m. Forward. m. Q m.

A:RIGHT I m Turned m Right m Q m A didn't see it. B didn't see A turn.
246-2517
PP:FORWARD I. m Moved. m Forward. m Q m. PP moved Forward and says so. 125BH,16BI;369-71SK,10-2SL
A:FORWARD Good y You y Move y Forward y CQ m A says Good.
247-2528 B was told to move Forward. PP did so with unblocking and says so.
PPu:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 51BH;106-7SC,
A:FORWARD Good y You y Turn y Left y CQ m 187SD,832-3SD,120SC
248-2539 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 152BB;27SH,25SJ,315-6SH,328-9SJ
A:PAT Good y You y Move y Forward y CQ m
S-e-- 245 --e-- 245 --s-- 246 --s-- 246 ----- 247 ----- 247 ----- 248 ----- 248
--#--- PP:F S#--- A:R S#--- PP:F --#--- A:F --s-- PP:F --s-- A:F --#--- PP:L --#--- A:P
--C#- --C#- --C#- S-C#- S-C#- --C#- --s#- --s#-
----- S----- S-C-- E-C--
249-2550 B was told to move Forward and PP did so but A was too busy to Pat.
PP:FORWARD Next. m. Turn. m. Is. m. Yours^ m. So. m. You. y. Squash. y. Cake. o. CQ m. 41BH,32BI;5SD,
A:LEFT Bad m I m Turned m Left m Q m Bad statement by PP. A says Bad. B saw A turn. 1084-533SD,
250-2566 381SB,535-9SD
PP:FORWARD Q n 67BH;
A:LEFT I m Turned m Left m Q m B saw A turn.
251-2573
B:FORWARD I. m. Pushed. n, Cake. n, Q n, RM Pushed Cake and PP says so. Rand=14;98-100SI
A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A move.
252-2583
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP Pushed Cake but says it moved Forward. 96BH,31BI;
A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A move. 560-1SI,292SG
----- 249 ----- 249 ----- 250 ----- 250 ----- 251 ----- 251 ----- 252 ----- 252
--#--- PP:F --#--- A:L --#--- PP:F --#--- A:L --#--- B:F --#--- A:F --#n-- PP:F --#n-- A:F
--s#- --s#- --e#- --e#- --n#- --n#- ---#- ---#C
E-C-- -EC-- -EC-- -EC- --EC- --EC- ---EC ---EC ---E
253-2593
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 126BA,127BB;232SK,
A:RIGHT You y Push y Cake o CQ m A didn't see it. 0SL,77-8SJ,79SH
254-2603 B was told to Push Cake. PP did so and reads WM properly, tells. A says Good.
PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So m. You y Move y Forward y CQ m 116BG,72BH,60BI;
A:FORWARD Good y Next m Turn m Is m Mine m So m You y Push y Cake o CQ m 338SK,100SL,113-5SL,
255-2624 35-6SL,339SK,200SJ,198SH
PP:FORWARD Next. m. Turn. m. Is. m. Yours. m So. m You. y Squash. y Cake. c CQ m 136BD,135BE,136BF;
A:FORWARD (Squashed) Good y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m 884SD,321SB,
285-6SB,322-6SB
256-2645 PP turned Left away from the Wall and sets up WM with <Mine.
PPu:LEFT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 148BG,74BH,
A:PAT Good y Q n A Pats and says Good. 71BI;290-2SH,298-9SJ,40-5SJ,43-7SH
--n-- 253 --n-- 253 --e-- 254 --e-- 254 ---e- 255 ---eC 255 ---e 256 ---e 256
--#--- PP:L --#--- A:R --#--- PP:F --#---C A:F --#---C PP:F --#---N A:F --#---N PP:L --#---W A:P
---#C ---#C ---#C ---#N ---#N ---#- C---# C---#
---E ---N ---N -----
257-2658
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 5BH;26-8SK
A:RIGHT I m Turned m Right m Q m A didn't see it. B didn't see A turn.
258-2668
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 7BH,16BI;29-31SK,
A:FORWARD Good y You y Turn y Right y CQ m A says Good.10-2SL
259-2679 B was told to turn Right and RM did so. A was too busy to Pat.
B:RIGHT Now. m. Q m. Incomplete sequence. Rand=19;391SK,77SL
A:FORWARD I m Moved m Forward m Q m B didn't see A move.
260-2687
PP:FORWARD Bad. n, I. n, Moved. n, Forward. n, Q n, PP moved Forward and says so 129BH;369-72SC
A:FORWARD I m Moved m Forward m Q m with no pointing and CQ. A didn't see it. B didn't see A move.
-----e 257 -----e 257 -----s 258 -----s 258 ----- 259 ----- 259 ----- 260 --N-- 260
--#---W PP:F --#---W A:R --#---W PP:F --#---W A:F --#---W-s B:R --#---N-s A:F --#---N-- PP:F --#--- A:F
C---#- C---#- C---#- C---#- C---#- C---#- C---#s C---#s

261-2698
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. A didn't see it. 144BC;108SK,
A:RIGHT I m Turned m Right m Q m B didn't see A turn. 542-3SK,180SL
262-2708
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 16BI;449SK,10-1SL,518SK,
A:FORWARD Good y You y Move y Forward y CQ m A says Good but is out-of-reach to Pat. 452SJ
263-2719 B didn't see A move. B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good,out-of-reach to Pat. 125BH,32BI;265-6SC,

A:FORWARD Good y You y Turn y Left y CQ m 863-4SD,279SB
264-2730 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but is out-of-reach to Pat. 228BA,152BB;27SH,
A:WAIT Good y You y Move y Forward y CQ m 25SJ,315-6SH,328-9SJ
--N-- 261 --W-- 261 --W-- 262 --W-- 262 --W-- 263 W-- 263 W-- 264 S-- 264
--#-- PP:L --#-- A:R --#-- PP:F --#-- A:F --#-- PP:F --#-- A:F --#-- PP:L --#-- A:W
C--#- C--#- C--#- C--#- C--#- C--#- C--#- C--#- C--#-
---S ---S ---W ---W ---W ---W ---W ---W ---W---
265-2741 B was told to move Forward. PP did so and says so. A says Good but must Wait
PP:FORWARD I. m. Moved. m. Forward. m. Q m. for imitation. 41BH,32BI;178-80SH,181-2SJ
A:WAIT Good y Next m Turn m Is m Yours m So m You y Push y Cake o CQ m
266-2757 B was told to Push Cake. PP did so.
PP:FORWARD Next. m. Turn. m Is. m. Mine. m. Q m. Incomplete but WM read properly. 69BH,61BI;282-4SH,
A:FORWARD Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 290-2SJ,184SH
267-2773 B was told to Squash Cake. PP did so, says so and sets up WM with <Yours.
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.
A:RIGHT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 137BG,67BH,47BI;287SB,
268-2794 225-31SB
PP:RIGHT I m Turned. m Right. m Q m PP turned Right and says so. 131BA,132BB;296SA,51-2SI
A:WAIT Good y You y Turn y Right y CQ m A says Good.
S---- 265 ----- 265 ----- 266 ----- 266 ----- 267 ----- 267 ----- 268 ----- 268
--#-- PP:F S#-- A:W S#-- PP:F --#-- A:F --#-- PP:F --#-C A:R --#-C PP:R --#-C A:W
C--#- C--#- C--#- S--#- S--#- S--#- S--#- S--#- S--#-
--w-- --w-- --w-- C-w-- Cw-- Sw-- Sn-- Wn--
269-2805 B was told to turn Right and PP did so. A Pats.
PP:RIGHT You. y. Move. y. Forward. y. CQ m. Valid command. 87BC;77SL,58SL,157-8SL
A:PAT You y Move y Forward y CQ m
270-2815 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 137BH,33BI;80-2SK,52SL,66-7SL
A:PAT Good y You y Turn y Right y CQ m
271-2826 B was told to turn Right and PP did so. A Pats.
PP:RIGHT You. y. Move. y. Forward. y. CQ m. Valid command. 0BH,43BI;350-3SH,362-5SJ
A:PAT You y Move y Forward y CQ m
272-2836 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 178BH,33BI;52SL,66-7SL
A:PAT Good y You y Move y Forward y CQ m
----- 269 ----- 269 ----- 270 ----- 270 ----- 271 ----- 271 ----- 272 ----- 272
--#-C PP:R --#-C A:P --#-C PP:F --#-C A:P --#-C PP:R --#-C A:P --#-C PP:F --#-C A:P
---#- ---#- ---#- N--#- N--#- E--#- E--#- E--#-
Wn--- Nn--- Nn--- n--- n--- n--- n--- n---
273-2847 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 32BI;48SL,66-7SL
A:PAT Good y You y Turn y Left y CQ m
274-2858 B was told to turn Left. PP unblocked did so and says so.
PPu:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 81BH;165SK,63SL,689-90SK,26SL,62SL
A:PAT Good y You y Move y Forward y CQ m
275-2869 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 32BI;48SL,66-7SL
A:PAT Good y You y Turn y Right y CQ m
276-2880 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 43BI;83-5SK,77-8SL
A:PAT Good y You y Push y Cake o CQ m
----- 273 ----- 273 ----- 274 ----- 274 ----- 275 ----- 275 ----- 276 ----- 276
--#-C PP:F --#-C A:P --#-C PP:L --#-C A:P --#-C PP:F --#NC- A:P --#NC- PP:R --#EC- A:P
--E#- --E#- --E#- --N#- --N#- ---#- ---#- ---#-
n--- n--- n--- n--- n--- n--- n--- n---
277-2891 B was told to Push Cake. PP did so and says so.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. A Pats and says Good. 40BI;159-60SL,168SL
A:PAT Good y You y Turn y Left y CQ m
278-2902 B was told to turn Left and RM did so. PP says so.
B:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. Rand=17;329SK,63SL,26SL,62SL
A:PAT Good y You y Move y Forward y CQ m
279-2913 B was told to move Forward. PP did so but A was too busy to Pat.
PP:FORWARD I. m. Moved. m. Forward. m. CQ n, PP says so but with CD. A says Bad. 32BI;106-7SC,120SC
A:FORWARD Bad y You y Turn y Right y CQ m
280-2924 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but too busy to Pat. 12BC;176SK,82SL,296SK,
A:RIGHT Good y You y Move y Forward y CQ m 78SL,509SK,189SL
----- 277 ----- 277 ----- 278 ----- 278 ----- 279 ---N- 279 ---N- 280 ---E- 280
--#EC- PP:F --#EC A:P --#EC B:L --#NC A:P --#NC PP:F --#-C A:F --#-C PP:R --#-C A:R
---#- ---#- ---#- ---#- ---#- ---#- n--#- n--#-

-n--- -n--- -n--- -n--- -n--- -n--- -----
 281-2935 B was told to move Forward. PP did so and says so.
 PP:FORWARD I m. Moved m. Forward m. Q m. A says Good but is out-of-reach to Pat. 12BH,32BI;
 A:WAIT Good y You y Turn y Right y CQ m 48SL,66-7SL
 282-2946 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but is out-of-reach to Pat. 183BC;77-8SL,
 A:WAIT Good y You y Push y Cake o CQ m 189SL
 283-2957 B was told to Push Cake. PP did so and says so.
 PP:FORWARD I. m. Pushed. m. Cake. c Q m A Pats and says Good. 19BH,40BI;159-60SL,168SL
 A:PAT Good y You y Push y Cake o CQ m
 284-2968 B was told to Push Cake. PP did so and says so.
 PP:FORWARD I. m. Pushed. m. Cake. o. Q m. A says Good but was too busy to Pat. 2BH,40BI;
 A:RIGHT Good y You y Push y Cake o CQ m 159-60SL,168SL
 ---E- 281 ---E 281 ---E 282 ---S 282 ---S 283 ---S 283 ---S 284 ---S 284
 -#-C PP:F -#-C A:W -#-C PP:R -#-C A:W -#-C PP:F -#-S A:P -#-S PP:F -#-S A:R
 -e-#- -e-#- -e-#- -e-#- -e-#- -e-#C -e-#C -e-#C -e-#S
 -----C
 285-2979 B was told to Push Cake and PP did so. A was too busy to Pat.
 PP:FORWARD Next. m. Turn. m. Is. m. Yours^ m. So. m. You. m. Q m. PP reads WM with prompt. 14BH,
 A:RIGHT You m Turn m Right m CQ m 40BI;1208SD,462-3SC,1309-10SD,492SB,786SD,36SL
 286-2992 B was told to turn Right after A turned away. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A didn't see B turn. 206BB;525-7SH,545-7SJ
 A:FORWARD I m Moved m Forward m Q m B saw A move.
 287-3002
 PP:FORWARD I. m. Pushed. m. Cake. o. Q m. PP Pushed Cake and says so. A didn't see it. 19BH;
 A:LEFT You y Push y Cake o CQ m 757-9SK,186SL,1SL
 288-3012 B was told to Push Cake and PP did so. A must WAIT for imitation.
 PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. You. y. Move. y. Forward. y. CQ m. 14BH,60BI;
 A:WAIT Bad y Next m Turn m Is m Mine m So m You y Push y Cake o CQ m PP wrong, A says Bad. 798-800SD,
 --- 285 --- 285 --- 286 --- 286 --- 287 --- 287 --- 288 --- 288 --- 288
 -#- PP:F -#- A:R -#- PP:R -#- A:F -#- PP:F -#- A:L -#- PP:F -#- A:W 549-51SK,
 -s-#S -s-#- -w-#- -w-#- -w-#- -w-#- -w-#- -w-#- -w-#- 37-9SL
 ---C ---CS ---CS ---CW ---CW ---CW- ---CW- ---CW-
 289-3033 B was told to Push Cake. PP did so, reads WM and tells A to Squash Cake. A says Good.
 PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. You. y. Squash. y. Cake. o. CQ m. 33BD,33BE,
 A:FORWARD (Squashed) Good y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m 33BF;
 290-3054 RM turned Right away from the Wall.A Pats. PP sets up WM with <Mine. A says Good. 453-61SB
 B:RIGHT Good. y. You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. Rand=4;
 A:PAT Good y Q n 1086-94SD
 291-3068
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 88BI;29-31SK,183-5SL
 A:LEFT Good y You y Turn y Right y CQ m A turned Left, sees and says Good.
 292-3079 B was told to turn Right and PP did so. A was too busy to Pat.
 PP:RIGHT Now. m. Q m. Incomplete sequence. 206BH,65BI;471SH,490SJ
 A:FORWARD You y Move y Forward y CQ m
 --- 289 --- 289 --- 290 --- 290 --- 291 --- 291 --- 292 --- 292 --- 292
 -#- PP:F -#- A:F -#C-- B:R -#C-- A:P -#C-- PP:F -#C-- A:L -#C-- PP:R -#C-- A:F
 s--#- s--#- ---#- ---#- ---#- ---#- -N-#- -N-#- -E-#-
 -CW-- CW--- sW--- sN--- sN--- s--- e--- e---
 293-3087 B was told to move Forward and PP did so. A Pats.
 PP:FORWARD I. m. Turned m. Left m. Q m. PP says it turned Left. A says Bad. 33BI;52SL,66SL,80SL
 A:PAT Bad y You y Turn y Left y CQ m
 294-3098 B was told to turn Left and RM did so. PP says so.
 B:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. Rand=1;21SL,26SL,62SL
 A:PAT Good y You y Push y Cake o CQ m
 295-3109 B was told to Push Cake. PP did so and says so.
 PP:FORWARD I. m. Pushed. m. Cake. o. Q m. A Pats and says Good. 40BI;319SK,159-60SL,321SK,
 A:PAT Good y You y Squeeze y Cake o CQ m 168SL
 296-3120 B was told to Squeeze Cake and PP did so. A Pats.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP says it moved Forward. 112BH,84BI;754-6SI
 A:PAT Bad y You y Turn y Left y CQ m A says Bad.
 --- 293 --- 293 --- 294 --- 294 --- 295 --- 295 --- 296 --- 296 --- 296
 -#C-- PP:F -#C-- A:P -#C-- B:L -#C-- A:P -#C-- PP:F -#N-- A:P -#N-- PP:F -#-- A:P
 -E-#- -E-#- -E-#- -E-#- -E-#- -E-#- -E-#- -E-#- -E-#-
 -e--- -e--- -e--- -e--- -e--- -e--- -e--- -e--- -e---
 297-3131 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 153BC;232-4SK,21SL,26SL,62SL
 A:PAT Good y You y Push y Cake o CQ m
 298-3142 B was told to Push Cake. PP did so and says so.
 PP:FORWARD I. m. Pushed. m. Cake. o. Q m. A says Good but was too busy to Pat. 72BH,40BI;159-60SL,
 A:LEFT Good y You y Push y Cake o CQ m 168SL

299-3153 B was told to Push Cake. PP did so and says so.
PP:FORWARD I m Pushed. m Cake. o. Q m A says Good but too busy to Pat. 69BH,40BI;639SG,406SK,168SL
A:LEFT Good y You y Turn y Left y CQ m

300-3164 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 166BB;74-6SH,288SJ,74-5SJ
A:PAT Good y You y Push y Cake o CQ m

-CN-- 297 -CW-- 297 -CW-- 298 CW--- 298 CW--- 299 W---- 299 W---- 300 S---- 300
-#--- PP:L -#--- A:P -#--- PP:F -#--- A:L -#--- PP:F C#--- A:L C#--- PP:L C#--- A:P
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
-e--- -e--- -e--- -e--- -n--- -n--- -w--- -w---

301-3175 B was told to Push Cake. PP did so and says so.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. A says Good but must WAIT for imitation. 72BH,40BI;578-80SH,598-600SJ
A:WAIT Good y Next m Turn m Is m Yours m So m You y Push y Cake o CQ m

302-3191 B was told to Push Cake. PP did so and read WM properly. A must WAIT for imitation.
PP:FORWARD Next. m. Turn. m. Is. m. Mine. m. So. m. You. y. Squash. y. Cake. o. CQ m. 52BD,51BE,52BF;
A:WAIT Bad y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m PP tells. A says Bad.283-6SB,
303-3212 B was told to Squash Cake. PP did so and says so. 295SE,301SF,302SG,288SH,773SI,296SJ,539SD
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.
A:RIGHT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 202BD,201BE,201BF;
304-3233 PP sets WM with <Yours. A says Good. 252-9SH,259-65SJ
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. A says Good. 23BH,2BI;
A:RIGHT Good m I m Turned m Right m Q m B didn't see A turn. 296SA,395SA,636SA

S--- 301 ---- 301 ---- 302 ---- 302 ---- 303 ---- 303 ---- 304 ---- 304
C#--- PP:F S#--- A:W S#--- PP:F -#--- A:W -#--- PP:F -#--- A:R -#--- PP:R -#--- A:R
---#- C--#- C--#- S--#- S--#- ---#- ---#- ---#-
-w--- -w--- -w--- Cw--- Cw--- Sw--C Sn--C Wn--C

305-3244 Valid command. 26BC;713-5SK,490SH
PP:RIGHT You. y. Move. y. Forward. y. CQ m.
A:FORWARD I m Moved m Forward m Q m B saw A Move.

306-3254 PP moved Forward and says so. 12BH;80-1SK,129SL,
A:LEFT You y Move y Forward y CQ m A didn't see it. B didn't see A turn. 180SL,456SD

307-3264 B was told to move Forward. PP did so. A Pats.
PP:FORWARD Next. m. Q m. PP starts saying Next inappropriately. A says Bad. 0BH,52BI;
A:PAT Bad y You y Move y Forward y CQ m

449SD

308-3273 B was told to move Forward. PP did so and says so.
PP:FORWARD I. n, Moved n, Forward m. Q m. A says Good but is out-of-reach to Pat. 77BG,31BH,28BI;
A:WAIT Good y You y Turn y Right y CQ m 470SD,107SC,120SC

---- 305 ---- 305 ---- 306 ---- 306 ---- 307 ---- 307 ---- 308 N---- 308
-#--- PP:R -#--- A:F -#--- PP:F -#--- A:L -#--- PP:F N#--- A:P N#--- PP:F -#--- A:W
---#- ---#- ---#- N--#- N--#- ---#- ---#- ---#-
We--C Ne--C N-e-C --e-C --n-C --n-C --n-C --n-C

309-3284 B was told to turn Right. PP did so and says so.
PP:RIGHT I. n, Turned. m. Right. m. Q m. A says Good but is out-of-reach to Pat. 94BA,94BB;
A:WAIT Good y You y Move y Forward y CQ m 176SK,77-8SL,296SK,509SK,189SL

310-3295 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 12BH,32BI;77-9SK,48SL,66-7SL
A:PAT Good y You y Move y Forward y CQ m

311-3306 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 31BH,32BI;96-8SH,95-7SJ
A:PAT Good y You y Move y Forward y CQ m

312-3317 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 0BH,32BI;1504-6SD
A:RIGHT Good y You y Move y Forward y CQ m

N--- 309 E--- 309 E--- 310 -E--- 310 -E--- 311 --E-- 311 --E-- 312 ---E- 312
-#--- PP:R -#--- A:W -#--- PP:F -#--- A:P -#--- PP:F -#--- A:P -#--- PP:F -#--- A:R
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
--n-C --n-C --n-C --n-C --n-C --n-C --n-C --n-C

313-3328 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 0BH,32BI;
A:WAIT Good y You y Turn y Right y CQ m 102-3SH,101-2SJ,152SH,153SJ

314-3339 B was told to turn Right. PP did so and says so.
PP:RIGHT I. n, Turned. m. Right. m. Q m. A says Good but is out-of-reach to Pat. 10BH,44BI;106SH,
A:WAIT Good y You y Move y Forward y CQ m 116SJ,118SH,117SJ,597SH,617SJ

315-3350 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 12BH,32BI;110-1SH,
A:FORWARD Good y Next m Turn m Is m Mine m So m You y Move y Forward y CQ m 123SJ,99-100SJ,101SH

316-3366 B was told to move Forward and PP did so. A was too busy to Pat.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP should be saying Next .. A says Bad. 108BB;177-9SB
A:FORWARD (Squashed) Bad y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m

---E- 313 ----E 313 ----E 314 ----S 314 ----S 315 ---- 315 ---- 316 ---- 316
 -#--- PP:F -#--- A:W -#--- PP:R -#--- A:W -#--- PP:F -#---S A:F -#---S PP:F -#--- A:F
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 --e-C --e-C --e-C --e-C --e-C --e-C --e-C --e-C
 317-3382 PP turned Right away from the Wall and sets up WM with <Mine. A Pats and says Good.
 PP:RIGHT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 12BI;426SK,
 A:PAT Good y Q n 40-7SL,428-34SK
 318-3395
 B:LEFT I. m. Moved. m. Forward. m. Q m. RM turned Left but PP says it moved Forward. Rand=12;183-5SL
 A:LEFT Bad y I m Turned m Left m Q m A says Bad. B saw A turn.
 319-3406
 B:RIGHT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. Rand=19;
 A:LEFT I m Turned m Left m Q m Redundant. B saw A turn. 426SK,621-3SJ,1772-6SD
 320-3421
 PP:LEFT I m Pushed. n Cake. n Q n PP turned Left but says it Pushed Cake. 243BH;805SK,
 A:FORWARD Bad m I m Moved m Forward m Q m A says Bad. B saw A move. 14SL,182SL
 ----- 317 ----- 317 ----- 318 ----- 318 ----- 319 ----- 319 ----- 320 ----- 320
 -#--- PP:R -#--- A:P -#--- B:L -#--- A:L -#--- B:R -#--- A:L -#--- PP:L -#--- A:F
 ---#S ---#W ---#W ---#S ---#S ---#W ---#W ---#S
 -C--e -C--e -C--e -C--e -C--n -C--n -C--w -C--w
 321-3432
 B:FORWARD Bad. n, I. n, Moved. n, Forward. n, CQ n, RM moved Forward. PP says so with CQ. Rand=16;
 A:FORWARD I m Moved m Forward m Q m A didn't see it. B saw A move. 150-4SL
 322-3443
 PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 10BH,69BI;176SK,129SL,
 A:RIGHT I m Turned m Right m Q m A didn't see it. B saw A turn. 296SK,180SL,509SK,187SL
 323-3453
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 12BH,16BI;10-2SL
 A:FORWARD Good m I m Moved m Forward m Q m A says Good but was too busy to Pat. B saw A move.
 324-3464
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 20BI;109SL,1SL,155SL
 A:LEFT You y Push y Cake o CQ m A didn't see it.
 ----- 321 ----- 321 ----- 322 ----- 322 ----- 323 ----- 323 ----- 324 ----- 324
 -#--- B:F -#--- A:F -#--- PP:R -#--- A:R -#--- PP:F -#--- A:F -#--- PP:F -#--- A:L
 ---#S ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 -C-w- -C-wS -C-wS -C-wW -C-nW -C-nW -C-w- -C-w-
 325-3474
 B was told to Push Cake. PP did so and says so.
 PP:FORWARD I. m. Pushed. m. Cake. c Q m. A Pats and says Good. 60BI;439SK,750-1SK,160SL,168SL
 A:PAT Good y You y Push y Cake o CQ m
 326-3485
 B was told to Push Cake and PP did so. A Pats.
 PP:FORWARD Next. m. Turn. m. Is. m. Mine. m. So. m. You. no! Q m. PP reads WM properly 169BD,168BE,
 A:PAT Bad y You y Turn y Right y CQ m but in wrong place. 168BF;646-8SB,492-3SB,593SF
 327-3499
 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 183BC;525-7SH,545-7SJ
 A:PAT Good y You y Push y Cake o CQ m
 328-3510
 B was told to Push Cake. PP did so and A Pats.
 PP:FORWARD I. m. Pushed. m. Cake. o. CQ m. PP says so but with CQ. A says Bad. 19BH,40BI;222SH,
 A:PAT Bad y You y Push y Cake o CQ m 372SJ,528-9SH,548-9SJ
 ----- 325 ----- 325 ----- 326 ----- 326 ----- 327 ----- 327 ----- 328 ----- 328
 -#--- PP:F -#--- A:P -#--- PP:F -#--- A:P -#--- PP:R -#--- A:P -#--- PP:F -#--- A:P
 --w#- --w#- --w#- C-w#- C-w#- C-w#- C-w#- N-w#-
 -Cw- -Cw- -Cw- W- W- N- N-
 329-3521
 B was told to Push Cake and PP did so. A Pats.
 PP:FORWARD Next. m Turn. m Is. m Mine. m So. m You. no! Q n PP says in wrong place. 2BH,82BI;
 A:PAT Bad y You y Push y Cake o CQ m A says Bad. 1222SD,408-12SH,428-32SJ
 330-3535
 B was told to Push Cake and PP did so. A Pats.
 PP:FORWARD I. m Moved. m. Forward. m. Q m. PP says it moved Forward. 186BC;366SH,938SI,
 A:PAT Bad y You y Turn y Right y CQ m A says Bad. 379SJ,1242-3SI
 331-3546
 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but was too busy to Pat. 298BB;
 A:RIGHT Good y You y Push y Cake o CQ m 525-7SH,545-7SJ
 332-3557
 B was told to Push Cake and PP did so. A Pats.
 PP:FORWARD Next. m Turn. m Is. m Mine. m So. m You. y. Q m. PP says in wrong place. 191BG,
 A:PAT Bad y You y Push y Cake o CQ m A says Bad. 19BH,40BI;1335-7SD,504-6SB
 ----- 329 C----- 329 C----- 330 NC--- 330 NC--- 331 EC--- 331 EC--- 332 -EC--- 332
 C#--- PP:F N#--- A:P N#--- PP:F -#--- A:P -#--- PP:R -#--- A:R -#--- PP:F -#--- A:P
 N-w#- --w#- --w#- --w#- --w#- --w#- --n#- --n#-

 333-3571
 B was told to Push Cake. PP did so and says so.
 PP:FORWARD I m Pushed m Cake c Q m A says Good but was too busy to Pat. 184BH,82BI;
 A:RIGHT Good y You y Push y Cake o CQ m 1840-2SD

334-3582 B was told to Push Cake. PP did so and says so.
PP:FORWARD I. m Pushed. m Cake. c Q m. A says Good but was too busy to Pat. 256BG,2BH,40BI;
A:RIGHT Good m I m Turned m Right m Q m B didn't see A turn. 1195SD,1825-6SD

335-3593
PP:FORWARD Next. m. Turn. m. Is. m. Mine^ n, Q n, PP Pushed Cake, says Next .. 0BG,2BH,63BI;627-9SI,
A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A move. 219-20SJ,217SH,785SD

336-3604
PP:LEFT Bad. n, I. m. Moved. n, Forward. n, CQ n, PP turned Left but says Forward with CQ. 10BB;
A:LEFT You y Turn y Right y CQ m A didn't see it. 55SD,369-72SC,1100-3SD

-EC-- 333 --EC- 333 --EC- 334 ---EC 334 ---EC 335 ----E 335 ----E 336 ----N 336
--#-- PP:F --#-- A:R --#-- PP:F --#-- A:R --#-- PP:F --#--C A:F --#--C PP:L --#--C A:L
--n#- --n#- --e#- --e#- --s#- --s#- --s#- --s#-
----- ----- ----- ----- ----- -----

337-3615 B was told to turn Right and PP did so.
PP:RIGHT Q m. PP was out-of-reach to Pat. 12BC;
A:WAIT You y Turn y Right y CQ m

338-3622 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but was out-of-reach to Pat. 13BA;
A:WAIT Good y You y Push y Cake o CQ m 525-7SH,545-7SJ

339-3633 B was told to Push Cake. PP did so and says so.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. A says Good but must 190BG,19BH,40BI;
A:WAIT Good m Next m Turn m Is m Yours m So m You y Push y Cake o CQ m WAIT for imitation. 222SH,

340-3649 B was told to Push Cake and PP did so. 372SJ,528-9SH,548-9SJ
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. A wanted PP to say Next .. A says Bad. 191BG,2BH,61BI;
A:FORWARD Bad y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 530-2SH,550-2SJ

----N 337 ----E 337 ----E 338 ----S 338 ----S 339 ----S 339 ----S 340 ----S 340
--#--C PP:R --#--C A:W --#--C PP:R --#--C A:W --#--C PP:F --#--S A:W --#--S PP:F --#--S A:F
--#-- --#-- --#-- --#-- --#-- --#-- --#-- --#--
--e-- --e-- --e-- --e-- --e-- --e-- --e-- --e--

341-3665 B was told to Squash Cake. PP did so, says so and sets up WM with <Yours.
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m Is. m <Yours. m. Q m. 14BH,
A:LEFT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 47BI;135-42SB

342-3686
PP:RIGHT I. m. Turned. m. Right. m. Q m PP turned Right and says so. 2BA,1BB;131SH,132SJ,
A:LEFT Good m I m Turned m Left m Q m A says Good. B saw A turn. 148SL,188SL

343-3697
PP:RIGHT Q n, 43BH;
A:FORWARD I m Moved m Forward m Q m B saw A move.

344-3704
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 200BH,3BI;479-81SK,
A:FORWARD I m Moved m Forward m Q m didn't see it. B didn't see A move. 0-1SL,155SL

----C 341 ----C 341 ----C 342 ----C 342 ----C 343 ----C 343 ----C 344 ----C 344
--#-- PP:F --#-- A:L --#-- PP:R --#-- A:L --#-- PP:R --#-- A:F --#-- PP:F --#-- A:F
--#S --#S --#S --#S --#S --#S --#S --#S
---eC ---eS ---nS ---nW ---wW ---wN ---wN ---w--

345-3714
PP:FORWARD Next. m. Turn. m. Is. m. Yours^ n, Q n, PP moved Forward and says Next .. 52BH,3BI;
A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A move. 707-10SD

346-3725
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP Pushed Cake but says it moved Forward. 67BH,31BI;
A:RIGHT You y Turn y Left m CQ m A didn't see it. 512-3SC,1405-6SD,542SB

347-3735 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but is out-of-reach to Pat. 153BC;
A:FORWARD Good y You y Push y Cake o CQ m 74-6SH,288SJ,74-5SJ

348-3746 B was told to Push Cake and PP did so. A is out-of-reach to Pat.
PP:FORWARD Next. m. Turn. m. Is. m. Yours^ m. So. m. Q n, PP says Next .. A says Bad. 72BH,40BI;
A:WAIT Bad y You y Push y Cake o CQ m 192-4SH,194-7SJ,191SH,313SK,35SL

----C 345 ----C 345 ----C 346 ---CN 346 ---CN 347 ---CW 347 ---CW 348 ---CW 348
--#-- PP:F --#--N A:F --#--N PP:F --#-- A:R --#-- PP:L --#-- A:F --#-- PP:F --#-- A:W
--#N --#N --#N --#N --#N --#N --#N --#N
-w-- -w-- -w-- -w-- -w-- -w-- -w-- -w--

349-3759 B was told to Push Cake. PP did so, says Next .. with prompt. A says Good, too busy to Pat.
PP:FORWARD Next. m Turn. m. Is. m. Yours^ m. So m. You y. Move y. Forward y. CQ m. 74BC;725-7SD,
A:FORWARD Good y Next m Turn m Is m Mine m So m You y Push y Cake o CQ m 219SB,669SH,314SK,37-9SL

350-3780 B was told to Push Cake. PP did so but A was too busy to Pat.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. PP didn't say Next .. A says Bad. 73BD,72BE,73BF;578-80SH,
A:FORWARD (Squashed) Bad y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m 599-600SJ

351-3796 PP turned Left away from Wall with unblocking and sets up WM with <Mine.
PPu:LEFT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m.
A:PAT Good y Q n A Pats and says Good. 12BI;656SK,40-7SL,658-64SK

352-3809

B:LEFT I m. Turned. m. Left. m. Q m. RM turned Left and PP says so. A says Good. Rand=5;
A:RIGHT Good y I m Turned m Right m Q n B didn't see A turn. 588-90SK,183-4SL
--CW- 349 -CW- 349 -CW- 350 CW- 350 nW- 351 nS- 351 nS- 352 nE- 352
-#- PP:F -#- A:F n#- PP:F n#- A:F -#- PP:L -#- A:P -#- B:L -#- A:R
n-#- n-#- -#- -#- -C-#- -C-#- -C-#- -C-#-

353-3820
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 175BH;80-2SK,199SL,11-2SL
A:RIGHT Good y You y Turn y Right y CQ m A says Good.
354-3831 B was told to turn Right and PP did so. A Pats.
PP:RIGHT You. y. Move. y. Forward. y. CQ m. Valid command. 0BH,43BI;350-3BH,362-5SJ
A:PAT You y Move y Forward y CQ m
355-3841 B was told to move Forward. PP did so and says so.
PP:FORWARD I m. Moved m. Forward m. Q m. A Pats and says Good. 178BH,33BI;52SL,66-7SL
A:PAT Good y You y Move y Forward y CQ m
356-3852 B was told to move Forward. PP unblocked did so and says so.
PPu:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 86BH;48SL,66-7SL
A:PAT Good y You y Turn y Right y CQ m
eE- 353 eE- 353 sE- 354 sS- 354 sS- 355 s- 355 s- 356 s- 356
-#- PP:F -#- A:R -#- PP:R -#- A:P -#- PP:F -#S- A:P -#S- PP:F -#- A:P
-C-#- -C-#- -C-#- -C-#- -C-#- -C-#- -C-#- -CS-#-

357-3863 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 43BI;83-5SK,77-8SL,189SL
A:PAT Good y You y Push y Cake o CQ m
358-3874 B was told to Push Cake and PP did so. A was too busy to Pat.
PP:FORWARD Next. m. Turn. m. Is. m. Mine. m. So. m. You. y. Q m. PP says Next .. wrong place. 217BH,
A:LEFT Bad y You y Squeeze y Cake o CQ m A says Bad. 40BI;447SE,456SF,456SG,476-80SC
359-3888 B was told to Squeeze Cake and PP did so. A Pats.
PP:FORWARD I m. Q n Incomplete sequence. 35BH,80BI;778SK
A:PAT You y Turn y Left y CQ m
360-3896 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 233BH,29BI;575-7SH,596-7SJ
A:PAT Good y You y Push y Cake o CQ m
s- 357 s- 357 s- 358 s- 358 e- 359 e- 359 e- 360 e- 360
-#- PP:R -#- A:P -#- PP:F -#- A:L -#- PP:F -#- A:P -#- PP:L -#- A:P
-CS-#- -CW-#- -CW-#- -CW-#- -CW-#- W-#- W-#- S-#-
----- C-#- C-#- C-#-
361-3907 B was told to Push Cake. PP did so and says so.
PP:FORWARD I. m Pushed. m Cake. c Q m A Pats and says Good. 72BH,40BI;672SC,1653SD,695-6SB
A:PAT Good y You y Turn y Left y CQ m
362-3918 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 153BC;373-5SD
A:PAT Good y You y Push y Cake o CQ m
363-3929 B was told to Push Cake. PP did so. A was too busy to Pat.
PP:FORWARD Q m. 66BG,72BH,40BI;
A:FORWARD You y Push y Cake o CQ m
364-3936 B was told to Push Cake. PP did so. A was too busy to Pat.
PP:FORWARD Q m. 66BG,67BH,81BI;
A:FORWARD You y Push y Cake o CQ m
e- 361 e- 361 e- 362 e- 362 e- 363 e- 363 -e- 364 -e- 364
-#- PP:F -#- A:P -#- PP:L -#- A:P -#- PP:F -#- A:F -#- PP:F -#- A:F
S-#- -#- -#- -#- -#- -#- -#- -#- -#- -#-
C-#- SC-#- SC-#- EC-#- EC-#- -EC-#- -EC-#- -EC-#-
365-3943 B was told to Push Cake. PP did so and says so.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. A Pats and says Good. 66BG,67BH,81BI;382SE,
A:PAT Good y You y Push y Cake o CQ m 388SF,389SG,403SC,455SC
366-3954 B was told to Push Cake. PP did so and says so.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. A says Good but is out-of-reach to Pat. 68BC;694-6SB
A:WAIT Good y You y Turn y Left y CQ m
367-3965 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but is out-of-reach to Pat. 277BA,166BB;
A:WAIT Good y You y Push y Cake o CQ m 962SD,318-9SB
368-3976 B was told to Push Cake. PP did so, reads WM with prompt and tells A to move.
PP:FORWARD Next. m Turn. m Is. m. Mine^ m. So. m. You. y. Move. y. Forward. y. CQ m. 207BC;1414-6SD,
A:FORWARD Good y Next m Turn m Is m Yours m So m You y Push y Cake o CQ m A says Good. 519-20SC,
--e- 365 --e- 365 --e- 366 --e- 366 --e- 367 --e- 367 --e- 368 --e- 368 549SB,494SE,
-#- PP:F -#- A:P -#- PP:F -#- A:W -#- PP:L -#- A:W -#- PP:F -#- C A:F 504SF,504SG,
--#- -#- -#- -#- -#C -#C -#C -#C -#N 459SH,1111SI,
--EC- --EC- --EC- --E- --E- --N- --N- --N- 200SJ,1422SD
369-3997 B was told to Push Cake. PP did so, reads WM properly and is prompted to tell but with Q.

PP:FORWARD Next m. Turn m. Is m. Mine m. So m You y Wait^ n Q m. A says Good. 232BB;527SC,884SD,
A:WAIT Good y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 284-6SB,583SA,703-5SB
370-4017 B was told to Squash Cake. PP did so, says so and sets up **WM** with <Yours.
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.
A:RIGHT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 154BA,155BB;288-95SA,
371-4038 287SB,225-31SB
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 131BA,132BB;296SA,288SB,
A:WAIT Good y You y Turn y Right y CQ m A says Good. 395SA,382SB,636SA,594SB
372-4049
PP:RIGHT You. y. Move. y. Forward. y. CQ m. Valid command. 246BA,244BB;595-8SB
A:PAT You y Move y Forward y CQ m
---e- 369 ---eC 369 ---eC 370 ---eN 370 ---sN 371 ---sE 371 ---sE 372 ---sS 372
-#---C PP:F -#---N **A:W** -#---N PP:F -#--- **A:R** -#--- PP:R -#--- A:W -#--- PP:R -#--- A:P
---#N ---#- ---#- -C-#- -C-#- -C-#- -C-#- -C-#-

373-4058 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 210BG,137BH,33BI;599-601SB
A:PAT Good y You y Turn y Right y CQ m
374-4070 B was told to turn Right and PP did so. A Pats.
PP:RIGHT You. y. Move. y. Forward. y. CQ m. PP's silly command. A says Bad. 211BG,0BH,43BI;602-5SB
A:PAT Bad y You y Move y Forward y CQ m
375-4081 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 212BG,178BH,28BI;31SL,66-7SL
A:PAT Good y You y Move y Forward y CQ m
376-4092 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 32BI;29-31SK,48SL,66-7SL
A:PAT Good y You y Turn y Left y CQ m
---sS 373 ---s- 373 ---s- 374 ---s- 374 ---s- 375 ---s- 375 ---s- 376 ---s- 376
-#--- PP:F -#---S A:P -#---S PP:R -#---W A:P -#---W PP:F -#---W A:P -#---W PP:F -#---W A:P
-C-#- -C-#- -C-#- -C-#- -C-#- -C-#- -C-#- -C-#-

377-4103 B was told to turn Left. RM did so. A Pats.
B:LEFT I. m. Moved. m. Forward. m. Q m. PP says it moved Forward. A says Bad. Rand=4;63SL,1671-2SI
A:PAT Bad y You y Move y Forward y CQ m
378-4114 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 287BC;2008-10SD,861-2SC
A:PAT Good y You y Turn y Right y CQ m
379-4125 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 331BA;618-20SB
A:PAT Good y You y Push y Cake o CQ m
380-4136 B was told to Push Cake. PP did so and says so.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. A says Good but was too busy to Pat. 217BG,217BH,40BI;
A:FORWARD Good y You y Squeeze y Cake o CQ m 1288SB,480-1SB
---s- 377 ---s- 377 ---s- 378 ---s- 378 ---s- 379 ---s- 379 ---s- 380 ---s- 380
-#W-- B:L -#S-- A:P -#S-- PP:F -#--- A:P -#--- PP:R -#--- A:P -#--- PP:F -#--- A:F
-C-#- -C-#- -C-#- -CS#- -CS#- -CW#- -CW#- -CW#-

381-4147 B was told to Squeeze Cake and PP did so. A Pats.
PP:FORWARD Next. m Q m. PP started to say Next .. A says Bad. 171BF;484SB
A:PAT Bad y You y Turn y Right y CQ m
382-4156 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 298BB;742-4SK,57SL,78SL,189SL
A:PAT Good y You y Push y Cake o CQ m
383-4167 B was told to Push Cake. PP did so and says so.
PP:FORWARD I. m Pushed. m Cake. c Q m A says Good but was too busy to Pat. 223BG,19BH,40BI;
A:LEFT Good m I m Turned m Left m Q m B saw A turn. 159-60SL,168SL
384-4178 PP says Next .. reading **WM** properly but wrong place. A says Bad.
PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. You. m. Q m, 184BH;765SF,765SG,629SI,785-6SD,
A:FORWARD Bad m I m Moved m Forward m Q m B didn't see A move. 238SC,1586SD
----- 381 ----- 381 ----- 382 ----- 382 ----- 383 C---- 383 C---- 384 NC--- 384
-#-s- PP:F C#-s- A:P C#-s- PP:R C#-s- A:P C#-s- PP:F N#-s- A:L N#-e- PP:F -#-e- A:F
CW-#- W--#- W--#- N--#- N--#- ---#- ---#- ---#-

385-4192
PP:LEFT Bad. n, I. m. Moved. n, Forward. n, CQ n, PP turned but says it moved Forward. 11BC;
A:LEFT You y Turn y Right y CQ m A didn't see it. 368-70SC,55SD,1100-1SD,826-7SB,894SA
386-4203 B was told to turn Right and PP did so.
PP:RIGHT Q m. A was out-of-reach to Pat. 313BA,306BB
A:WAIT You y Turn y Right y CQ m
387-4210 B was told to turn Right. PP did so and says so. A says Good
PP:RIGHT I. m. Turned. m. Right. m. Q m. but is out-of-reach to Pat. 13BA,307BB;525-7SH,545-7SJ

A:WAIT Good y You y Push y Cake o CQ m
388-4221 B was told to Push Cake. PP did so and says so. A Pats and says Good. 19BH,40BI;365SH,380SJ,730-1SH,743-4SJ
PP:FORWARD I. m. Pushed. m. Cake. o. Q m.
A:PAT Good y You y Push y Cake o CQ m
NC--- 385 WC--- 385 WC--- 386 NC--- 386 NC--- 387 EC--- 387 EC--- 388 -EC-- 388
-#--e PP:L -#--e A:L -#--n PP:R -#--n A:W -#--n PP:R -#--n A:W -#--n PP:F -#--n A:P
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
389-4232 B was told to Push Cake and PP did so. A must WAIT for imitation so no Pat.
PP:FORWARD Next m Turn m Is m Yours m So m You y Q m. Right place but incomplete. 184BH,40BI;
A:WAIT Next m Turn m Is m Mine m So m You y Push y Cake o CQ m 798-800SD,251-3SB
390-4250 B was told to Push Cake. PP did so and tells A to Squash. A says Good.
PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. You. y. Squash. y. Cake. o. CQ m. 175BD,174BE,
A:FORWARD (Squashed) Good y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m 174BF;1254SD,
391-4271 PP turned Right away from Wall and sets up WM with <Mine. A Pats and says Good. 454-61SB
PP:RIGHT Good. y. You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 183BG,
A:PAT Good y Q n 189BH;551-9SH,571-9SJ
392-4285
PP:FORWARD I. m. Turned. m. Left. m. Q m. PP moved Forward, says it turned Left. 227BH,88BI;395SK,
A:LEFT Bad y You y Turn y Right y CQ m A says Bad. 183-4SL,729SK,212SL
-EC-- 389 -EC- 389 -EC- 390 -EC- 390 ---En 391 ---Sn 391 ---Sn 392 ----n 392
-#--n PP:F -#--n A:W -#--n PP:F -#--n A:F -#-- PP:R -#-- A:P -#-- PP:F -#--S- A:L
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
---#- ---#- ---#- ---#- C---- C---- C---- C----
393-4296 B was told to turn Right. RM did so and PP says so.
B:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. Rand=19;57SL,78SL,189SL
A:PAT Good y You y Move y Forward y CQ m
394-4307 B was told to move Forward. PP did so and says so. A says Good
PP:FORWARD I. m. Moved. m. Forward. m. Q m. but was too busy to Pat. 94BH,32BI;29-31SK,48SL,66-7SL
A:FORWARD Good y You y Turn y Left y CQ m
395-4318 B was told to turn Left. PP did so and says so.
PP:LEFT I m Turned. m. Left. m. Q m. A Pats and says Good. 206BH,78BI;723SH,26SL,62SL
A:PAT Good y You y Move y Forward y CQ m
396-4329 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but too busy to Pat. 279BH,32BI;26-8SK,
A:FORWARD Good y You y Move y Forward y CQ m 48SL,66-7SL
----w 393 ----w 393 ----w 394 ----w 394 ---w- 395 ---w- 395 ---w- 396 ---w- 396
-#--S- B:R -#--W- A:P -#--W- PP:F -#--W- A:F -#--W- PP:L -#--S- A:P -#--S- PP:F -#--S- A:F
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
C--- C--- C--- C--- C--- C--- C--- C---
397-4340 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 7BH,32BI;68-70SH,318SJ,68-9SJ
A:PAT Good y You y Turn y Right y CQ m
398-4351 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 6BD,6BE,6BF;519-21SH,540-1SJ
A:PAT Good y You y Move y Forward y CQ m
399-4362 B was told to move Forward. PP did so but A was too busy to Pat.
PP:FORWARD I. m Pushed. m. Cake. o. Q m. PP says it Pushed Cake because 12BH,32BI;915SI,1495-6SI
A:FORWARD Bad y You y Push y Cake o CQ m context right after move. A says Bad.
400-4373 B was told to Push Cake. PP did so and says so.
PP:FORWARD I m. Pushed. m. Cake. o. Q m. A Pats and says Good. 2BH,82BI;1208SD,160SL,737SE
A:PAT Good y You y Turn y Right y CQ m
--w-- 397 --w-- 397 --w-- 398 --w-- 398 --w-- 399 --w-- 399 -w--- 400 -w--- 400
-#--- PP:F -#--- A:P -#--- PP:R -#--- A:P -#--- PP:F -#--- A:F -#--- PP:F -#--- A:P
--S#- ---#- ---#- ---#- ---#- ---#- ---#- C---#-
C--- C-S-- C-S-- C-W-- C-W-- CW--- CW--- W---
401-4384 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 183BC;1590-2SD
A:PAT Good y You y Push y Cake o CQ m
402-4395 B was told to Push Cake and PP did so. A must Wait for imitation so no Pat.
PP:FORWARD Next. m. Turn. m. Is. m. Mine^ m So. m You. y. Q n Incomplete with prompt. 19BH,40BI;
A:WAIT Next m Turn m Is m Yours m So m You y Push y Cake o CQ m 798SD,957-8SB,251SB,234SE,239SF
403-4413 B was told to Push Cake. PP did so and with unblocking tells A to WAIT but no CQ.
PP:FORWARD Next m. Turn m. Is m. Mine m So m You y. Wait. y Q m. A says Good but must WAIT. 14BB;
A:WAIT Good y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 365SH,408-12SH,177SL
404-4433 B was told to Squash Cake. PP did so, says so and sets up WM with <Yours. A says Good.
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.
A:LEFT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 222BB;135-42SB
-w--- 401 -w--- 401 -w--- 402 -w--- 402 -w--- 403 Cw--- 403 Cw--- 404 Nw--- 404
-#--- PP:R -#--- A:P -#--- PP:F C#--- A:W C#--- PP:F N#--- A:W N#--- PP:F -#--- A:L
C--#- C--#- C--#- N--#- N--#- ---#- ---#- ---#- ---#-

W---- N---- N---- -----

405-4454
 PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 2BA,1BB;531SA,507SB,
 A:LEFT Good m I m Turned m Left m Q m A says Good. B saw A turn. 659-60SH,671-2SJ

406-4465
 PP:RIGHT Q n, 199BC
 A:FORWARD I m Moved m Forward m Q m B saw A move.

407-4472
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. A didn't see it. 185BD;
 A:RIGHT I m Turned m Right m Q m B didn't see A turn. 463SE,473SF,474SG

408-4482
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. A says Good. 226BA,225BB;
 A:FORWARD Good y You y Move y Forward y CQ m 544-6SA,520-2SB

409-4493
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. B was told to move Forward. PP did so and says so.
 A:FORWARD Good y You y Turn y Left y CQ m A says Good but too busy to Pat. 227BA,226BB;547-9SA

410-4504
 PP:LEFT I. m. Turned. m. Left. m. Q m. B was told to turn Left. PP did so and says so.
 A:RIGHT Good y You y Turn y Left y CQ m A says Good but too busy to Pat. 228BA,152BB;550-2SA,

411-4515
 PP:LEFT I. m. Turned. m. Left. m. Q m. B was told to turn Left. PP did so and says so.
 A:PAT Good y You y Move y Forward y CQ m A Pats and says Good. 41BH,75BI;599SK,63SL,26SL,62SL

412-4526
 PP:FORWARD I. m Moved. m Forward. m Q m B was told to move Forward. PP did so and says so.
 A:RIGHT Good y You y Move y Forward y CQ m A says Good but was too busy to Pat. 32BI;550-2SA,
 110-1SH,123SJ,99-100SJ,101SH

413-4537
 PP:FORWARD I. m Moved. m Forward. m Q m B was told to move Forward. PP did so and says so.
 A:FORWARD Good y You y Turn y Right y CQ m A says Good but too busy to Pat. 0BH,32BI;593SH,
 613SJ,598-9SH,618-9SJ

414-4548
 PP:RIGHT I. m. Turned. m. Right. m. Q m. B was told to turn Right. PP did so and says so.
 A:PAT Good y You y Turn y Right y CQ m A Pats and says Good. 31BH,43BI;42SK,77-8SL,189SL

415-4559
 PP:RIGHT I m Turned. m. Right. m. Q m B was told to turn Right. PP did so and says so.
 A:PAT Good y You y Move y Forward y CQ m A Pats and says Good. 65BI;577SK,78SL,189SL

416-4570
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. B was told to move Forward. PP did so and says so.
 A:RIGHT I m Turned m Right m Q m A didn't see it. 143BH,32BI;234-6SH,239-40SJ
 B didn't see A move.

417-4580
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 51BH;137SK,372SK,11SL,
 A:FORWARD I m Moved m Forward m Q m B didn't see A move. 381SK,12SL

418-4590
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 54BH,9BI;108SK,0-2SL,542-3SK
 A:FORWARD I m Moved m Forward m Q m B saw A move.

419-4600
 PP:FORWARD Next. m. Turn. m. Is. m. Yours^ n, Q n, PP reads WM with prompt. Incomplete. 41BH,3BI;
 A:RIGHT You y Push y Cake o CQ m 206-9SC,718-21SD

420-4611
 B was told to Push Cake. PP did so, reads WM properly and tells. A says Good.
 PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. You. y. Move. y. Forward. y. CQ m. 116BD,
 A:FORWARD Good y Next m Turn m Is m Mine m So m You y Push y Cake o CQ m 115BE,116BF;725-6SD,211SC,

421-4632
 B was told to Push Cake. PP did so, reads WM properly and tells. A says Good.
 PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. You. y. Squash. y. Cake. o. CQ m. 264BG,67BH,
 A:FORWARD (Squashed) Good y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m 61BI;195SH,

422-4653
 PP turned Left away from Wall and sets up WM with <Mine. 453-5SH,472-4SJ,1909-13SD
 PP:LEFT Good. y. You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 71BI;

A:PAT Good y Q n A Pats and says Good. 849-57SK,137SL,192-6SL,45-7SL
423-4667
PP:LEFT I m. Turned m. Q m. Incomplete. 203BH,96BI;860SK,183-4SL,862-3SK,212SL
A:RIGHT I m Turned m Right m Q m B didn't see A's turn.
424-4676
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. A says Good. 264BH,16BI;
A:RIGHT Good y I m Turned m Right m Q m B didn't see A turn. 80-2SK,10-2SL
----- 421 ----- 421 C---- 422 C---- 422 C---- 423 C---- 423 C---- 424 C---- 424
--#--- PP:F --#--- A:F --#--- PP:L --#--- A:P --#--- PP:L --#--- A:R --#--- PP:F --#--- A:R
---#s ---#s ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
--EC- --EC --Es --Ns --Ns --Ws --Ww --W-w
425-4687
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. A says Good. 0BH,104BI;
A:FORWARD Good m I m Moved m Forward m Q m B didn't see A move. 10-2SH,10SJ,5-6SJ
426-4698
PP:FORWARD You. n, Turn. n, Right. n, CQ m. PP tells A but can't see A. A doesn't see it. 0BH,20BI;
A:LEFT I m Turned m Left m Q m B didn't see A turn. 92SK,109SL,327-8SK,285SK
427-4708
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. A says Good. 10BH;176SK,
A:WAIT Good y You y Move y Forward y CQ m 640-1SJ,597SH
428-4719 B was told to move Forward. PP did so and says so. A says Good
PP:FORWARD I. m. Moved. m. Forward. m. Q m. but was out-of-reach to Pat. 12BH,32BI;110-1SH,
A:WAIT Good y You y Move y Forward y CQ m 123SJ,99-100SJ,101SH
C---- 425 C---- 425 C---- 426 C---- 426 C---- 427 C---- 427 C---- 428 C---- 428
--#--- PP:F --#--- A:F --#--- PP:F --#--- A:L --#--- PP:R --#--- A:W --#--- PP:F --#--- A:W
---#- ---#- ---#n ---#n ---#w ---#w ---#w N---#w
--W-n --W-n --W--- W--- W--- N--- N---
429-4730 B was told to move Forward and PP did so. A is out-of-reach to Pat.
PP:FORWARD I. n, Pushed. n, Cake. n, Q n, PP says it Pushed Cake. A says Bad. 0BH,32BI;
A:WAIT Bad y You y Push y Cake o CQ m 937SI,1766-7SI
430-4741 B was told to Push Cake. PP did so and says so.
PP:FORWARD I n, Pushed. m. Cake. o. Q m. A says Good but is out-of-reach to Pat. 301BB;778SC,
A:RIGHT Good y You y Turn y Right y CQ m 805SB,994SB
431-4752 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but is out-of-reach to Pat. 360BB;525-7SH,
A:WAIT Good y You y Push y Cake o CQ m 545-7SJ
432-4763 B was told to Push Cake. PP did so, reads WM and tells A to WAIT.
PP:FORWARD Next. m. Turn. m. Is. m. Mine. m. So. m. You. y. Wait. y. Q m. 187BC;1230SD,408-12SH,
A:WAIT Good y You y Push y Cake o CQ m A says Good. Not CQ and must WAIT. 428-32SJ,756SH,770SJ
C---- 429 C---- 429 C---- 430 NC--- 430 NC--- 431 EC--- 431 EC--- 432 -EC-- 432
--#--- PP:F N#--- A:W N#--- PP:F --#--- A:R --#--- PP:R --#--- A:W --#--- PP:F --#--- A:W
N---#w ---#w ---#w ---#w ---#n ---#n ---#n ---#n

433-4778 B was told to Push Cake. PP did so, reads WM properly with unblocking, tells. A says Good.
PP:FORWARD Next m Turn m Is m. Mine m So m You y Move. y. Forward. y. CQ m. 188BC;1235-7SD,421-2SC,
A:FORWARD Good y Next m Turn m Is m Yours m So m You y Push y Cake o CQ m 447SB,496-7SB,411SG,374SH,
434-4799 B told to Push Cake. PP did so. A must WAIT. PP tells. A says Bad. 955SI,388SJ,1243SD
PP:FORWARD Next. m. Turn. m. Is. m. Mine^ m. So. m. You. y. Squash. y. Cake. o. CQ m. 212BB;429-30SC,
A:WAIT Bad y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 1254-5SD,455-6SB,411SE,418SF,
435-4820 B told to Squash Cake. PP did so, says so and sets up WM. 420SG,376SH,974SI,392SJ,1262SD
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m Is. m <Yours. m. Q m. 1BD,
A:LEFT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m A says Good. 1BE,1BF;
436-4841 185SK,86SL,125-31SJ
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. A says Good. 4BH,2BI;131SH
A:LEFT Good m I m Turned m Left m Q m B saw A turn.
-EC- 433 --EC- 433 --EC- 434 ---EC 434 ---E 435 ---E 435 ---E 436 ---S 436
--#--- PP:F --#--- A:F --#-n PP:F --#-n A:W --#-n PP:F --#-n A:L --#-w PP:R --#-w A:L
---#n ---#n ---#- ---#- ---#- ---#C ---#C ---#C

437-4852
PP:RIGHT Q n, 101BI
Tchr: Focus-on-robot-A-Pushing-the-Cake-instead-of-robot-B-to-help-the-imitation-process.
A:FORWARD I m Pushed m Cake o Q m B saw A Push.
438-4859
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. A didn't see it. 200BH,
A:FORWARD I m Pushed m Cake o Q m B didn't see A Push. 17BI;369SK,4SL,174-5SJ,335SH
439-4869
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. A didn't see it. 51BH;
A:RIGHT I m Turned m Right m Q m B didn't see A turn. 2387-8SD,1118SB
440-4879
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. A says Good. 51BH,16BI;

A:FORWARD Good y I m Pushed m Cake o Q m B didn't see A Push. 480-2SH,499=500SJ,452SJ
 ----S 437 ----W 437 ----W 438 ----W- 438 ---W- 439 --W-- 439 --W-- 440 -W--- 440
 -#--s PP:R -#--s A:F -#--s PP:F -#--s A:F -#--s PP:F -#--s A:R -#--s PP:F -#--s A:F
 ---#C ---#C ---#s ---#s ---#- ---#- ---#- ---#-
 -----C -----C ---Cs ---Cs ---Cw ---Cw
 441-4890
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. A says Good. 125BH;572-4SK,5SL
 A:FORWARD Good y You y Turn y Right y CQ m
 442-4901 B was told to turn Right. PP did so and says so.
 PPu:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 171BH;766-8SH,778-9SJ,354SJ
 A:PAT Good y You y Move y Forward y CQ m
 443-4912 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 143BH,32BI;
 A:WAIT Good y You y Turn y Left y CQ m 106-7SC,187SD,832-3SD,120SC
 444-4923 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but is out-of-reach to Pat. 146BA;369-71SB
 A:WAIT Good y You y Move y Forward y CQ m
 -W--- 441 -S--- 441 -S--- 442 -W--- 442 -W--- 443 W--- 443 W--- 444 S--- 444
 -#-- PP:L -#-- A:F -#-- PP:R -#-- A:P -#-- PP:F -#-- A:W -#-- PP:L -#-- A:W
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 --Cw- --Cw- -Cw-- -Cw-- -Cw-- -Cw-- -Cw-- -Cw--
 445-4934 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 41BH,32BI;276-8SH,
 A:FORWARD Good y Next m Turn m Is m Mine m So m You y Move y Forward y CQ m 282-4SJ
 446-4950 B was told to move Forward. PP did so and tells A to Squash. A says Good.
 PP:FORWARD Next m Turn m Is. m. Yours m. So m. You y. Squash y. Cake c CQ m 125BH,46BI;1084-5SD,
 A:FORWARD (Squashed) Good y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m 380-1SB,
 447-4971 PP turned away from Wall, reads WM properly with unblocking, sets up WM with <Mine. 532-6SB
 PP:LEFT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 168BA,168BB;
 A:PAT Good y Q n A Pats and says Good. 290-2SH,298-9SJ,40SJ,43-7SH,41-5SJ
 448-4984
 PP:FORWARD Good. no! I. n, Q n, PP moved Forward and started to say so. 5BH,88BI;206SK,402SK
 A:RIGHT I m Turned m Right m Q m B didn't see A turn.
 S--- 445 ---- 445 ---- 446 ---- 446 ---C- 447 ---C- 447 ---C- 448 ---C- 448
 -#-- PP:F S#-- A:F S#-- PP:F -#-- A:F -#-- PP:L -#-- A:P -#-- PP:F -#-- A:R
 ---#- ---#- ---#- S--#- S--#- S--#- E--#- E--#- E--#-
 -Cw-- -Cw-- Cw--- Cw--- w---- w---- w---- w----
 449-4993
 PPu:FORWARD I m Moved. m. Forward. m. Q m PP moved Forward with unblocking, says so. 80BH;
 A:FORWARD Good y You y Turn y Right y CQ m A says Good. 395SK,729-30SK,11-2SL
 450-5004 B was told to turn Right but PP turned Left. A Slaps.
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP says it turned Left. A says Good. 81BH;165SK,77SL,
 A:SLAP Good y You y Turn y Right y CQ m 521-2SJ,502SH
 451-5015 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 66BH,43BI;840SK,77-8SL,189SL
 A:PAT Good y You y Turn y Right y CQ m
 452-5026 B was told to turn Right but RM Waits. PP says it turned Right.
 B:WAIT I. m. Turned. m. Right. m. Q m. A Slaps and says Bad. Rand=15;1133-5SC
 A:SLAP Bad y You y Turn y Right y CQ m
 ---C- 449 ---C- 449 ---C- 450 ---C- 450 ---C- 451 ---C- 451 ---C- 452 ---C- 452
 -#-- PP:F -#-- A:F -#-- PP:L -#-- A:S -#-- PP:R -#-- A:P -#-- B:W -#-- A:S
 -E#- -E#- n-E#- n-N#- n-N#- n-E#- n-E#- n-E#-
 n--- n--- ----
 453-5037 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 92BH,73BI;741-3SH,754-6SJ
 A:PAT Good y You y Move y Forward y CQ m
 454-5048 B was told to move Forward and PP did so. A didn't see it.
 PP:FORWARD Q m. 94BH,32BI
 A:FORWARD I m Moved m Forward m Q m B didn't see A move.
 455-5055
 PP:LEFT Next. m. Turn. m. Is. m. Mine. n, Q m. Out of place, not proper read of WM. 106BC;308-11SH,
 A:FORWARD I m Moved m Forward m Q m B didn't see A move. 319-22SJ
 456-5066
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 41BH,3BI;102-4SK,0-2SL
 A:RIGHT You y Turn y Right y CQ m A didn't see it.
 ---C- 453 ---C- 453 ---C- 454 ---C- 454 ---C- 455 ---C- 455 n--C- 456 n--C- 456
 -#-- PP:R -#-- A:P -#-- PP:F -#-- A:F n#-- PP:L n#-- A:F -#-- PP:L -#-- A:R
 n-E#- n-S#- n-S#- n-S#- ---#- ---#- ---#- ---#-
 ---S-- ---S-- --E-- --E-- --N--
 457-5076 B was told to turn Right but PP turned Left. A is out-of-reach to Pat.
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP says it turned Left. A says Good. 84BH;599SK,923-4SK,

A:FORWARD Good y You y Turn y Right y CQ m 78SL,189SL
458-5087 B was told to turn Right. PP did so and says so.
PP:RIGHT I m. Turned. m. Right. m. Q m A Pats and says Good. 289BH,43BI;374-6SK,77SL,189SL
A:PAT Good y You y Turn y Right y CQ m
459-5098 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 178BH,43BI;77-8SL,189SL
A:PAT Good y You y Move y Forward y CQ m
460-5109 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 200BH,32BI;
A:FORWARD Good y You y Move y Forward y CQ m 243-5SH,248-50SJ
e--C- 457 e--C- 457 -e-C- 458 -e-C- 458 -e-C- 459 -e-C- 459 -e-C- 460 -e-C- 460
--#-- PP:L --#-- A:F --#-- PP:R --#-- A:P --#-- PP:R --#-- A:P --#-- PP:F --#-- A:F
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
--N-- --W-- --W-- --N-- --N-- --E-- --E-- --E--
461-5120 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 52BH,32BI;
A:WAIT Good y You y Turn y Left y CQ m 379-81SA,1131-2SB
462-5131 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but is out-of-reach to Pat. 146BA,147BB;
A:FORWARD Good y You y Move y Forward y CQ m 369-71SB
463-5142 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good, must WAIT for imitation, no Pat. 156BD,
A:WAIT Good y Next m Turn m Is m Yours m So m You y Move y Forward y CQ m 155BE,156BF;1071-3SD,
464-5158 B told to move Forward. PP did so, reads WM properly, tells A to Wait, no CQ. 360-1SC
PP:FORWARD Next. m. Turn. m. Is. m. Mine. m. So. m. You. y. Wait. y. Q m. 186BA;391-4SA,378-81SB,
A:WAIT Good y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 884-6SC,1673-5SD
--eC- 461 --eC- 461 --eC- 462 --eC- 462 --eC- 463 --eC- 463 --eC- 464 --eC- 464
--#-- PP:F --#-- A:W --#-- PP:L --#-- A:F --#-- PP:F --#-- A:W --#-- PP:F --#-- A:W
---#- ---#- ---#- ---#- ---#- ---#N ---#N ---#-
---E- ---E- ---E- ---N- ---N- ---N- ---N- ---N- ---N-
465-5178 B was told to Squash Cake. PP did so, says so and sets up WM with <Yours.
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.
A:RIGHT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 154BA,155BB;252-9SH,
466-5199 258-65SJ
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. A says Good. 23BH,2BI;296SA,
A:RIGHT Good m I m Turned m Right m Q m B didn't see A turn. 395SA,636SA
467-5210
PP:RIGHT You. y. Move. y. Forward. y. CQ m. Valid command. 282BA,278BB;587-9SH,607-9SJ,490SH,610SJ
A:FORWARD I m Moved m Forward m Q m B saw A move.
468-5220
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 12BH,95BI;
A:FORWARD I m Pushed m Cake o Q m A didn't see it. B didn't see A Push. 1708-9SD,456SD
--eC 465 -C-eN 465 -C-sN 466 -C-sE 466 -C-wE 467 -C-wS 467 -Cw-S 468 -Cw-- 468
--#--N PP:F --#-- A:R --#-- PP:R --#-- A:R --#-- PP:R --#-- A:F --#-- PP:F --#--S A:F
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
----- ----- ----- ----- -----
469-5230
PP:FORWARD I. m. Turned. m. Left. m. Q m. PP moved Forward but says it turned Left. 0BH,108BI;292SK,
A:FORWARD I m Pushed m Cake o Q m A didn't see it. B didn't see A Push. 225SL,1781-2SI
470-5240
PP:FORWARD I. m. Turned. n, Cake. m. Q m. PP moved Forward, says nonsense. 8BH,108BI;7SG,51SI,9SE
A:LEFT Bad y You y Turn y Right y CQ m
471-5251 B was told to turn Right. PP did so but A is out-of-reach to Pat.
PP:RIGHT I. n, Turned. m. Right. m. CQ m. PP says so but with CQ. A says Bad. 87BC;106SH,116-7SJ,
A:WAIT Bad y You y Move y Forward y CQ m 118SH,597SH,617SJ,985SK
472-5262 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 12BH,28BI;
A:FORWARD Good y You y Move y Forward y CQ m 112-4SH,111-2SJ
Cw--- 469 Cw--- 469 w---- 470 w---- 470 s---- 471 s---- 471 s---- 472 s---- 472
--#--S PP:F --#-- A:F C#--- PP:F C#--- A:L C#--- PP:R C#--- A:W C#--- PP:F C#--- A:F
---#- ---#S ---#S ---#- ---#- ---#- ---#- ---#- ---#-
----- ----- -----S -----S -----W -----W ---W-
473-5273 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 96BB;129-31SB
A:FORWARD Good y Next m Turn m Is m Mine m So m You y Move y Forward y CQ m
474-5289 B was told to move Forward. PP did so and tells A to Squash Cake. A says Good.
PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. You. y. Squash. y. Cake. c CQ m 98BG,0BH,46BI;
A:FORWARD (Squashed) Good y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m 85SL,
475-5310 PP turned Left towards the Wall. A Slaps. 703SK,1300-1SI,1257-62SD,636-40SC
PP:LEFT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 71BI;438-42SC,
A:SLAP Good y Q n PP sets up WM with <Mine. A says Good. 1267-70SD,634-7SD,180-2SC

476-5323
PP:RIGHT Good. y Q n Incomplete sequence. 24BH;183SL
A:LEFT You y Turn y Right y CQ m
----- 473 ----- 473 ----- 474 ----- 474 ----- 475 ----- 475 ----- 476 ----- 476
s#--- PP:F s#--- A:F #--- PP:F #--- A:F #--- PP:L #--- A:S #--- PP:R #--- A:L
C--#- C--#- s--#- s--#- -C--#- -C--#- -C--#- -C--#-
--W-- --W-- C-W-- CW--- sW--- sS--- sS--- sW---
477-5331 B was told to turn Right and RM turned Right. A Pats.
B:RIGHT Good. y. You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. Rand=3;
A:PAT You y Squeeze y Cake o CQ m PP repeats statement. Not wrong. 493-501SK,195-6SL,45-7SL
478-5347 B was told to Squeeze Cake and RM did so. A Pats.
B:FORWARD Q n Rand=5
A:PAT You y Turn y Right y CQ m
479-5354 B was told to turn Right but RM turned Left. A Slaps.
B:LEFT I. m. Turned m. Left. m. Q m. PP says it turned Left. A says Good. Rand=14;892-3SK,
A:SLAP Good y You y Turn y Right y CQ m 53SL,78SL,905SK,189SL
480-5365 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right m. Q m. A Pats and says Good. 279BH,43BI;77-8SL,189SL
A:PAT Good y You y Turn y Right y CQ m
----- 477 ----- 477 ----- 478 ----- 478 ----- 479 ----- 479 ----- 480 ----- 480
--#--- B:R #--- A:P #--- B:F #--- A:P #--- B:L #--- A:S #--- PP:R #--- A:P
-C--#- -C--#- -C--#- -NC--#- -NC--#- -WC--#- -WC--#- -NC--#-
eW--- eN--- eN--- e--- e--- e--- e--- e---
481-5376 B was told to turn Right. PP did so. A Pats.
PP:RIGHT Bad. n I. n Moved. n Forward. n Q n PP says it moved Forward. A says Bad. 65BI;441-4SI
A:PAT Bad y You y Squeeze y Cake o CQ m
482-5388 B was told to Squeeze Cake and RM did so. A Pats.
B:FORWARD I. m. Turned. m Left. m Q m. PP says it turned Left. A says Bad. Rand=2;323SK,1092-3SI
A:PAT Bad y You y Turn y Left y CQ m
483-5399 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 93BI;165SK,21SL,689-90SK,265SL,62SL
A:PAT Good y You y Move y Forward y CQ m
484-5410 B was told to move Forward. PP did so and says so.
PP:FORWARD I m. Moved m. Forward m. Q m A says Good but was too busy to Pat. 66BH,32BI;870-2SI
A:FORWARD Good y You y Move y Forward y CQ m
----- 481 ----- 481 ----- 482 ----- 482 ----- 483 ----- 483 ----- 484 ----- 484
--#--- PP:R #--- A:P #--- B:F #--- A:P #--- PP:L #--- A:P #--- PP:F #N-- A:F
-NC#- -EC#- -EC#- -E#- -E#- -N#- -N#- ---#-
e--- e--- e--- e-C-- e-C-- e-C-- e-C-- e-C--
485-5421 B was told to move Forward. PP did so and says so.
PP:FORWARD I m Moved m Forward m. Q m. A says Good but too busy to Pat. 80BH,32BI;106-7SC,1547-8SD,
A:FORWARD Good y You y Turn y Right y CQ m 120SC,1549SD
486-5432 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 94BB;519-21SH,764SJ,540-1SJ
A:PAT Good y You y Move y Forward y CQ m
487-5443 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 95BG,12BH,32BI;165SC,601SD,
A:PAT Good y You y Move y Forward y CQ m 168-9SB,170SA
488-5454 B was told to move Forward. PP did so and says so.
PP:FORWARD I. n, Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 106BA;171-3SA,
A:WAIT Good y You y Turn y Right y CQ m 170-2SB
----- 485 --N-- 485 --N-- 486 --E-- 486 --E-- 487 ---E- 487 ---E- 488 ---E 488
--N-- PP:F #--- A:F #--- PP:R #--- A:P #--- PP:F #--- A:P #--- PP:F #--- A:W
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
-eC-- -eC-- --eC- --eC- --eC- --eC- --eC- --eC-
489-5465 B was told to turn Right. PP did so and says so.
PP:RIGHT I. n, Turned n, Right y. Q m. A says Good but is out-of-reach to Pat. 94BA,94BB;173SB,
A:WAIT Good y You y Move y Forward y CQ m 118SH,597SH
490-5476 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but must WAIT for imitation. 12BH,32BI;
A:WAIT Good y Next m Turn m Is m Yours m So m You y Move y Forward y CQ m 515SD,130-1SB
491-5492 B was told to move Forward. PP did so and from WM tells A to Push Cake.
PP:FORWARD Good. y. Next. m. Turn. m. Is. m. Mine. m. So. m. You. y. Push. y. Cake. o. CQ m. 87BG,
A:FORWARD Good y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 0BH,46BI;2265-74SD
492-5514 B was told to Squash Cake. PP did so, says so and sets up WM with <Yours.
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.
A:LEFT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 256BD,255BE,255BF;
---E 489 ---S 489 ---S 490 ---S 490 ---S 491 ---S 491 ---S 492 ---S 492
--#--- PP:R #--- A:W #--- PP:F #---S A:W #---S PP:F #--- A:F #--- PP:F #--- A:L
---#- ---#- ---#- ---#- ---#- ---#S ---#S ---#-
--eC- --eC- --eC- --eC- --eC- --eC- --eC- --eS

493-5535
PP:RIGHT I. m. Turned. m. Right. m. Q m.
Tchr changes Cake to Roll. <<<<<<<<<<
A:WAIT Good y You y Turn y Right y CQ m
494-5546 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. y. Q m A Pats and says Good. 43BH;77-8SL,189SL
A:PAT Good y You y Move y Forward y CQ m
495-5557 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 49BH,32BI;1052-4SD
A:PAT Good y You y Move y Forward y CQ m
496-5568 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 159BG,52BH,32BI;647-9SD
A:PAT Good y You y Move y Forward y CQ m

----- 493 ----- 493 ----- 494 ----- 494 ----- 495 ----- 495 ----- 496 ----- 496
--#-- PP:R --#-- A:W --#-- PP:R --#-- A:P --#-- PP:F --#-- A:P --#-- PP:F --#--N A:P
--#-- --#-- --#-- --#-- --#-- --#-- ---#N ---#N ---#-
--CnS --RnW --RnW --RnN --RnN --Rn- --Rn- --Rn-

497-5579 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 129BG,51BH,32BI;187SD,832-3SD
A:PAT Good y You y Turn y Left y CQ m
498-5590 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 43BC;27SH,25SJ,315-6SH,328-9SJ
A:PAT Good y You y Move y Forward y CQ m
499-5601 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 41BH,32BI;240-2SH,245-7SJ
A:PAT Good y You y Move y Forward y CQ m

New file c:\PPDataW\aal.txt Sat Sep 24 09:25:13 NZST 2016 End of First 500 Steps.

500-5612 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but too busy to Pat. 51BH,32BI;240-2SH,
A:LEFT Good y You y Move y Forward y CQ m 247SJ,245-6SJ

----- 497 ----N 497 ----N 498 ----W 498 ----W 499 ---W- 499 ---W- 500 --W-- 500
--#--N PP:F --#-- A:P --#-- PP:L --#-- A:P --#-- PP:F --#-- A:P --#-- PP:F --#-- A:L
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
--Rn- --Rn- --Rn- --Rn- --Rn- --Rn- --Rn- --Rn-

501-5623 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but out-of-reach to Pat. 51BH,32BI;
A:FORWARD Good y You y Move y Forward y CQ m 1144-6SE,1157-9SF,1157-9SG
502-5634 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but out-of-reach to Pat. 346BC;1250-2SC,
A:WAIT Good y You y Turn y Left y CQ m 187SD,832-3SD
503-5645 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but out-of-reach to Pat. 146BA,440BB;1278-80SA
A:WAIT Good y You y Move y Forward y CQ m
504-5656 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 406BA;1281-3SA

A:FORWARD Good y Next m Turn m Is m Mine m So m You y Move y Forward y CQ m

--W-- 501 -W-- 501 -W-- 502 W-- 502 W-- 503 S-- 503 S-- 504 ---- 504
--#-- PP:F --#-- A:F --#-- PP:F --#-- A:W --#-- PP:L --#-- A:W --#-- PP:F S#-- A:F
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
--Rw- --Rw- --Rw- --Rw- --Rw- --Rw- --Rw- --Rw-

505-5672 B was told to move Forward and PP did so, but PP says Cake, not Roll. A says Bad.
PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. You. y. Squash. y. Cake. o. CQ m. 407BA;1044-6SE,
A:FORWARD (Squashed) Bad y I m Squashed m Roll m So m Next m Turn m Is m <Yours m Q m 1057-9SF,
506-5693 A was too busy to Pat. PP turns away from Wall. A Pats. 1057-9SG,294-9SE,299-304SF,299-304SG
PP:LEFT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 155BC;298-9SJ,
A:PAT Bad y You y Move y Forward y CQ m PP says Cake instead of Roll. A says Bad. 40-5SJ
507-5709 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but out-of-reach to Pat. 5BH,28BI;52SH,
A:RIGHT Good y You y Move y Forward y CQ m 1320SI,300-2SJ,293-4SH
508-5720 B was told to move Forward. PP did so and says so.
PP:FORWARD I m. Moved. m. Forward. m. Q m. A Pats and says Good. 80BH,32BI;621SE,66-7SL,623SE
A:PAT Good y You y Turn y Left y CQ m

----- 505 ----- 505 ----- 506 ----- 506 ----- 507 ----- 507 ----- 508 ----- 508
S#--- PP:F --#--- A:F --#R-- PP:L --#R-- A:P --#R-- PP:F --#R-- A:R --#R-- PP:F --#R-- A:P
---#- S--#- S--#- E--#- E--#- -E-- -E-- -E-- -E--
Rw--- Rw--- w---- w----

509-5731 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 240BC;624-6SE,634-6SF,633-5SG
A:PAT Good y You y Push y Roll o CQ m
510-5742 B was told to Push Roll and PP did so using BE. A Pats.
PP:FORWARD I. m. Pushed. m. Cake. o. O m. PP says it Pushed Cake using SF,SG. A says Bad. 223BE,

A:PAT Bad y You y Squeeze y Roll o CQ m BE,SF and SG are slot-filler templates. 637SF,637SG,1333SI
511-5753 B was told to Squeeze Roll and PP did so. A is out-of-reach to Pat.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. PP says it Pushed Cake. A says Bad. 224BE;938SI,
A:RIGHT Bad y You y Turn y Right y CQ m 1242SI,1856SI
512-5764 B was told to turn Right. PP did so and says so.
PP:RIGHT I m. Turned. m. Right. m. Q m. A says Good but out-of-reach to Pat. 183BC;57SL,78SL,189SL
A:FORWARD Good y You y Push y Roll o CQ m
----- 509 ----- 509 ----- 510 ---R-- 510 ---R-- 511 ---NR- 511 ---NR- 512 ---ER- 512
--R-- PP:L --R-- A:P --R-- PP:F --N-- A:P --N-- PP:F --#--- A:R --#--- PP:R --#--- A:F
--E#- --N#- --N#- --#- --#- --#- --#- --#-
n---- n---- n---- n---- n---- n---- e---- e----
513-5775 B was told to Push Roll and PP did so. A Pats.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. PP says it Pushed Cake. A says Bad. 118BI;762SF,
A:FORWARD Bad y You y Push y Roll o CQ m 762SG,1549SI
514-5786 B was told to Push Roll and PP did so. A is out-of-reach to Pat.
PP:FORWARD I n, Pushed. n, Roll^ n, Q n, A out-of-reach to push B's arm, prompts. 360BG;399SF,
A:FORWARD You y Turn y Right y CQ m 1210SG,747SG,119SE
515-5796 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 13BC;1104-6SK,53SL,78SL,189SL
A:PAT Good y You y Push y Roll o CQ m
516-5807 B was told to Push Roll. PP did so and says so with prompt.
PP:FORWARD I m Pushed m Roll^ o Q m A says Good but must WAIT for imitation. 348BH,118BI;967-9SH
A:WAIT Good y Next m Turn m Is m Yours m So m You y Push y Roll o CQ m
--ER- 513 --ER- 513 --ER- 514 ----E 514 ----E 515 ----S 515 ----S 516 ---- 516
--#--- PP:F --#--- A:F --#--- PP:F --#---R A:F --#---R PP:R --#---R A:P --#---R PP:F --#---S A:W
--#- --#- --#- --#- --#- --#- --#- --#-
-e- -e- -e- -e- -e- -e- -e- -e-
517-5823 B was told to Push Roll and PP did so. A must WAIT for imitation.
PP:FORWARD Q n 349BH
A:WAIT Next m Turn m Is m Yours m So m You y Squash y Roll o CQ m
518-5835 B was told to Squash Roll and PP did so.
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.
A:LEFT Bad y You y Squashed y Roll m So m Next m Turn m Is m <Mine m Q m 255BE;129SF,129SG,270-4SD
519-5856 PP says it Squashed Cake and sets up WM with <Yours. A says Bad.
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right, says so. 2BC;131SH,132SJ,659-60SH,
A:LEFT Good m I m Turned m Left m Q m A says Good. B saw A turn. 671-2SJ
520-5867 43BH,101BI
PP:RIGHT Q m. B saw A move.
A:FORWARD I m Moved m Forward m Q m
----- 517 ----- 517 ----- 518 ---R- 518 ---R- 519 ---R- 519 ---R- 520 ---R- 520
--#--S PP:F --#-- A:W --#-- PP:F --#-- A:L --#-- PP:R --#-- A:L --#-- PP:R --#-- A:F
---#R ---#S ---#S ---#- ---#- ---#- ---#- ---#-
---e- ---eR ---eR ---eS ---nS ---nW ---wW ---wN
521-5874
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 200BH,3BI;661-3SH,
A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A move. 673-5SJ
522-5884
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 52BH,3BI;369-71SK,
A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A move. 0-1SL,155SL
523-5894
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 51BH,3BI;484-6SE,493-5SF,
A:RIGHT I m Turned m Right m Q m A didn't see it. B didn't see A move. 493-4SG,292SG
524-5904
PP:LEFT I. m. Moved. m. Forward. m. Q m. PP turned Left but says it moved Forward. 49BE;10-2SL
A:FORWARD Bad y You y Push y Roll y CQ m A says Bad.
---R- 521 ---R- 521 ---R- 522 ---R- 522 ---R- 523 ---RN 523 ---RN 524 ---RW 524
--#--- PP:F --#--- A:F --#--- PP:F --#---N A:F --#---N PP:F --#--- A:R --#--- PP:L --#--- A:F
---#- ---#N ---#N ---#- ---#- ---#- ---#- ---#-
--wN --w- -w- -w- w- w- n- n-
525-5915 B told to Push Roll, PP did so, tells. A says Good. A out-of-reach to unblock pointing.
PP:FORWARD Next n, Turn n, Is n, Yours n, So n, You y. Move. y. Forward. y. CQ m. 260BE;790SF,790SG,
A:FORWARD Good y Next m Turn m Is m Mine m So m You y Push y Roll o CQ m too busy to Pat. 1620SI,
526-5936 B was told to Push Roll and PP did. A must WAIT. 781-2SE,36-9SL
PP:FORWARD Next. m Turn. m Is. m Yours. m. So. m. You. y. Move. y. Forward. y. CQ m. 121BI;
A:WAIT Bad y Next m Turn m Is m Mine m So m You y Push y Roll o CQ m A says Bad. 993-1001SH,982-9SJ
527-5957 B was told to Push Roll and did so. PP tells A with prompt to Squash Roll. A says Good.
PP:FORWARD Next m Turn m Is m Yours m So m You y Squash y. Roll^ o Q m 72BE;261SL,258-60SL,35-7SL,
A:FORWARD (Squashed) Good y I m Squashed m Roll m So m Next m Turn m Is m <Yours m Q m 135SL
528-5978 PP turned Left away from the Wall. A Pats.
PP:LEFT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 12BI;688-95SJ
A:PAT Bad y You y Turn y Left y CQ m PP says Cake again but sets up WM with <Mine correctly.

---RW 525 --RW- 525 --RW- 526 -RW-- 526 -RW-- 527 RW--- 527 nW--- 528 nS--- 528 A says Bad.
 -#--- PP:F -#--- A:F n#--- PP:F n#--- A:W n#--- PP:F n#--- A:F -#-R- PP:L -#-R- A:P
 n---#- n---#- ---#- ---#- ---#- ---#- ---#- ---#-

 529-5994 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 269BH,79BI;588-90SK,21SL,26SL,62SL
 A:PAT Good y You y Move y Forward y CQ m
 530-6005 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 175BH,32BI;96-8SH,
Tchr: Tchr-is-now-trying-to-Push-Roll-and-say-so-where-robot-B-can-see-it.
 A:RIGHT Good y You y Move y Forward y CQ m 95-7SJ
 531-6016 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but too busy to Pat. 221BG,0BH,32BI;
 A:FORWARD Good y You y Turn y Right y CQ m 80-2SK,48SL,66-7SL
 532-6027 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 43BI;77-8SL,189SL
 A:PAT Good y You y Squeeze y Roll o CQ m
 nS--- 529 nE--- 529 nE--- 530 n-E-- 530 e-E-- 531 e--E- 531 -e-E- 532 -e-S- 532
 -#-R- PP:L -#-R- A:P -#-R- PP:F -#-R- A:R -#-R- PP:F -#-R- A:F -#-R- PP:R -#-R- A:P
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

 533-6038 B was told to Squeeze Roll and RM did so. A was too busy to Pat.
 B:FORWARD Q n Rand=9
 A:FORWARD Now y You y Wait y CQ m
 534-6045 B was told to Wait but RM turned Left. A Slaps.
 B:LEFT I. m. Turned. m. Left. m. Q m. PP says it turned Left. A says Good. Rand=7;165SK,
 A:SLAP Good y You y Turn y Right y CQ m 689-90SK
 535-6056 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 66BH,43BI;77-8SL,189SL
 A:PAT Good y Now y You y Wait y CQ m
 536-6067 B was told to Wait and RM did so. A Pats.
 B:WAIT I. m. Turned. m. Right. m. Q m. PP says it turned Right. A says Bad. Rand=8;2433-5SI
 A:PAT Bad y Now y You y Wait y CQ m
 -e-S- 533 -e--- 533 --e--- 534 --e-- 534 --e-- 535 --e-- 535 --e-- 536 --e-- 536
 -#-R- B:F -#RS- A:F -#RS- B:L -#RE- A:S -#RE- PP:R -#RS- A:P -#RS- B:W -#RS- A:P
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

 537-6078 B was told to Wait. PP did so and with prompting says so.
 PP:WAIT I m Am^ m Waiting^ m Q m A Pats and says Good. 414BC;2920SD,1394SC^,1281SE^
 A:PAT Good y Now y You y Wait y CQ m A hasn't ever WAITed and said "I Am Waiting" for B to imitate.
 538-6089 B was told to Wait. PP did so and says so.
 PP:WAIT I m Am. m. Waiting. m. Q m. A says Good but was too busy to Pat. 414BC;1393-4SC,2921SD,
 A:RIGHT Good y Now y You y Wait y CQ m 1397SC,2927SD
 539-6100 B was told to Wait. PP did so and says so.
 PP:WAIT I. m. Am. m. Waiting. m. Q m. A says Good but was too busy to Pat. 479BB;1447SB,1442SB,
 A:FORWARD Good y I m Pushed m Roll m Q m A didn't see A Push. 1448SB
 540-6111
 B:LEFT I. m. Turned. m. Left. m. Q m. RM turned Left and PP says so. Rand=16;1116-7SF,1782SI
 A:WAIT Good y You y Turn y Right y CQ m A says Good.
 --e-- 537 --e-- 537 --e-- 538 --e-- 538 --s-- 539 --s-- 539 ----- 540 ----- 540
 -#RS- PP:W -#RS- A:P -#RS- PP:W -#RS- A:R -#RS- PP:W -#RS- A:F -#sS- B:L -#sE- A:W
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

 541-6122 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but was too busy to Pat. 413BC;77-8SL,189SL
 A:FORWARD Good m I m Pushed m Roll o Q m B saw A Push.
 542-6133
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. A didn't see it. 127BI;
 A:FORWARD I m Squeezed m Roll o Q m B didn't see A Squeeze. 1398-400SC,2940-2SD
 543-6143
 PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. A didn't see it. 66BH;840SK,
 A:RIGHT I m Turned m Right m Q m B saw A turn. 981-2SK
 544-6153
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. A didn't see it. 310BH;2166SI,
 A:FORWARD I m Pushed m Roll o Q m B didn't see A Push. 1024-6SJ,1781-2SI,
 ----- 541 ----- 541 ----- 542 ----- 542 ----- 543 ----- 543 ----- 544 ----- 544
 -#sE- PP:R -#sS- A:F -#-S- PP:L -#-E- A:F -#-E- PP:R -#-S- A:R -#-S- PP:L -#-E- A:F
 -R#- -R#- -s#- -s#- -s#- -s#- -s#- -s#-

 545-6163
 PP:FORWARD Good. n, You. n, Turn. n, Right. m. CQ n, Neither robot could see the other. 336BE,

A:FORWARD I m Pushed m Roll o Q m B didn't see A Push. 385BF;32SI,288SI,37-8SI
546-6174
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. A didn't see it. 40BH;176SK,
A:RIGHT I m Turned m Right m Q m B saw A turn. 296SK,521SH
547-6184
PP:FORWARD I. m. Turned. m. Left. m. Q m. PP moved Forward but says it turned Left. 12BH,16BI;
A:WAIT Bad y You y Turn y Right y CQ m A says Bad. 292SK,10SL,860-1SJ,859SH
548-6195 B was told to turn Right but PP moved Forward. A was out-of-reach to Slap.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP says it moved Forward. A says Good. 8BH,35BI;92SK,
A:WAIT Good y I m Am m Waiting m Q m B saw A Waiting. 57SL,114-5SJ,117SH
----- 545 ----- 545 ----- 546 ----- 546 ----- 547 ----- 547 ----- 548 ----- 548
-#-E- PP:F -#-E- A:F -#-E PP:R -#-S A:R -#-S PP:F -#-S A:W -#-S PP:F -#-S A:W
---#- ---#- R--#- R--#- R--#- R--#S R--#S R--#-
Rw--- Rw--- w---- w---- n---- n---- n---- n---S
549-6206
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. A says Good. 10BH;176SK,296SK,
A:FORWARD Good m I m Pushed m Roll o Q m B saw A Push. 641SJ
550-6217 PP moved Forward and tells A to Push Cake. A says Bad.
PP:FORWARD Good. y. Next. m. Turn. m. Is. m. Mine. m. So. m. You. y. Push. y. Cake. o. CQ n, 12BH;
A:FORWARD Bad m I m Pushed m Roll o Q m B saw A Push. 292SK,268SL,944-5SK,914-20SH
551-6234
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 8BH;80-1SK, 281SL,
A:FORWARD I m Pushed m Roll o Q m A didn't see it. B saw A Push. 122SH,806SJ
552-6244
PP:FORWARD Good. n, You. y. Push. n, Cake. n, CQ m. Invalid command. 0BH,130BI;80SK,275-6SL,
A:RIGHT Bad y I m Turned m Right m Q m A says Bad. B saw A turn. 698SK,528SK
----- 549 ----- 549 ----- 550 ----- 550 R---- 551 R---- 551 nR--- 552 nR--- 552
-#--- PP:R -#--- A:F R#--- PP:F R#--- A:F n#--- PP:F n#--- A:F -#--- PP:F -#--- A:R
R--#- R--#- n--#- n--#- ---#- ---#- ---#- ---#-
n---S n---W ---W- ---W- ---W- ---W- ---W- ---W-
553-6256
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 0BH;374SK,128SL,
A:FORWARD Good y I m Pushed m Roll o Q m A says Good. B saw A Push. 849-50SH
554-6267
PP:FORWARD I. m. Turned. m. Left. m. Q m. PP moved Forward but says it turned. 178BH,133BI;29-30SK,
A:FORWARD Bad m I m Pushed m Roll o Q m A says Bad. B saw A Push. 268-70SL
555-6278
PP:LEFT I. m. Squeezed. n, Cake. n, CQ m. PP turned Left but says it Squeezed Cake CQ. 206BH;
A:RIGHT Bad y You y Turn y Left y CQ m A says Bad. 448-50SI,141SE,144SF,143SG
556-6289 B was told to turn Left. PP moved Forward and says it turned Left.
PP:FORWARD I. m. Turned. m Left. m. Q m. A Slaps and says Bad. 279BH,74BI;21-2SE,21SF,21SG,
A:SLAP Bad y You y Turn y Left y CQ m 24SF,24SG,184SG
eR--- 553 eR--- 553 -eR-- 554 -eR-- 554 --eR- 555 --eR- 555 --sR- 556 --sR- 556
---#- PP:R ---#- A:F ---#- PP:F ---#- A:F ---#- PP:L ---#- A:R ---#- PP:F ---#- A:S
---#- ---#- ---#- -N-#- -N-#- -W-#- -W-#- -W-#-
-W--- -N--- -N--- ----- ----- -----
557-6300 B was told to turn Left and PP did so. A Pats.
PP:LEFT I. m. Moved. m. Forward. m. Q m. PP says it moved Forward. A says Bad. 43BC;655-7SI
A:PAT Bad y You y Move y Forward y CQ m
558-6311 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 135BC;187SD,
A:WAIT Good y You y Turn y Left y CQ m 1251-2SC,832-3SD
559-6322 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but is out-of-reach to Pat. 146BA;27SH,25SJ,
A:WAIT Good y You y Move y Forward y CQ m 315-6SH,328-9SJ
560-6333 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 41BH,32BI;240-2SH,247SJ,245-6SJ
A:PAT Good y You y Move y Forward y CQ m
--sR- 557 --sR- 557 --sR- 558 --sR- 558 --sR- 559 --sR- 559 --sR- 560 --sR- 560
-#--- PP:L -#--- A:P -#--- PP:F -#--- A:W -#--- PP:L -#--- A:W -#--- PP:F -#--- A:P
W--#- S--#- S--#- ---#- ---#- ---#- ---#-
----- ----- S---- S---- E---- E---- -E--
561-6344 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 351BG,51BH,32BI;2671SD,1302-3SB
A:PAT Good y You y Move y Forward y CQ m
562-6355 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 352BG,51BH,32BI;2494-5SD,1336SA
A:PAT Good y You y Move y Forward y CQ m
563-6366 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but is out-of-reach to Pat. 359BC;1310-2SB
A:LEFT Good y You y Turn y Left y CQ m

564-6377 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but is out-of-reach to Pat. 146BA,440BB;
A:WAIT Good y You y Move y Forward y CQ m 1313-5SB

--sR- 561 --sR- 561 --sR- 562 --sR- 562 --sR- 563 --sR- 563 --eR- 564 --eR- 564
--#--- PP:F --#--- A:P --#--- PP:F --#--- A:P --#--- PP:F --#--- A:L --#--- PP:L --#--- A:W
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
---E- ---E- ---E- ---E- ---E- ---E- ---E- ---E- ---N

565-6388 B was told to move Forward but PP Waited. A is out-of-reach to Slap.
PP:WAIT I n, Q m. Incomplete sequence. 184BA;385SA
A:WAIT You y Move y Forward y CQ m

566-6396 B was told to move Forward but PP Waited. A is out-of-reach to Slap.
PP:WAIT I. n, Q m. Incomplete sequence. 434BC;821SI,1076SJ
A:FORWARD I m Pushed m Roll o Q m B saw A Push.

567-6404 PP moved Forward and says so. A says Good. 60BH;
A:WAIT Good y Next m Turn m Is m Yours m So m You y Move y Forward y CQ m 479SK,674-5SJ

568-6420 B was told to move Forward. PP did so, reads WM properly and tells A. A says Good but was
PP:FORWARD Next m. Turn m. Is m. Mine. m. So. m. You. y. Wait. y. Q m. too busy to Pat. 186BA;
A:WAIT Good y Next m Turn m Is m Yours m So m You y Squash y Roll o CQ m 2700-1SD,1321SB,265SE,269SF,
--eR- 565 --eR- 565 --eR- 566 --eR- 566 --eR- 567 --eR- 567 --eR- 568 --eR- 568 268SG,499SE,
--#--- PP:W --#--- A:W --#--- PP:W --#--- A:F --#--- PP:F --#--- A:W --#--- PP:F --#---N A:W 847SF,846-7SG,
---#- ---#- ---#- ---#- ---#- ---#N ---#N ---#- 835-6SE,509SF,
---N ---N ---N ---N ---N ---N ---N ---N ---N 848SF,509SG

569-6440 B was told to Squash Roll. PP did so and sets up WM but says Cake. A says Bad.
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.
A:RIGHT Bad y You y Squashed y Roll m So m Next m Turn m Is m <Mine m Q m 136BE;213SF,213SG,600SI,
570-6461 84-8SD

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. A says Good. 123BC;906SD,
A:FORWARD Good m I m Moved m Forward m Q m B didn't see A move. 1095SD,636SA

571-6472 PP turned Left but says it moved Forward CQ 106BC;
A:RIGHT I m Turned m Right m Q m A didn't see it. B didn't see A turn. 55SD,1100-2SD

572-6483 PP didn't see A to command. 145BC;921-4SD
PP:RIGHT You. n, Turn. n, Right. m. CQ n, A didn't see it. B didn't see A move.
A:FORWARD I m Moved m Forward m Q m
---eR 569 ---eN 569 ---sN 570 ---sE 570 ---E 571 ---N 571 ---N 572 ---E 572
--#---N PP:F --#--- A:R --#--- PP:R --#--- A:F --#-s- PP:L --#-s- A:R --#-w- PP:R --#-w- A:F
---#- -R-#- -R-#- -R-#- -R-#- -R-#- -R-#- -R-#- -R-#-

573-6493 PP turned but says it moved Forward. 157BA;0SE,
A:LEFT I m Turned m Left m Q m A didn't see it. B didn't see A turn. 356SF,358SG,328SH,
574-6504 53SI,342SJ

PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 146BC;108SK,222SL,
A:FORWARD I m Moved m Forward m Q m A didn't see it. B saw A move. 315-6SH,785SJ

575-6514 PP moved Forward and says so. 41BH,3BI;348SJ,174-5SJ,
A:RIGHT I m Turned m Right m Q m A didn't see it. B saw A turn. 173SH

576-6524 PP moved Forward and says so. 51BH,16BI;171-3SH,
A:FORWARD I m Pushed m Roll o Q m A didn't see it. B saw A Push. 173-5SJ

---E 573 ---N 573 ---N 574 ---W 574 ---W 575 ---W 575 ---W 576 ---W 576
--#w- PP:L --#w- A:L --#s- PP:L --#s- A:F --#--- PP:F --#--- A:R --#--- PP:F --#--- A:F
-R-#- -R-#- -R-#- -R-#- -Rs#- -Rs#- -Rw#- -Rw#-

577-6534 PP moved Forward and says so. 51BH,130BI;449SK,500SJ,
A:FORWARD I m Squeezed m Roll o Q m A didn't see it. B saw A Squeeze. 482SH,452SJ

578-6544 PP turned Right and gave valid command but pointing at A
PP:RIGHT Good. n, You. n, Turn. n, Right. m. CQ n, failed because A behind. 125BH,128BI;7SF,1302SG,
A:RIGHT Next m Turn m Is m Mine m So m You y Turn y Left y CQ m

579-6560 170BC
PP:LEFT Q m

A:FORWARD Next m Turn m Is m Mine m So m Now y You y Wait y CQ m B told to Wait but RM Squashed Roll
580-6572 and PP says so with unblocking and prompt. A says Good.
B:FORWARD (Squashed) I m Squashed m Roll^ m So m Next m Turn m Is m <Yours m Q m Rand=10;720SI,
A:RIGHT Good y You y Squashed y Roll m So m Next m Turn m Is m <Mine m Q m 599-600SI,212SE,217SF,
--W- 577 --W- 577 --W- 578 --N- 578 --N- 579 --W- 579 --W- 580 --W- 580 217SG,604SI,
--#--- PP:F --#--- A:F R#--- PP:R R#--- A:R R#--- PP:L R#--- A:F n#--- B:F n#---R A:R 88SD
Rw-#- Rw-#- w-#- w-#- n-#- n-#- ---#- ---#-

[illegible]

599-6820 B was told to Wait but PP turned Left. A Slaps.
PP:LEFT I. m. Turned. m. Left. m. Q m. PP says it turned Left. A says Good. 88BH;71SK,265SL,
A:SLAP Good y You y Turn y Right y CQ m 61-2SJ,63SH

600-6831 B was told to turn Right and PP did so. A Pats.
PP:RIGHT I. m. Moved. m. Forward. m. Q m. PP says it moved Forward. A says Bad. 27BH,117BI;
A:PAT Bad y Now y You y Wait y CQ m 2675-7SI

597 597 598 598 599 599 600 600
-#--- PP:L -#--- A:S -#--- PP:F -#--- A:P -#--- PP:L -#--- A:S -#--- PP:R -#--- A:P
-N-#- -W-#- -W-#- -W-#- -W-#- -S-#- -S-#- -W-#-
e-R-- e-R-- e-R-- e-R-- e-R-- e-R-- e-R-- e-R--

601-6842 B was told to Wait but RM turned Right. A Slaps.
B:RIGHT I. m. Turned. m. Right m. Q m. PP says it turned Right. A says Good. Rand=8;176SK,
A:SLAP Good y You y Turn y Left y CQ m 266SL,296SK,263-4SL,509SK

602-6853 B was told to turn Left. PP did so and says so.
PP:LEFT I m Turned. m. Left. m. Q m A says Good but was too busy to Pat. 12BH,75BI;1442SF,
A:LEFT Good y Now y You y Wait y CQ m 26SL,62SL

603-6864 B was told to Wait and RM did so. A Pats. PP makes wrong statement. A says Bad.
B:WAIT I. m. Squashed. m. Roll. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m. Rand=4;1372-7SE,
A:PAT Bad y Now y You y Wait y CQ m 1377-82SF,1379-83SG,212SE,217SF,217SG,

604-6880 B was told to Wait and PP did so. 216SE,220SF,219SG
A was too busy to Pat. 457BC
PP:WAIT Q n
A:LEFT Now y You y Wait y CQ m

601 601 602 602 603 603 604 604
-#--- B:R -#--- A:S -#--- PP:L -#--- A:L -#--- B:W -#--- A:P -#--- PP:W -#--- A:L
W-#- -N-#- -N-#- -W-#- -W-#- -W-#- -W-#- -W-#-
e-C-- e-C-- e-C-- e-C-- n-C-- n-C-- n-C-- n-C--

605-6887 B was told to Wait and PP did so. A Pats.
PP:WAIT Q n 417BH
Tchr: A-wants-B-to-face-the-Wall-beside-it-for-Remembering-Numbers-in-cAB-orientation.

A:PAT Now y You y Wait y CQ m
606-6894 B was told to Wait and PP did so. A must Wait to set up imitation sequence so no Pat.
PP:WAIT Q n 543BB
A:WAIT Make y Your y Number y Three y CQ m First imitation sequence.

607-6902 PP must Wait and say nothing to allow 2nd imitation sequence to follow 1st. 417BH
A:WAIT My m Number m Is m <Three m Q m Second imitation sequence.

608-6910 A Pats B for keeping on Waiting. 417BH;509-13SI
PP:WAIT Good. n You. n Turn. n Left. n CQ n A says Bad because PP talked.
A:PAT Bad y Now y You y Wait y CQ m

605 605 606 606 607 607 608 608
-#--- PP:W -#--- A:P -#--- PP:W -#--- A:W -#--- PP:W -#--- A:W -#--- PP:W -#--- A:P
W-#- -W-#- -W-#- -W-#- -W-#- -W-#- -W-#- -W-#-
w-C-- w-C-- w-C-- w-C-- w-C-- w-C-- w-C-- w-C--

609-6922 B was told to Wait and PP did so. A must Wait to set up Question for imitation.
PP:WAIT Q n Quiet is FLT-Quiet which allows a Question to be imitated. 426BD,417BE,424BF
A:WAIT What y Is y Your y Number y Quiet m Now m My m Number m Is m Three m Q m

610-6936 A Pats B for keeping on Waiting. 419BE
PP:WAIT Q n
A:PAT Now y You y Wait y CQ m

611-6943 B was told to Wait and PP did so. A must Wait to set up imitation sequence so no Pat.
PP:WAIT Q n Process repeated for number Two. 458BC
A:WAIT Make y Your y Number y Two y CQ m First imitation sequence.

612-6951 PP must Wait and say nothing to allow 2nd imitation sequence to follow 1st. 418BE
A:WAIT My m Number m Is m <Two m Q m Second imitation sequence.

609 609 610 610 611 611 612 612
-#--- PP:W -#--- A:W -#--- PP:W -#--- A:P -#--- PP:W -#--- A:W -#--- PP:W -#--- A:W
W-#- -W-#- -W-#- -W-#- -W-#- -W-#- -W-#- -W-#-
w-C-- w-C-- w-C-- w-C-- w-C-- w-C-- w-C-- w-C--

613-6959 A Pats B for keeping on Waiting. 419BE
PP:WAIT Q n
A:PAT Now y You y Wait y CQ m

614-6966 B was told to Wait and PP did so. A must Wait to set up Question for imitation.
PP:WAIT Q n Quiet is FLT-Quiet which allows a Question to be imitated. 548BB
A:WAIT What y Is y Your y Number y Quiet m Now m My m Number m Is m Two m Q m

615-6980 A Pats B for keeping on Waiting. 419BE
PP:WAIT Q n
A:PAT Now y You y Wait y CQ m

616-6987 B was told to Wait and PP did so. A must Wait to set up imitation sequence so no Pat.
PP:WAIT Q n Process repeated for number One. 548BB
A:WAIT Make y Your y Number y One y CQ m First imitation sequence.

----- 613 ----- 613 ----- 614 ----- 614 ----- 615 ----- 615 ----- 616 ----- 616
 -#--- PP:W -#--- A:P -#--- PP:W -#--- A:W -#--- PP:W -#--- A:P -#--- PP:W -#--- A:W
 W--#- W--#- W--#- W--#- W--#- W--#- W--#- W--#-
 w-C-- w-C-- w-C-- w-C-- w-C-- w-C-- w-C-- w-C--
 617-6995
 PP:WAIT Q n PP must Wait and say nothing to allow 2nd imitation sequence to follow 1st. 418BE
 A:WAIT My m Number m Is m <One m Q m
 618-7003
 PP:WAIT Q n A Pats B for keeping on Waiting. 419BE
 A:PAT Now y You y Wait y CQ m
 619-7010 B was told to Wait and PP did so. A must Wait to set up Question for imitation.
 PP:WAIT Q n Quiet is FLT-Quiet which allows a Question to be imitated. 548BB
 A:WAIT What y Is y Your y Number y Quiet m Now m My m Number m Is m One m Q m
 620-7024
 PP:WAIT Q n 419BE
 A:RIGHT You y Turn y Right y CQ m
 ----- 617 ----- 617 ----- 618 ----- 618 ----- 619 ----- 619 ----- 620 ----- 620
 -#--- PP:W -#--- A:W -#--- PP:W -#--- A:P -#--- PP:W -#--- A:W -#--- PP:W -#--- A:R
 W--#- W--#- W--#- W--#- W--#- W--#- W--#- W--#-
 w-C-- w-C-- w-C-- w-C-- w-C-- w-C-- w-C-- w-C--
 621-7031 B was told to turn Right but PP turned Left. A Slaps.
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP says it turned Left. A says Good. 60BE;71SK,231SL,
 A:SLAP Good y You y Turn y Left y CQ m 61-2SJ,63SH
 622-7042 B was told to turn Left and PP did so. PP tells A.
 PP:LEFT You. y. Turn. m. Right. y. CQ m A obeys so no Pat. 27BH,38BI;64-7SH,63-6SJ
 A:RIGHT You y Turn y Left y CQ m
 623-7052 B was told to turn Left but PP Waited. A Slaps.
 PP:WAIT Q m. 5BH,36BI
 A:SLAP You y Turn y Left y CQ m
 624-7059 B was told to turn Left and RM turned Right. A Slaps.
 B:RIGHT I. m. Turned. m. Left. m. Q m. PP says it turned Left. A says Bad. Rand=6;2683-5SI
 A:SLAP Bad y You y Turn y Left y CQ m
 ----- 621 ----- 621 ----- 622 ----- 622 ----- 623 ----- 623 ----- 624 ----- 624
 -#--- PP:L -#--- A:S -#--- PP:L -#--- A:R -#--- PP:W -#--- A:S -#--- B:R -#--- A:S
 W--#- S--#- S--#- E--#- E--#- E--#- E--#- S--#-
 n-C-- n-C-- n-C-- n-C-- e-C-- e-C-- e-C-- e-C--
 625-7070 B was told to turn Left but PP turned Right. A Slaps.
 PP:RIGHT I. m Turned. m. Left. m. Q m. PP says it turned Left. A says Bad. 414BE;1445SE,1442SF,
 A:SLAP Bad y You y Turn y Right y CQ m 1449SG,1616-7SC
 626-7081 B was told to turn Right. PP did so with unblocking and says so.
 PPu:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 413BH;2692-4SI,1165-6SJ,1183SH
 A:PAT Good y You y Move y Forward y CQ m
 627-7092 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 250BC;997SC,449SD,1020-1SB
 A:PAT Good y You y Move y Forward y CQ m
 628-7103 B was told to move Forward. PP did so and says so.
 PP:FORWARD I m Moved. m. Forward. m. Q m. A Pats and says Good. 251BC;106SB,107SC,471SD,
 A:PAT Good y You y Turn y Right y CQ m 120SC,496SD
 ----- 625 ----- 625 ----- 626 ----- 626 ----- 627 ----- 627 ----- 628 N---- 628
 -#--- PP:R -#--- A:S -#--- PP:R -#--- A:P -#--- PP:F N#--- A:P N#--- PP:F -#--- A:P
 S--#- W--#- W--#- N--#- N--#- ---#- ---#- ---#-
 e-C-- e-C-- e-C-- e-C-- e-C-- e-C-- e-C-- e-C--
 629-7114 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m Turned. m Right. m Q m. A Pats and says Good. 94BB;106SH,116-7SJ,118SH,
 A:PAT Good y You y Move y Forward y CQ m 597SH,617SJ
 630-7125 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 242BG,12BH,32BI;593SH,613SJ,
 A:PAT Good y You y Move y Forward y CQ m 598-9SH,618-9SJ
 631-7136 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was out-of-reach to Pat. 31BH,32BI;
 A:FORWARD Good y You y Move y Forward y CQ m 167-9SB
 632-7147 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was out-of-reach to Pat. 96BG,0BH,
 A:FORWARD Good y You y Move y Forward y CQ m 32BI;454-6SD
 N---- 629 E---- 629 E---- 630 -E--- 630 -E--- 631 --E-- 631 --E-- 632 ---E- 632
 -#--- PP:R -#--- A:P -#--- PP:F -#--- A:P -#--- PP:F -#--- A:F -#--- PP:F -#--- A:F
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 e-C-- e-C-- e-C-- e-C-- e-C-- e-C-- e-C-- e-C--
 633-7158 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was out-of-reach to Pat. 106BB;
 A:WAIT Good y You y Turn y Right y CQ m 170-2SB

634-7169 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. y. Q m. A says Good but was out-of-reach to Pat. 94BA,94BB;
A:WAIT Good y You y Move y Forward y CQ m 1431-3SA,173SB,1273-4SB

635-7180 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 444BA,433BB;
A:FORWARD Good y Next m Turn m Is m Mine m So m You y Move y Forward y CQ m 1434-6SA,1275SB,130-1SB

636-7196 B was told to move Forward. PP did so and tells A to Squash Cake. A says Good.
PP:FORWARD Bad. y. Next. m. Turn. m. Is. m. Yours. m. So. m. You. y. Squash. y. Cake. o. CQ m. 292BA,
A:FORWARD (Squashed) Good y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m 108BB;624SD,
---E- 633 ---E 633 ---E 634 ---S 634 ---S 635 ---S 635 ---S 636 ---S 636 742-50SD
---#--- PP:F ---#--- A:W ---#--- PP:R ---#--- A:W ---#--- PP:F ---#---S A:F ---#---S PP:F ---#--- A:F
---#--- ---#--- ---#--- ---#--- ---#--- ---#--- ---#--- ---#---
---eC- ---eC- ---eC- ---eC- ---eC- ---eC- ---eC- ---eC-

637-7218 PP turns Right away from the Wall and sets up WM with <Mine. A Pats and says Good.
PP:RIGHT You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 239BD;687SE,
A:PAT Good y You y Turn y Right y CQ m 699SF,698SG,603SH,1439SI,623SJ,1773-5SD,730-1SC,758SB

638-7234 B was told to turn Right. RM did so. A Pats.
B:RIGHT I. m. Moved. m. Forward. m. Q m. PP says it moved Forward. A says Bad. Rand=3;2277-9SI
A:PAT Bad y You y Move y Forward y CQ m

639-7245 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 384BC;647-9SD,
A:LEFT Good y You y Move y Forward y CQ m 185-6SC

640-7256 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 385BC;266-8SA,
A:FORWARD Good y You y Turn y Right y CQ m 265-7SB

641-7267 B was told to turn Right. PP did so and says so.
PP:RIGHT I m. Turned. m. Right. m. Q m. A says Good. 94BB;77-8SL,556SK,712SK,189SL
A:FORWARD Good y Now y You y Wait y CQ m

642-7278 B was told to Wait and PP did so. A Pats.
PP:WAIT My. m. Number. m. Is. m. <Three. m. CQ m. PP sets WM to Three unasked. 145BI;1343SK,
A:PAT Bad y Now y You y Wait y CQ m A says Bad. 1348SK,1346-7SK,3357SD

643-7290 B was told to Wait and PP did so. A was too busy to Pat.
PP:WAIT Good. n I. m. Q n Unwanted talk by PP. A says Bad. 445BD,428BE,444BF;775-6SI
A:RIGHT Bad y Now y You y Wait y CQ m

644-7300 B was told to Wait and PP did so. A Pats.
PP:WAIT Bad. n Now. m. You. n Wait. n CQ n More Unwanted talk by PP. A says Bad. 420BH,150BI;
Tchr: Remembering-Numbers-in-cBA-orientation. 2709-13SI
A:PAT Bad y Now y You y Wait y CQ m

645-7312 B was told to Wait and PP did so. A surprised by PP's response.
PP:WAIT What. y. Is. y. Your. y. Number. y. Q?. m. 446BD,429BE,445BF;1343SK,1353SK,1349SK,3370-1SD
A: Now m My m Number m Is m Two m Q m A replies obediently!
A:WAIT What y Is y Your y Number y Q? m B was asked for its number and replies correctly.
PP: Now. m. My. m. Number. m. Is. m. Three. m. Q m Correct because set up on step 642. 3372-6SD
A: Good A approves.

646-7336 PP Waits and A Pats to keep it Waiting.
PP:WAIT Now. m. My. m. Number. m. Is. m. Three. m. Q m. Unasked. A says Bad. 420BH;1343SK,1354SK,
A:PAT Bad y Now y You y Wait y CQ m 1245SH,3375-6SD

647-7349 B was told to Wait and PP did so. A Pats.
PP:WAIT What. y. Is. y. Your. y. Number. y. Q?. m. PP keeps talking. A says Bad. 446BD,429BE,445BF;
A: Bad y Q n 3457SD,1691SC,3481SD,1748-50SB,1939-40SA
A:PAT Now y You y Wait y CQ m

648-7362 B was told to Wait and PP did so. A Pats.
PP:WAIT Make. y. Your. y. Q n PP starts to talk. A says Bad. 446BD,429BE,445BF;
A:PAT Bad y Now y You y Wait y CQ m 1343-4SK
---E 645 ---E 645 ---E 646 ---E 647 ---E 647 ---E 648 ---E 648
---e PP:W ---e A:W ---e PP:W ---e A:P ---e PP:W ---e A:P ---e PP:W ---e A:P
---#--- ---#--- ---#--- ---#--- ---#--- ---#--- ---#--- ---#---
---C--- ---C--- ---C--- ---C--- ---C--- ---C--- ---C--- ---C---

649-7372 B was told to Wait and PP did so without talking.
PP:WAIT Q y. A shows B with FLT-Quiet how to answer a question. 572BB
A:WAIT What y Is y Your y Number y Quiet m Now m My m Number m Is m Three m Q m

650-7386 PP Waited and sets up WM in wrong place. A says bad.
PP:WAIT You. n Squashed. n Cake. n So. n Next. m. Turn. m. Is. m. <Mine. m. Q m. 420BH;501-3SI,171SE,

A:WAIT Bad y Now y You y Wait y CQ m 179-82SC
651-7402 B was told to Wait and PP did so. A Pats.
PP:WAIT I. n Turned. m. Right. m. Q y. PP says it turned Right. A says Bad. 575BB;266SL,263-4SL
A:PAT Bad y Now y You y Wait y CQ m
652-7413 B was told to Wait and PP did so without talking.
PP:WAIT Q y. 420BH
A:WAIT Make y Your y Number y One y CQ m
---E 649 ---E 649 ---E 650 ---E 650 ---E 651 ---E 651 ---E 652 ---E 652
-#-e PP:W -#-e A:W -#-e PP:W -#-e A:W -#-e PP:W -#-e A:P -#-e PP:W -#-e A:W
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
-C--- -C--- -C--- -C--- -C--- -C--- -C--- -C---
653-7421
PP:WAIT Q n Because PP is quiet, this response of A is in the context of its previous response. 420BH
A:WAIT My m Number m Is m <One m Q m
654-7429 PP Waited. A Pats to keep it Waiting.
PP:WAIT Now. n You. y. Wait. n Q n PP tells. A says Bad. 420BH,157BI;501-2SI,2702SI
A:PAT Bad y Now y You y Wait y CQ m
655-7440 B was told to Wait and PP did so without talking. A Pats.
PP:WAIT Q y. 572BB
A:PAT Now y You y Wait y CQ m
656-7447 B was told to Wait and PP did so without talking.
PP:WAIT Q y. A needs to Wait for imitation. 488BC
A:WAIT Make y Your y Number y Two y CQ m
---E 653 ---E 653 ---E 654 ---E 654 ---E 655 ---E 655 ---E 656 ---E 656
-#-e PP:W -#-e A:W -#-e PP:W -#-e A:P -#-e PP:W -#-e A:P -#-e PP:W -#-e A:W
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
-C--- -C--- -C--- -C--- -C--- -C--- -C--- -C---
657-7455
PP:WAIT Q n Because PP is quiet, this response of A is in the context of its previous response. 433BE
A:WAIT My m Number m Is m <Two m Q m
658-7463
PP:WAIT Q n A shows B with FLT-Quiet how to answer a question. 434BE
A:WAIT What y Is y Your y Number y Quiet m Now m My m Number m Is m Two m Q m
659-7477
PP:WAIT Q n PP Waited and A Pats to keep it Waiting. 434BE
A:PAT Now y You y Wait y CQ m
660-7484 B was told to Wait and PP did so without talking.
PP:WAIT Q y. A needs to Wait for imitation. 482BC
A:WAIT Make y Your y Number y Three y CQ m
---E 657 ---E 657 ---E 658 ---E 658 ---E 659 ---E 659 ---E 660 ---E 660
-#-e PP:W -#-e A:W -#-e PP:W -#-e A:W -#-e PP:W -#-e A:P -#-e PP:W -#-e A:W
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
-C--- -C--- -C--- -C--- -C--- -C--- -C--- -C---
661-7492
PP:WAIT Q n Because PP is quiet, this response of A is in the context of its previous response. 433BE
A:WAIT My m Number m Is m <Three m Q m
662-7500
PP:WAIT Q n A shows B with FLT-Quiet how to answer a question. 434BE
A:WAIT What y Is y Your y Number y Quiet m Now m My m Number m Is m One m Q m
663-7514
PP:WAIT Q n 434BE
A:WAIT What y Is y Your y Number y Q? m B was asked for its number.
PP: Now. m My. m. Number. m. Is. m. Three. m. Q m. PP answers correctly but 3372-3SD,1696SC,
A: Good not by reading WM properly. A says Good. 1753-5SB,1944-5SA
664-7528
PP:WAIT Q n 586BA,574BB
A:WAIT Make y Your y Number y One y CQ m
---E 661 ---E 661 ---E 662 ---E 662 ---E 663 ---E 663 ---E 664 ---E 664
-#-e PP:W -#-e A:W -#-e PP:W -#-e A:W -#-e PP:W -#-e A:W -#-e PP:W -#-e A:W
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
-C--- -C--- -C--- -C--- -C--- -C--- -C--- -C---
665-7536 B was told to Make Its Number One. PP does so with <One but CQ wrong.
PP:WAIT My m. Number m. Is m <One. m. CQ m. A Pats and says Good. 420BH,156BI;
A:PAT Good y Now y You y Wait y CQ m 1343SK,1208-9SJ,3357SD,1356SK
666-7548 B was told to Wait and PP did so without talking.
PP:WAIT Q m. A was too busy to Pat. 446BD,429BE,445BF
A:WAIT What y Is y Your y Number y Q? m B was asked for its number. PP answers with prompt.
PP: Now. m. My. m. Number. m. Is. m. One^ m. CQ m. Correct except for CQ. 3372-3SD,1696SC,
A: Bad A says Bad to stop CQ. 1753-5SB,1944-5SA,1529SE
667-7563
PP:WAIT My. m Number m Is. m One m Q m PP Waits and A Pats. 457BD,430BE;1343SK,1348SK,1533SG,

A:PAT Bad y Now y You y Wait y CQ m Unasked and Now omitted but no CQ. A says Bad. 1247SH
668-7575 B was told to Wait and PP did so without talking.
PP:WAIT Q n A was too busy to Pat. 575BB
A:WAIT Make y Your y Number y Two y CQ m
---E 665 ---E 665 ---E 666 ---E 666 ---E 667 ---E 667 ---E 668 ---E 668
-#-e PP:W -#-e A:P -#-e PP:W -#-e A:W -#-e PP:W -#-e A:P -#-e PP:W -#-e A:W
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
-C--- -C--- -C--- -C--- -C--- -C--- -C--- -C---
669-7583 B was told to Make Its Number Two. PP does so with <Two^ and no CQ.
PP:WAIT My. m. Number. m. Is. m. <Two^ m. Q m A Pats and says Good. 435BE;1530SF,1532SG,1266SH,
A:PAT Good y Now y You y Wait y CQ m 2789SI,1209SJ,3357SD
670-7595 B was told to Wait and PP did so without talking.
PP:WAIT Q n 485BC
A:WAIT What y Is y Your y Number y Q? m B was asked for its number. PP answers with unblocking
PP: Now m. My m Number m Is m Two^ m. Q m. and prompt. A says Good. 1978-80SA,1944-5SA
A: Good
671-7609
PP:WAIT Q n PP Waits and A Pats to keep it Waiting. 454BD,430BE
A:PAT Now y You y Wait y CQ m
672-7616 B was told to Wait and PP did so without talking.
PP:WAIT Q m. 482BC
A:WAIT Make y Your y Number y Three y CQ m
---E 669 ---E 669 ---E 670 ---E 670 ---E 671 ---E 671 ---E 672 ---E 672
-#-e PP:W -#-e A:P -#-e PP:W -#-e A:W -#-e PP:W -#-e A:P -#-e PP:W -#-e A:W
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
-C--- -C--- -C--- -C--- -C--- -C--- -C--- -C---
673-7624 B was told to Make Its Number Two. PP does so luckily with <Three.
PP:WAIT My. m. Number. m. Is. m. <Three m Q m A Pats and says Good. 435BE;1530SF,1532SG,1266SH,
A:PAT Good y You y Turn y Left y CQ m 2789SI,1209SJ,3357SD
674-7636 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left m Q m. A Pats and says Good. 103BC;206-7SD,26SC,1338SE
A:PAT Good y You y Turn y Left y CQ m
675-7647 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but was too busy to Pat. 43BC;63SL,26SL,62SL
A:RIGHT Good m I m Turned m Right m Q m B saw A turn.
676-7658
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 104BI;369-71SK,
A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A move. 199SL,11-2SL
---E 673 ---E 673 ---E 674 ---N 674 ---W 675 ---W 676 ---W 676
-#-e PP:W -#-e A:P -#-e PP:L -#-e A:P -#-e PP:L -#-e A:R -#-s PP:F -#-s A:F
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
-C--- -C--- -C--- -C--- -C--- -C--- -C--- -C---
677-7668
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 51BH,3BI;1111-2SH,348SJ,
A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A move. 174-5SJ,173SH
678-7678
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 324BG,51BH,3BI;771SJ,
A:RIGHT I m Turned m Right m Q m A didn't see it. B didn't see A turn. 500SJ,482SH,452SJ
679-7688
PP:FORWARD I. m. Moved m. Forward n, Q m. PP moved Forward and says so. 125BH,16BI;142SE,183SF,
A:FORWARD Good y You y Turn y Left y CQ m A says Good but was too busy to Pat. 183SG,176SH
680-7699 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but was too busy to Pat. 147BB;27SH,25SJ,
A:FORWARD Good y You y Move y Forward y CQ m 315-6SH,328-9SJ
---W- 677 ---W- 677 ---W- 678 ---W- 678 ---W- 679 ---W- 679 ---W- 680 ---S- 680
-#-s PP:F -#-s A:F -#-s PP:F -#-s A:R -#-s PP:F -#-s A:F -#-s PP:L -#-s A:F
---#s ---#s ---#s ---#s ---#s ---#s ---#s ---#s
-C--- -C--- -C--s -C--s -C--w -C--w -C-w -C-w-
681-7710 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but needs to Wait for imitation. 395BB;
A:WAIT Good y Next m Turn m Is m Yours m So m You y Move y Forward y CQ m 1133-5SB
682-7726 B was told to move Forward and PP did so. A was too busy to Pat. PP tells to Push Roll!!
PP:FORWARD Good. y. Next. m. Turn. m. Is. m. Mine. y. So. m. You. y. Push. y. Roll. o. CQ m. 125BH,
A:FORWARD Bad y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 46BI;1244-52SD,3258SD
683-7748 A says Bad. B was told to Squash Cake. PP did so and says so. A says Good.
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m So. m. Next. m. Turn. m. Is. m. <Yours. m Q m 276BB;
A:RIGHT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 224-31SB,629-35SA
684-7769
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. A says Good. 131BA,132BB;
A:LEFT Good y You y Turn y Right y CQ m 296SA,288SB,395SA,382SB,636SA,594SB
S---- 681 ----- 681 ----- 682 ----- 682 ----- 683 ----- 683 ----- 684 ----- 684

-#--- PP:F S#--- A:W S#--- PP:F -#--- A:F -#--- PP:F -#---C A:R -#---C PP:R -#---C A:L
 ---#- ---#- ---#- S--#- S--#- ---#- ---#- ---#-
 -Cw-- -Cw-- -Cw-- -Cw-- Cw--- Sw--- Sn--- Wn---
 685-7780 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 246BA,244BB;77-8SL,189SL
 A:PAT Good y You y Move y Forward y CQ m
 686-7791 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 137BH,32BI;
 A:FORWARD Good y You y Turn y Left y CQ m 491-3SH,512-3SJ
 687-7802 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 0BH,75BI;3320-2SD
Tchr: Remembering-Numbers-in-cAB-orientation.
 A:PAT Good y Now y You y Wait y CQ m
 688-7813 B was told to Wait and PP does without talking.
 PP:WAIT Q m. 426BD,417BE,424BF
 A:WAIT What y Is y Your y Number y Q? m B was asked for its Number and says Three using WM.
 PP: Now. m. My. m. Number. m. Is. m. Three. m. CQ m. A overlooks the CQ and says Good. 3512-6SD,
 A: Good 1411SK
 ----- 685 ----- 686 ----- 686 ----- 687 ----- 687 ----- 688 ----- 688
 -#---C PP:R -#---C A:P -#---C PP:F -#---C A:F -#---C PP:L -#---C A:P -#---C PP:W -#---C A:W
 ---#- ---#- ---#- N--#- N--#- W--#- W--#- W--#-
 Ww--- Nw--- Nw--- -w--- w--- w--- w--- w---
 689-7827 PP Waited and A Pats to keep it Waiting. PP repeats with CQ. A says Bad.
 PP:WAIT Bad. y. Now. m. My. m. Number. m. Is. m. Three. m. CQ m. 429BD;2790SI,1404SK,1397-8SK,
 A:PAT Bad y Now y You y Wait y CQ m 1311SH,3516SD,3679SD
 690-7841 B was told to Wait. PP did so. A Pats.
 PP:WAIT Bad. m. Now. y. You. y. Wait. y. CQ m. PP tells A to Wait. A says Bad. 426BD,417BE,424BF;
 A:PAT Bad y Now y You y Wait y CQ m 2780-3SI,3529SD
 691-7853 B was told to Wait. PP did so. A Pats.
 PP:WAIT Good. n Q n PP speaks. A says Bad. 608BB;2780SI
 A:PAT Bad y Now y You y Wait y CQ m
 692-7862 B was told to Wait and PP does without talking.
 PP:WAIT Q y. 458BC
 A:WAIT Make y Your y Number y One y CQ m
 ----- 689 ----- 689 ----- 690 ----- 690 ----- 691 ----- 691 ----- 692 ----- 692
 -#---C PP:W -#---C A:P -#---C PP:W -#---C A:P -#---C PP:W -#---C A:P -#---C PP:W -#---C A:W
 W--#- W--#- W--#- W--#- W--#- W--#- W--#- W--#-
 w---- w---- w---- w---- w---- w---- w---- w----
 693-7870 PP Waits and A Pats to keep it Waiting.
 PP:WAIT I. n Turned. n Left. m. Q m. B was told to Make its Number One 417BH,164BI;
 A:PAT Bad y Now y You y Wait y CQ m but PP says nonsense. A says Bad. 2882-4SI
 694-7881 B was told to Wait. PP did so. A Pats.
 PP:WAIT Now. n Q y. PP says Now. A says Bad. 510BC;1326SK
 A:PAT Bad y Now y You y Wait y CQ m
 695-7890 B was told to Wait. PP did so. A Pats.
 PP:WAIT What. y. Is. y. <Two. m. CQ n PP says nonsense. A says Bad. 417BH,163BI;1326SK,
 A:PAT Bad y Now y You y Wait y CQ m 1393SK,1333SK,1410SK
 696-7901 B was told to Wait. PP did so. A Pats.
 PP:WAIT Make. y. Q n PP says nonsense. A says Bad. 546BB;1326SK
 A:PAT Bad y Now y You y Wait y CQ m
 ----- 693 ----- 693 ----- 694 ----- 694 ----- 695 ----- 695 ----- 696 ----- 696
 -#---C PP:W -#---C A:P -#---C PP:W -#---C A:P -#---C PP:W -#---C A:P -#---C PP:W -#---C A:P
 W--#- W--#- W--#- W--#- W--#- W--#- W--#- W--#-
 w---- w---- w---- w---- w---- w---- w---- w----
 697-7910 B was told to Wait. PP did so. A Pats.
 PP:WAIT My. n Q n PP says nonsense. A says Bad. 609BB;1326SK,334SI
 A:PAT Bad y Now y You y Wait y CQ m
 698-7919 B was told to Wait and PP does without talking.
 PP:WAIT Q y. 609BB
 A:WAIT Make y Your y Number y Two y CQ m
 699-7927 B was told to make its number Two but PP makes it <Three. A says Bad.
 PP:WAIT My m Number m Is m. <Three. m. Q m PP Waits and A Pats. 444BE;2882SI,1398SK,1395SK,
 A:PAT Bad y Now y You y Wait y CQ m 3542SD
 700-7939 B was told to Wait and PP does without talking.
 PP:WAIT Q m. 611BB
 A:WAIT What y Is y Your y Number y Q? m B is asked for its number. PP says Three without prompt.
 PP: Now. m. My. m. Number. m. Is. m. Three. m. CQ m. A overlooks CQ and says Good. 2038-43SA,
 A: Good 1842-7SB
 ----- 697 ----- 697 ----- 698 ----- 698 ----- 699 ----- 699 ----- 700 ----- 700
 -#---C PP:W -#---C A:P -#---C PP:W -#---C A:W -#---C PP:W -#---C A:P -#---C PP:W -#---C A:W
 W--#- W--#- W--#- W--#- W--#- W--#- W--#- W--#-

W---- W---- W---- W---- W---- W---- W---- W----
 701-7953 B was told to Wait. PP did so. A Pats.
 PP:WAIT Now. n Q n PP says nonsense. A says Bad. 626BA;2790SI
 A:PAT Bad y Now y You y Wait y CQ m
 702-7962 B was told to Wait and PP does without talking.
 PP:WAIT Q m. 609BB
 A:WAIT Make y Your y Number y Two y CQ m
 703-7970 B was told to make its number Two but PP makes it <One and uses CQ. A says Bad.
 PP:WAIT My m. Number m. Is m <One. m. CQ m. PP Waits and A Pats. 555BA;1328SH,2068-9SA,
 A:PAT Bad y Now y You y Wait y CQ m 3542SD,1581SE
 704-7982 B was told to Wait and PP does without talking.
 PP:WAIT Q m. 608BB
 A:WAIT What y Is y Your y Number y Q? m B is asked for its number. PP says One^ with prompt.
 PP: Now. m. My. m. Number. m. Is. m. One^ m. Q m. A says Good. 2038-42SA,1842-6SB
 A: Good
 ----- 701 ----- 701 ----- 702 ----- 702 ----- 703 ----- 703 ----- 704 ----- 704
 -#--C PP:W -#--C A:P -#--C PP:W -#--C A:W -#--C PP:W -#--C A:P -#--C PP:W -#--C A:W
 W--#- W--#- W--#- W--#- W--#- W--#- W--#- W--#-
 w---- w---- w---- w---- w---- w---- w---- w----
 705-7996 PP Waits and A Pats. 435BD,443BE;2795SI
 PP:WAIT What. n Q n PP says nonsense. A says Bad.
 A:PAT Bad y Now y You y Wait y CQ m B was told to Wait and PP does without talking.
 706-8005 609BB
 PP:WAIT Q m.
 A:WAIT Make y Your y Number y Two y CQ m
 707-8013 B was asked to Make its Number Two and PP did so.
 PP:WAIT My m Number m Is m <Two. m. Q m. A Pats and says Good. 555BA,615BB;2071SA,2068-9SA,3542SD
 A:PAT Good y Now y You y Wait y CQ m
 708-8025 B was told to Wait and PP does without talking.
 PP:WAIT Q m. 510BC
 A:WAIT What y Is y Your y Number y Q? m B is asked for its number. PP says Two^ with prompt.
 PP: Now. m. My. m. Number. m. Is. m. Two^ m. Q m. A says Good. 2038-42SA,1842-6SB
 A: Good
 ----- 705 ----- 705 ----- 706 ----- 706 ----- 707 ----- 707 ----- 708 ----- 708
 -#--C PP:W -#--C A:P -#--C PP:W -#--C A:W -#--C PP:W -#--C A:P -#--C PP:W -#--C A:W
 W--#- W--#- W--#- W--#- W--#- W--#- W--#- W--#-
 w---- w---- w---- w---- w---- w---- w---- w----
 709-8039 PP Waits and A Pats. 432BD,443BE;3488-9SD,1333SK
 PP:WAIT What. y. Is. n <Two. m. Q n PP says nonsense. A says Bad.
 A:PAT Bad y Now y You y Wait y CQ m B was told to Wait and PP does without talking.
 710-8050 609BB
 PP:WAIT Q m.
 A:WAIT Make y Your y Number y One y CQ m
 711-8058 B was asked to Make its Number One and PP did so.
 PP:WAIT My. m. Number. m. Is. m. <One m Q m A Pats and says Good. 560BA;1605SF,1604SG,1330SH,
 A:PAT Good y Now y You y Wait y CQ m 2899SI,1311SJ,3542SD
 712-8070 B was told to Wait and PP does without talking.
 PP:WAIT Q m. 617BB
 A:WAIT What y Is y Your y Number y Q? m B is asked for its number. PP says One. A says Good.
 PP: Now. m. My. m. Number. m. Is. m. One. m. Q m. 2038-42SA,1842-6SB
 A: Good
 ----- 709 ----- 709 ----- 710 ----- 710 ----- 711 ----- 711 ----- 712 ----- 712
 -#--C PP:W -#--C A:P -#--C PP:W -#--C A:W -#--C PP:W -#--C A:P -#--C PP:W -#--C A:W
 W--#- W--#- W--#- W--#- W--#- W--#- W--#- W--#-
 w---- w---- w---- w---- w---- w---- w---- w----
 713-8084 PP Waits and A Pats. 640BA,616BB
 PP:WAIT Q n
 A:PAT Now y You y Wait y CQ m
 714-8091 B was told to Wait and PP does without talking.
 PP:WAIT Q m. 458BC
 A:WAIT Make y Your y Number y Three y CQ m
 715-8099 B was asked to Make its Number Three and PP did so.
 PP:WAIT My. m. Number. m. Is. m. <Three m Q n A Pats and says Good. 550BA;1605SF,1604SG,2330SH,
 A:PAT Good y Now y You y Wait y CQ m 2899SI,1311SJ,3542SD
 716-8111 B was told to Wait and PP does without talking.
 PP:WAIT Q m. 620BB
 A:WAIT What y Is y Your y Number y Q? m B is asked for its number. PP says Three. A says Good.
 PP: Now. m. My. m. Number. m. Is. m. Three. m. CQ m. 2038-42SA,1842-6SB
 A: Good
 ----- 713 ----- 713 ----- 714 ----- 714 ----- 715 ----- 715 ----- 716 ----- 716
 -#--C PP:W -#--C A:P -#--C PP:W -#--C A:W -#--C PP:W -#--C A:P -#--C PP:W -#--C A:W

W--#- W--#- W--#- W--#- W--#- W--#- W--#- W--#-
w---- w---- w---- w---- w---- w---- w---- w----
717-8125 PP began to talk nonsense. A says Bad. 626BA,614BB;348SL
PP:WAIT My. m. Q m
Tchr: Talking-about-Touching
A:RIGHT Bad y I m Turned m Right m Q m B saw A turn.
718-8134 PP reads Three from WM properly but then uses CQ. A says Bad.
PP:WAIT Now. m. My. m Number. m. Is. m. Three. m. CQ m. 417BH;1326SK,1397-8SK,1311SH,3516SD,3679SD
A:RIGHT Bad y You y Turn y Right y CQ m
719-8147 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but was too busy to Pat. 440BD,422BE,438BF;
A:FORWARD Good m I m Moved m Forward m Q m B didn't see A move. 1208-9SH,2880SI,1165-6SJ,1183SH
720-8158 A couldn't see B move but could see Cake. CQ is wrong.
PP:FORWARD I. n, Squeezed. n, Cake. n, CQ m. A says Bad. 12BH,20BI;77SK,109SL,137-9SJ
A:FORWARD Bad m I m Moved m Forward m Q m B didn't see A move.
----- 717 ----- 717 ----- 718 ----- 718 ----- 719 ----- 719 ----- 720 ----- 720
-#--C PP:W -#--C A:R -#--C PP:W -#--C A:R -#--C PP:R -#--C A:F -#--C PP:F N#--C A:F
W--#- W--#- W--#- W--#- W--#- N--#- N--#- N--#-
w---- w---- n---- n---- e---- e---- e---- e----
721-8169 PP moved Forward and says so. A didn't see it.
PP:FORWARD Bad. n, I. m. Moved. m. Forward. m. CQ m. 31BH,48BI;0SE,274SF,273SG,270SE,356SF,1363-4SG,
A:FORWARD I m Moved m Forward m Q m 18SE,1362-3SF,358SG,1357SE,353SE,359SF,360SG
722-8180 B didn't see A move.
PP:LEFT Bad. n, I. m. Moved. m. Forward. m. CQ m. PP turned Left but says it moved Forward. 144BC;
A:LEFT I m Turned m Left m Q m A didn't see it. B didn't see A turn.913SD,1836-7SC,
723-8191 3115-6SD,1736SA
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. A says Good. 519BA;
A:WAIT Good y Look j I j Am j Touching j Black j Stump j Q m 1110SH,1094-5SJ,315-6SH,785SJ
724-8205
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 41BH;449SK,500SJ,
A:LEFT Good y I m Turned m Left m Q m A says Good. B saw A turn. 482SH,452SJ
----- 721 N----- 721 N----- 722 W----- 722 W----- 723 S----- 723 S----- 724 ----- 724
N#--C PP:F -#--C A:F -#--C PP:L -#--C A:L -#--C PP:L -#--C A:W -#--C PP:F S#--C A:L
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
--e-- --e-- --e-- --e-- ---n- ---n- ---n- ---n-
725-8216
PP:FORWARD I m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 125BH,53BI;369SK
A:FORWARD Good y I m Moved m Forward m Q m A says Good. B saw A move. 106SL,454-5SJ,435SH,
726-8227
PP:FORWARD I m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 51BH,20BI;137SK,109SL,
A:RIGHT Good y I m Turned m Right m Q m A says Good. B saw A turn. 171SJ,771SH,782SJ
727-8238
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. A says Good. 54BH,94BI;
A:FORWARD Good m I m Moved m Forward m Q m B saw A move. 108SK,199SL,784-5SJ,774SH
728-8249
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 41BH,20BI;1111-2SH,
A:RIGHT Look j I j Am j Touching j Black j Stump j Stump j Q m A didn't see it. 348SJ,174-5SJ
----- 725 ----- 725 ----- 726 ----- 726 ----- 727 ----- 727 ----- 728 ----- 728
S#--C PP:F -#--C A:F -#--C PP:F -#--C A:R -#--C PP:L -#--C A:F -#--C PP:F -#--C A:R
---#- S--#- S--#- ---#- ---#- ---#- ---#- ---n#- ---n#-
---w- ---w- --w-- S-w-- S-n-- E-n-- E---- E---
729-8262
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 51BH,175BI;569-71SK,
A:LEFT I m Turned m Left m Q m A didn't see it. B saw A turn. 410-2SL
730-8272
PP:FORWARD Q m. 21BI
A:FORWARD I m Moved m Forward m Q m B didn't see A move.
731-8279
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 52BH,3BI;1923-4SI,
A:RIGHT I m Turned m Right m Q m A didn't see it. B didn't see A turn. 261SG
732-8289
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 54BH,19BI;1357-8SH,
A:FORWARD Good y I m Moved m Forward m Q m A says Good. B saw A move. 1338SJ,784-5SJ,774SH
----- 729 ----- 729 ----- 730 ----- 730 ----- 731 ----- 731 ----- 732 ----- 732
-#--C PP:F -#--C A:L -#--C PP:F -#--C A:F -#n-C PP:F -#n-C A:R -#e-C PP:L -#e-C A:F
--e#- --e#- --n#- --n#- ---#- ---#- ---#- ---#-
-E--- -E--- -E--- -E--- ---E- ---E- ---E- ---E-
733-8300
PP:FORWARD I. m. Moved. m. Forward. m. CQ m. PP moved Forward and says so with CQ. 41BH,20BI;
A:RIGHT Look j I j Am j Touching j Black j Stump j Q m 229-31SK,109SL,1SL,155SL,803SK
734-8313

PP:FORWARD Q n 96BH
A:LEFT I m Turned m Left m Q m B saw A turn.
735-8320
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP Pushed Cake but says it moved Forward. 199BG,204BH,
A:FORWARD Bad y I m Moved m Forward m Q m A says Bad. B didn't see A move. 87BI;198SF,198SG,562SI
736-8331
PP:LEFT Bad. n I. m. Moved. n Forward. n CQ m. PP turned Left but says it moved Forward. 118BC;
A:RIGHT Bad m I m Turned m Right m Q m A says Bad. B saw A turn. 150-4SL
----- 733 ----- 733 ----- 734 -----C 734 -----C 735 ---CN 735 ---CN 736 ---CW 736
-#-eC PP:F -#-eC A:R -#-sC PP:F -#-sN A:L -#-eN PP:F -#-e- A:F -#-e- PP:L -#-e- A:R
---#- ---#N ---#N ---#- ---#- ---#- ---#- ---#-
---N -----
737-8343
B:FORWARD Next. m. Turn. m. Is. m. Yours. m. Q m. RM Pushed Cake. PP talks. Rand=12;309-12SK,
A:FORWARD I m Moved m Forward m Q m B didn't see A move. 128SL
738-8354
PP:FORWARD Next. m. Turn. m. Is. m. Mine. m. So. m. Q m. PP Pushed Cake and talks. 262BG,67BH,31BI;
A:RIGHT You y Turn y Left y CQ m 707-9SD,208SB,787SK
739-8366 B was told to turn Left but PP Pushed Cake. A is out-of-reach to Pat.
PP:FORWARD I m. Pushed m. Cake o. Q m. PP says it Pushed Cake. A says Good. 67BH;1331-2SI,580SH
A:WAIT Good y You y Turn y Left y CQ m
740-8377 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good. 69BH,91BI;63SL,26SL,62SL
A:WAIT Good y What y Are y You y Touching i Q? i
PP: Q n, A:- PP fails to answer.
---CW 737 ---CW- 737 ---CW- 738 -CW-- 738 -CW-- 739 CW--- 739 CW--- 740 CS--- 740
-#-s B:F -#-s A:F -#-s PP:F -#-s A:R -#-s PP:F -#-s A:W -#-s PP:L -#-s A:W
---#- ---#- ---#s ---#s ---#w ---#w ---#w ---#w

741-8390
B:LEFT I. m. Turned. m. Left. m. Q m. RM turned Left and PP says so. Rand=1,588-90SK
A:WAIT Good y Look j I j Am j Touching j Black j Stump j Q m A says Good.
742-8404
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 175BH,175BI;80SK,410SL
A:WAIT Look j I j Am j Touching j Black j Stump j Q m A doesn't say Good. 700-1SJ,687SH
743-8417
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 0BH,175BI;374-5SK,
A:RIGHT Good y I m Turned m Right m Q m A says Good. B saw A turn. 410-1SL,1062SJ
744-8428
PP:FORWARD I. m Moved. m. Forward. m. Q m. PP moved Forward and says so. 178BH,104BI;
A:FORWARD Good y I m Moved m Forward m Q m A says Good. B saw A move. 870-2SK,199SL,11-2SL
CS--- 741 CE--- 741 CE--- 742 C-E-- 742 C-E-- 743 C-S-- 743 C-S-- 744 C--- 744
-#- B:L -#- A:W -#- PP:F -#- A:W -#- PP:R -#- A:R -#- PP:F -#S- A:F
---#w ---#w ---#w ---#w ---#w ---#w ---#n ---#n

745-8439
PP:FORWARD I. m. Moved. m. Forward. m. CQ m. PP moved Forward and says so with CQ. 86BH,20BI;
A:LEFT I m Turned m Left m Q m A lets it go. B didn't see A turn. 730-1SI,342SG,413SL
746-8449
PP:FORWARD I. m Moved m. Forward m. Q m. PP moved Forward and says so. 7BH;180SE,145SF,184SF,
A:FORWARD Good y I m Moved m Forward m Q m A says Good. B didn't see A move. 1338SE,188SG
747-8460
PP:LEFT Next. m. Turn. m. Is. m. Mine. m. So. m. Q m. Incomplete sequence. 106BC;308-11SH,319-22SJ,
A:FORWARD You y Turn y Left y CQ m 417SL
748-8472 B was told to turn Left. PP did so and says so. A doesn't
PP:LEFT I. m. Turned. m. Left. m. Q m. want to Pat or say Good. 41BH;102-4SK,211SL,26SL,62SL
A:WAIT Look i I i Am i Touching i Brown i Stump i Q m
C--- 745 C--- 745 C--- 746 C--- 746 C--- 747 C--- 747 C--- 748 C--- 748
-#S-n PP:F -#-n A:L -#-w PP:F -#-w A:F -#-w PP:L -#-w A:F -#w- PP:L -#w- A:W
---#- ---S#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
----- ---S-- ---S-- ---E-- ---E-- ---N--
749-8485
PPu:FORWARD Q m 84BH
A:WAIT Look i I i Am i Touching i Brown i Stump i Q m
750-8495
B:RIGHT You. y. Squashed. y. Cake. m. So. m. Q m. RM turned Right and PP talks. Rand=18;426SK,
A:LEFT Bad y Look j You j Are j Touching j Black j Stump j Q m 428-30SK
751-8510
PP:LEFT I. m Turned. m. Right. m. Q m. PP turned Left but says it turned Right. 243BH;
A:WAIT Bad y You y Turn y Left y CQ m A says Bad. 1449-51SK,411SL,422SL
752-8521 B was told to turn Left. RM did so and PP says so.

B:LEFT I m. Turned. m. Left. m. Q m. A Pats and says Good. Rand=16;18SK,21SL,26SL,62SL
A:PAT Good y You y Move y Forward y CQ m
C---- 749 C---- 749 C---- 750 C---- 750 C---- 751 C---- 751 C---- 752 C---- 752
-#w-- PP:F -#w-- A:W -#w-- B:R -#w-- A:L -#s-- PP:L -#s-- A:W -#s-- B:L -#s-- A:P
---#- --N#- --N#- --E#- --E#- --N#- --N#- --W#-
--N- -- -- -- -- -- -- --
753-8532 B was told to move Forward. PP did so and says so. A says Good but
PP:FORWARD I. m. Moved. m. Forward. m. Q m. is too busy to Pat. 5BH,32BI;870-2SK,48SL,66-7SL
A:RIGHT Good y You y Turn y Right y CQ m
754-8543 B was told to turn Right. PP did so and says so. A doesn't want to
PP:RIGHT I. m. Turned. m. Right. m. Q m. Pat or say Good. 86BH,43BI;42SK,77-8SL,937-8SK,189SL
A:WAIT Look i I i Am i Touching i Brown i Stump i Q m
755-8556
PP:RIGHT Q m. 291BH
A:WAIT You y Turn y Left y CQ m
756-8563 B was told to turn Left and PP did so. A Pats.
PP:LEFT I. m. Turned. m. Right. m. Q m. PP says it turned Right. 129BH,181BI;
A:PAT Bad y Now y You y Wait y CQ m A says Bad. 1717SF,1721SG,3110SI
C---- 753 C---- 753 C---- 754 C---- 754 C---- 755 C---- 755 C---- 756 C---- 756
-#s-- PP:F -#s-- A:R -#w-- PP:R -#w-- A:W -#w-- PP:R -#w-- A:W -#w-- PP:L -#w-- A:P
--W#- --W#- --W#- --N#- --N#- --E#- --E#- --N#-
----- -- -- -- -- -- -- --
757-8574 B was told to Wait. PP did so with unblocking. A Pats.
PPu:WAIT What y. Q n Incomplete sequence. 171BH;580SK,266SL
A:PAT Now y You y Wait y CQ m
758-8582 B was told to Wait and PP did so. A doesn't Pat because of imitation.
PP:WAIT What. y. Q n Incomplete sequence. 505BD,480BE,509BF;4010SD
A:WAIT What y Are y You y Touching i Q? i PP answers the request and A says Good.
PP: Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m. 580-1SK,1470-3SK
A: Good
759-8598
PP:RIGHT Q n 503BD
A:WAIT You y Turn y Left y CQ m
760-8605 B was told to turn Left. PP did so and says so.
PP:LEFT I m Turned m Left. m. Q m A Pats and says Good. 504BD,479BE,508BF;4002SD,1938SC,
A:PAT Good y Now y You y Wait y CQ m, 574SK,62SL
C---- 757 C---- 757 C---- 758 C---- 758 C---- 759 C---- 759 C---- 760 C---- 760
-#w-- PP:W -#w-- A:P -#w-- PP:W -#w-- A:W -#w-- PP:R -#w-- A:W -#w-- PP:L -#w-- A:P
--N#- --N#- --N#- --N#- --N#- --E#- --E#- --N#-
----- -- -- -- -- -- -- --
761-8616 B was told to Wait and PP did so. A doesn't Pat because of imitation.
PP:WAIT What. y. Are. y. You. y. Turn. y. Left. y. CQ m. PP talks nonsense. 556BC;4010SD,
A:WAIT Bad y Look i You i Are i Touching i Brown i Stump i Q m A says Bad. 1506-7SK,339SL,1278SK,
762-8632 1499-500SK
PP:RIGHT Q m. 503BD
A:WAIT Look i I i Am i Touching i Brown i Stump i Q m
763-8642
PP:FORWARD Q n 129BH,182BI;
A:LEFT Look j You j Are j Touching j Black j Stump j Q m
764-8652
PP:LEFT I m Turned m Left. m. Q m PP turned Left and says so. 499BD,474BE,503BF;
A:WAIT Good y You y Turn y Left y CQ m A says Good. 3970SD,2192SA,1451SK
C---- 761 C---- 761 C---- 762 C---- 762 C---- 763 C---- 763 C---- 764 C---- 764
-#w-- PP:W -#w-- A:W -#w-- PP:R -#w-- A:W -#w-- PP:F -#w-- A:L -#s-- PP:L -#s-- A:W
--N#- --N#- --N#- --E#- --E#- --E#- --E#- --N#-
----- -- -- -- -- -- -- --
765-8663 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. 551BC;3978-80SD,1929-30SC
A:PAT Good y You y Move y Forward y CQ m
766-8674 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 682BA,657BB;
A:FORWARD Good y You y Move y Forward y CQ m 2197-9SA,2003-5SB
767-8685 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 86BH,32BI;
A:RIGHT Good y You y Turn y Right y CQ m 984-6SB
768-8696 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but was too busy to Pat. 357BB;519-21SH,
A:FORWARD Good y You y Move y Forward y CQ m 764SJ,540-1SJ
C---- 765 C---- 765 C---- 766 C---- 766 C---- 767 C---- 767 C---- 768 C---- 768
-#s-- PP:L -#s-- A:P -#s-- PP:F -#s-- A:F -#s-- PP:F -#s-- A:R -#s-- PP:R -#s-- A:F
--N#- --W#- --W#- --W#- --W#- --W#- --W#- --W#- --N#- --N#-

769-8707 B was told to move Forward and PP did so. A was too busy to Pat.
PP:FORWARD I m. Q m. Incomplete sequence. 137BH,32BI;1057SC
A:RIGHT You y Turn y Right y CQ m

770-8715 B was told to turn Right but PP Pushed Cake. A Slaps.
PP:FORWARD I. m. Pushed. m. Cake o. Q m. PP says it Pushed Cake. A says Good. 184BH;938SI,1242SI,
A:SLAP Good y You y Turn y Right y CQ m 654SJ,803SH,1856SI

771-8726 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 360BB;1832-4SD
A:PAT Good y You y Turn y Right y CQ m

772-8737 B was told to turn Right but PP Pushed Cake. A Slaps.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. PP says it Pushed Cake. A says Good. 19BH;616SK,77SL,
A:SLAP Good y You y Turn y Right y CQ m 743-4SJ,731SH

C---- 769 C---- 769 C---- 770 NC--- 770 NC--- 771 EC--- 771 EC--- 772 -EC-- 772
-#--- PP:F N#--- A:R N#--- PP:F -#--- A:S -#--- PP:R -#--- A:P -#--- PP:F -#--- A:S
Nw-#- -w-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#-

773-8748 B was told to turn Right. RM did so and PP says so.
B:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. Rand=6;383SK,77-8SL,189SL
A:PAT Good y Now y You y Wait y CQ m

774-8759 B was told to Wait and PP did so. A Pats.
PP:WAIT I. m. Turned. m. Right. m. Q m. PP says it turned Right. A says Bad. 127BH,190BI;
A:PAT Bad y Look i I i Am i Touching i Brown i Stump i Q m 3177-9SI

775-8773 PP turned Right and says so. 185BI;
PP:RIGHT I. m. Turned. m. Right. m. CQ m. A says Good. 577-8SK,941SK
A:WAIT Good y You y Turn y Left y CQ m

776-8784 B was told to turn Left. PP did so and says so. No Pat
PP:LEFT I. m. Turned. m. Left. m. Q m. and no Good for imitation. 143BH,75BI;1746SF,1750SG,
A:WAIT Look i You i Are i Touching i Brown i Stump i Q m 62SL

-EC-- 773 -SC-- 773 -SC-- 774 -SC-- 774 -SC-- 775 -WC-- 775 -WC-- 776 -SC-- 776
-#--- B:R -#--- A:P -#--- PP:W -#--- A:P -#--- PP:R -#--- A:W -#--- PP:L -#--- A:W
-n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#-

777-8797 PP turned Right and says so. 569BC;
PP:RIGHT I. m. Turned. m. Right. m. CQ m. A says Good. 4107-9SD,1976-7SC
A:WAIT Good y You y Turn y Left y CQ m

778-8808 B was told to turn Left. PP did so and says so. No Pat
PP:LEFT I. m. Turned. m. Left. m. Q m. and no Good for imitation. 704BA;2253-5SA,2056-8SB
A:WAIT What y Are y You y Touching i Q? i
PP: Q n A:- PP fails to answer.

779-8820 PP turned Left and says so. 499BH,179BI;
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good. 419-421SL
A:WAIT Good y You y Turn y Right y CQ m

780-8831 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 567BC;1969-70SC,
A:PAT Good y Now y You y Wait y CQ m 4090-1SD,2048SB

-SC-- 777 -WC-- 777 -WC-- 778 -SC-- 778 -SC-- 779 -EC-- 779 -EC-- 780 -SC-- 780
-#--- PP:R -#--- A:W -#--- PP:L -#--- A:W -#--- PP:L -#--- A:W -#--- PP:R -#--- A:P
-n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#-

781-8842 B was told to Wait and PP did so. No Pat from A.
PP:WAIT Q n 702BA
A:WAIT What m Am m I m Touching i Q? i
PP: Q n A:- PP fails to answer.

782-8851 PP turned Left and says so. 515BD,492BE,521BF;
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good. 1460SH,3202SI,4130-1SD,1985SC
A:WAIT Good y You y Turn y Right y CQ m

783-8862 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 707BA;2263-5SA,2065SB,2048SB
A:PAT Good y You y Turn y Right y CQ m

784-8873 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. CQ m. A Pats and says Good. 127BH,65BI;577-8SK,77-8SL,
A:PAT Good y You y Move y Forward y CQ m 941SK,189SL

-SC-- 781 -SC-- 781 -SC-- 782 -EC-- 782 -EC-- 783 -SC-- 783 -SC-- 784 -WC-- 784
-#--- PP:W -#--- A:W -#--- PP:L -#--- A:W -#--- PP:R -#--- A:P
-n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#-

785-8884 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 143BH,32BI;187SD,
A:PAT Good y You y Turn y Left y CQ m 1276-7SA,266-7SB

786-8895 B was told to turn Left. PP did so and says so.

PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 451BA,394BB;27SH,25SJ,
A:PAT Good y You y Move y Forward y CQ m 315-6SH,328-9SJ
787-8906 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 41BH,32BI;276-8SH,282-4SJ
A:PAT Good y You y Turn y Left y CQ m
788-8917 B was told to turn Left. PP did so and says so.
PP:LEFT I. m Turned. m. Left. m. Q m. A Pats and says Good. 125BH,75BI;4002-3SD,2022SB
A:PAT Good y Now y You y Wait y CQ m
--C-- 785 W-C-- 785 W-C-- 786 S-C-- 786 S-C-- 787 --C-- 787 --C-- 788 --C-- 788
--#--- PP:F --#--- A:P --#--- PP:L --#--- A:P --#--- PP:F S#--- A:P S#--- PP:L E#--- A:P
--n-- --n-- --n-- --n-- --n-- --n-- --n-- --n--

789-8928 B was told to Wait and PP did so.
PP:WAIT I. m Q m. Incomplete sequence. 505BG,171BH,190BI;3231SI
A:WAIT Look i You i Are i Touching i Brown i Stump i Q m
790-8939
PP:RIGHT I. m. Turned. m. Right. m. CQ m. PP turned Right and says so but with CQ. 503BG,173BH,
A:WAIT Bad y You y Turn y Left y CQ m A says Bad. 195BI;577-8SK,445SL,442SL,941SK,443SL
791-8950 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. No Pat or Good from A. 519BD,496BE,525BF;
A:WAIT What y Are y You y Touching i Q? i 4002-4SD,2000-1SC
PP: Q n A:- PP fails to answer.
792-8962 PP says it is touching Brown Stump. A says Good.
PP:WAIT Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m. 171BH,179BI;580SK,419SL,
A:WAIT Good y Look i You i Are i Touching i Brown i Stump i Q m 1408-9SJ,1430SH,4023-5SD
--C-- 789 --C-- 789 --C-- 790 --C-- 790 --C-- 791 --C-- 791 --C-- 792 --C-- 792
E#--- PP:W E#--- A:W E#--- PP:R S#--- A:W S#--- PP:L E#--- A:W E#--- PP:W E#--- A:W
--n-- --n-- --n-- --n-- --n-- --n-- --n-- --n--

793-8979
PP:RIGHT I m Turned m Right m Q m PP turned Right and says so. 690BB;2083SB,
A:WAIT Look i I i Am i Touching i Brown i Stump i Q m 2285-6SA
794-8992
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 143BH,182BI;
A:RIGHT Good m I m Turned m Right m Q m A says Good. B saw A turn. 569-71SK,424SL,442SL
795-9003
PP:FORWARD I. m. Moved. m. Forward. n, Q m. PP moved Forward and says so. 467BH,104BI;3628-30SD,
A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A move. 1752-3SC
796-9013
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 106BC;772-4SH,783-5SJ
A:LEFT I m Turned m Left m Q m A didn't see it. B saw A turn.
--C-- 793 --C-- 793 --C-- 794 --C-- 794 --C-- 795 --C-- 795 --C-- 796 --C-- 796
E#--- PP:R S#--- A:W S#--- PP:F --#--- A:R --#--- PP:F --#--- A:F --#--- PP:L --#--- A:L
--n-- --n-- --n-- --n-- --n-- --n-- --n-- --n--

797-9023
PP:FORWARD Good. y. I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 41BH,21BI;369SK,
A:FORWARD I m Moved m Forward m Q m A didn't see it. B saw A move. 13SL,621SK,
798-9034 370SK,175SJ
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 51BH,3BI;1111-2SH,
A:FORWARD I m Squeezed m Cake o Q m A didn't see it. B saw A Squeeze. 348SJ,174-5SJ,173SH
799-9044
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 51BH,18BI;479SK,7SL,
A:RIGHT I m Turned m Right m Q m A didn't see it. B didn't see A turn. 674-5SJ,1092SH
800-9054
PP:FORWARD I. m. Moved. m. Forward. n, Q m. PP moved Forward and says so. 52BH,16BI;
A:WAIT Good y You y Turn y Left y CQ m A says Good. 1817-9SB
--C-- 797 --C-- 797 --C-- 798 --C-- 798 --nC- 799 --nC- 799 --eC- 800 --eC- 800
--#--- PP:F --#--- A:F --#n-- PP:F --#n-- A:F --#--- PP:F --#--- A:R --#--- PP:F --#--- A:W
--n-- --n-- --n-- --n-- --n-- --n-- --n-- --n--
E---- -E---- -E---- -E-- --E-- --E-- --E--
801-9065 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but is out-of-reach to Pat. 619BA,
A:FORWARD Good y You y Move y Forward y CQ m 147BB;353-4SC,1055-6SD,371SB
802-9076 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but needs to Wait. 422BA,411BB;
A:WAIT Good y Next m Turn m Is m Mine m So m You y Move y Forward y CQ m 1340-2SA,1183-5SB
803-9092 PP reads WM properly and tells A to Squash. A does and says Good.
PP:FORWARD Next. m. Turn. m. Is. m. Yours. m. So. m. You. y. Squash. y. Cake. o. CQ m. 412BB;
A:FORWARD (Squashed) Good y I m Squashed m Cake m So m Next m Turn m Is m <Yours m Q m 1136-7SB,
804-9113 PP turns away from Wall and sets up WM with <Mine. 380-1SB,394SA,532-6SB

PP:LEFT Good. y. You. y. Squashed. y. Cake. m. So. m. Next. m. Turn. m. Is. m. <Mine. m. Q m. 235BA,
A:PAT Good y You y Move y Forward y CQ m A Pats and says Good. 233BB,2368-76SD
--eC- 801 --eC- 801 --eC 802 --eC 802 --eC 803 --eC 803 --eC 804 --eC 804
--#-- PP:L --#-- A:F --#-- PP:F --#-- A:W --#-- PP:F --#--N A:F --#--N PP:L --#--W A:P
---#- ---#- ---#- ---#N ---#N ---#- ---#C ---#C
---E ---N ---N ---# ---# ---# ---# ---#

805-9130 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A didn't see it. 32BI;26-8SK,48SL,66-7SL
A:RIGHT You y Turn y Left y CQ m

806-9140 B was told to turn Left. RM did so and PP says so.
B:LEFT I m. Turned. m. Left. m. Q m. A says Good but was too busy to Pat. 7BH,36BI;26-7SL,62SL
A:FORWARD Good y Look j You j Are j Touching j Black j Stump j Q m

807-9154 PP turned Left and says so. A says Good. 184BI;1390-2SJ
PP:LEFT I m. Turned. m. Left. m. Q m.
A:WAIT Good y You y Turn y Right y CQ m

808-9165 B was told to turn Right. PP did so. A Pats.
PP:RIGHT I. m. Turned. m. Right. m. CQ y. PP says so but uses CQ. 483BH,117BI;
A:PAT Bad y Now y You y Wait y CQ m A says Bad. 426SK,77-8SL,189SL,230SL
---e 805 ---e 805 ---s 806 ---s 806 ---s 807 ---s 807 ---s 808 ---s 808
--#--W PP:F --#--W A:R --#--W B:L --#--S A:F --#--Ss PP:L --#--Es A:W --#--Es PP:R --#--Ss A:P
---#C ---#C ---#C ---#C ---#C ---#C ---#C ---#C ---#C
---# ---# ---# ---# ---# ---# ---# ---# ---#

809-9176 B was told to Wait but PP turned Right and says it moved Forward.
PP:RIGHT I. m. Moved. n Forward. m. Q n A Slaps and says Bad. 243BH;902SK,393SL,3301-2SI
A:SLAP Bad y You y Turn y Left y CQ m

810-9187 B was told to turn Left. PP did so and says so.
PP:LEFT I m. Turned m Left. m. Q m. A says Good but was too busy to Pat. 530BD,507BE,
A:FORWARD Good m I m Moved m Forward m Q m B saw A move. 536BF;1820SF,1824SG,62SL

811-9198 RM turned Left and PP says so. Rand=2;
B:LEFT I. m. Turned. m. Left. m. Q m. A didn't see it. 165SK,109SL,1025-6SJ
A:RIGHT You y Turn y Right y CQ m

812-9208 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. No Pat or Good as imitation. 66BH,112BI;837-9SH,
A:WAIT What y Are y You y Touching j Q? j 839-41SJ
PP: Q n A:- PP fails to answer.

--- 809 --- 809 --- 810 --- 810 --- 811 --- 811 --- 812 --- 812
--#--Ss PP:R --#--Ws A:S --#--Ws PP:L --#--Ss A:F --#--S- B:L --#--E- A:R --#--E- PP:R --#--S- A:W
---#C ---#C ---#C ---#C ---#s ---#s ---#w ---#w
---# ---# ---# ---# ---#C ---#C ---#C ---#C

813-9220 PPu:WAIT Good. y. You. y. Move. y. Forward. y. CQ m. PP Waits and tells impossible. 310BH;608SK,
A:WAIT Look j You j Are j Touching j Black j Stump j Q m No Bad as imitation. 955-7SK,609SK,

814-9234 PP turned Right and says so. 92BH;
A:WAIT Good y You y Turn y Left y CQ m A says Good. 902-3SK,743SH

815-9245 B was told to turn Right. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 588BC;1832SF,1836SG,
A:PAT Good y Now y You y Wait y CQ m 1505SH,3343SI,1482SJ

816-9256 B was told to Wait and PP did so. No Pat as imitation.
PP:WAIT I. m Q m. Incomplete sequence. 517BH,125BI;3341SI
A:WAIT What m Am m I m Touching j Q? j

PP: Good. y. You. n Move. y. Forward. y. CQ m. PP tells impossible. A says Bad. 3349-51SI,
A: Bad 1524SH,4298-9SD,2069SC

--- 813 --- 813 --- 814 --- 814 --- 815 --- 815 --- 816 --- 816
--#--S- PP:W --#--S- A:W --#--S- PP:R --#--W- A:W --#--W- PP:L --#--S- A:P --#--S- PP:W --#--S- A:W
---#w ---#w ---#w ---#w ---#w ---#w ---#w ---#w
---C ---C ---C ---C ---C ---C ---C ---C

817-9271 PP turned Right but starts to say it moved.92BH;
PP:RIGHT I. m. Moved. n Q n A says Bad. B didn't see A turn. 1814SE,1812SF
A:LEFT Bad m I m Turned m Left m Q m

818-9281 B can't see A for PP to give the command. 94BH;
PP:FORWARD You. no! Turn. no! Left. no! CQ m. A didn't see B to say Bad. 29SK,203SL,1467-9SK
A:FORWARD I m Pushed m Cake o Q m

819-9291 PP turned Right but says it moved Forward. 206BH;
PP:RIGHT Good. m. I. m. Moved. m. Forward. m. Q m. A didn't see it. 391SK,1546SK,2039-40SI
A:RIGHT You y Turn y Left y CQ m

820-9302 B was told to turn Left. PP did so and says so.
PP:LEFT I m Turned. m Left. m. Q m. A says Good but was too busy to Pat. 174BC;1424-6SH,
A:FORWARD Good y Now y You y Wait y CQ m 1402-4SJ

--- 817 --- 817 --- 818 --- 818 --- 819 --- 819 --- 820 --- 820
--#--S- PP:R --#--W- A:L --#--W- PP:F --#--W- A:F --#--W- PP:R --#--N- A:R --#--N- PP:L --#--W- A:F

---#w ---#w ---#s ---#s ---#- ---#- ---#- ---#-
 ---C ---C ---C ---C ---Cs ---Cs ---Cw ---Cw
 821-9313 B was told to Wait and PP did so. A was too busy to Pat.
 PP:WAIT What m. Am. i. Touching. i. Brown. i. Stump. i. Q m. Bad question. 171BH,190BI;1427SH,
 A:FORWARD Bad y Now y You y Wait y CQ m A says Bad. 1506SK,1471-2SK,1433SH
 822-9326 B was told to Wait. PP did so and says it is touching, without Look.
 PP:WAIT I. i. Am. i. Touching i. Brown i. Stump i. Q m A says Good. 173BH,186BI;1427SH,1405SJ,581SK,
 A:FORWARD Good m I m Pushed m Cake o Q m B saw A Push. 1471SK,1432-3H,1519SJ
 823-9339
 PP:LEFT I. n, Q m. Incomplete sequence. 173BH;892SK,226SL
 A:FORWARD I m Pushed m Cake o Q m B saw A Push.
 824-9347
 PP:FORWARD Q m. 279BH,108BI
 A:RIGHT I m Turned m Right m Q m B saw A turn.
 --- 821 --- 821 --- 822 --- 822 --- 823 --- 823 --- 824 --- 824
 -#W-- PP:W -#W-- A:F -#W-- PP:W -#W-- A:F -#W-- PP:L -#S-- A:F -#S-- PP:F -#--- A:R
 ---#- ---#- ---#- ---#- ---#- ---#- C--#- C-S#-
 --Cw- --Cw- --Cw- --Cw- Cw--- Cw--- w---- w----
 825-9354
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 7BH,16BI;105-6SK,10-1SL,
 A:FORWARD Good m I m Pushed m Cake o Q m B didn't see A Push. 1381SJ
 826-9365
 PP:RIGHT I. m. Q m. Incomplete sequence. 40BH;176SK,226SL
 A:FORWARD I m Pushed m Cake o Q m B saw A Push.
 827-9373
 PP:FORWARD Good. n, Next. n, Turn. m. Is. m. Mine^ n, Q m. Tolerated. 12BH,108BI;80SK,698SK,
 Tchr: The-Cake-has-been-dumped-in-the-top-left-corner-to-simplify-contexts.
 A:RIGHT You y Turn y Right y CQ m A didn't see it. 523-5SK,289SL
 828-9385 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 0BH,112BI;350SH,362SJ,
 A:PAT Good y You y Move y Forward y CQ m 849-50SH,851-2SJ
 --- 825 --- 825 --- 826 --- 826 C---- 827 C---- 827 C---- 828 C---- 828
 -#--- PP:F -#--- A:F C#--- PP:R C#--- A:F n#--- PP:F n#--- A:R e#--- PP:R e#--- A:P
 C-S#- C--#- n--#- n--#- ---#- ---#- ---#- ---#-
 n--- n-S-- --S-- --W-- --W-- --W-- --W-- --N--
 829-9396 B was told to move Forward. PP did so and says so.
 PP:FORWARD I m. Moved. m. Forward. m. Q m. A Pats and says Good. 178BH,32BI;29-31SK,67SL
 A:PAT Good y Now y You y Wait y CQ m
 830-9407 B was told to Wait. PP did so. A Pats.
 PP:WAIT What m Am i I. m. Moved. m Forward. m. Q m. PP's confused question. 206BH,190BI;
 A:PAT Bad y Now y You y Wait y CQ m A says Bad. 1427SH,1434SH,1471SK,3424-5SI
 831-9420 B was told to Wait. PP did so and says it is touching but without Look.
 PP:WAIT I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m. A says Good. 610BC;1427SH,3423SI,1405SJ,
 A:WAIT Good y Look i I i Am i Touching i Brown i Stump i Q m 1544-5SH,1521-2SJ,1432-3SH,1519-20SJ
 832-9436
 PP:RIGHT I. m. Moved. m. Forward. m. Q m. PP turned Right but says it moved Forward. 173BH,185BI;
 A:WAIT Bad y You y Turn y Left y CQ m A says Bad. 391SK,424SL,1547SK,442SL,1516SJ
 C--- 829 C--- 829 C--- 830 C--- 830 C--- 831 C--- 831 C--- 832 C--- 832
 e#--- PP:F e#--- A:P e#--- PP:W e#--- A:P e#--- PP:W e#--- A:W e#--- PP:R e#--- A:W
 ---#- -N-#- -N-#- -N-#- -N-#- -N-#- -N-#- -E-#-
 -N--- ----- ----- ----- ----- ----- ----- -----
 833-9447 B was told to turn Left. PP did so and says so.
 PP:LEFT I m. Turned. m. Left. m. Q m. No Pat and no Good for imitation. 547BG,129BH,74BI;
 A:WAIT Look i You i Are i Touching i Brown i Stump i Q m 1424-6SH,3423-4SI,1403-4SJ
 834-9460
 PP:RIGHT I m Turned. m. Right. m. Q m. PP turned Right and says so. 611BC;4425SD,
 A:WAIT Good y You y Turn y Left y CQ m A says Good. 1547-8SK
 835-9471 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. No Pat and no Good for imitation. 612BC;4429-31SD,
 A:WAIT What y Are y You y Touching i Q? i 2134SC
 PP: Q n A:- PP fails to answer.
 836-9483
 PP:WAIT Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m. PP says it's touching. 171BH,
 A:WAIT Good y What y Are y You y Touching i Q? i 179BI;1470-1SH,1452SJ,1408-11SJ,1430-2SH,4417SD
 PP: Look. i. Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m. 1428SH,3448SI,1907SE,
 A: Good Two Looks but A says Good. 1903SF,1909SG,1431SH,3451SI,1410SJ,4447SD,2144SC,4417SD
 C--- 833 C--- 833 C--- 834 C--- 834 C--- 835 C--- 835 C--- 836 C--- 836
 e#--- PP:L e#--- A:W e#--- PP:R e#--- A:W e#--- PP:L e#--- A:W e#--- PP:W e#--- A:W
 -E-#- -N-#- -N-#- -E-#- -E-#- -N-#- -N-#- -N-#-
 ----- ----- ----- ----- ----- ----- ----- -----
 837-9506

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 552BD;
A:RIGHT Good y You y Move y Forward y CQ m A says Good. 1901SE,1896SF,1906SG
838-9517 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 395SK,48SL,729-30SK,66-7SL
A:FORWARD Good y You y Turn y Left y CQ m B was told to turn Left. PP with unblocking did so and says so.
839-9528 PPU:LEFT I. m. Turned. m. Left. m. Q m. A says Good but 149BE;500-2SH,
A:LEFT Good y You y Move y Forward y CQ m was too busy to Pat. 520-2SJ
840-9539 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 906-8SH,908-10SJ
A:FORWARD Good y You y Turn y Left y CQ m
C---- 837 C---- 837 C---- 838 C---- 838 C---- 839 C---- 839 C---- 840 C---- 840
e#--- PP:R e#--- A:R s#--- PP:F s#--- A:F -#--- PP:L -#--- A:L -#--- PP:F -#N-- A:F
-N-#- -E-#- -E-#- --E#- s-E#- s-N#- e-N#- e-#-

841-9550 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but was too busy to Pat. 80BH,75BI;
A:LEFT Good y Look i You i Are i Touching i Brown i Stump i Q m 1424-6SH,1402-4SJ
842-9564
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 171BH,195BI;1561-2SH,
A:WAIT Good y You y Turn y Left y CQ m A says Good. 1147-8SI,1536-8SJ,1564SH
843-9575 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. No Pat or Good for imitation. 618BH;4478-80SD
A:WAIT Look i I i Am i Touching i Brown i Stump i Q m
844-9588
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 619BC;
A:WAIT Good y You y Turn y Left y CQ m A says Good. 4488-90SD,2167-8SC
C---- 841 C---- 841 C---- 842 C---- 842 C---- 843 C---- 843 C---- 844 C---- 844
-#N-- PP:L -#W-- A:L -#W-- PP:R -#N-- A:W -#N-- PP:L -#W-- A:W -#W-- PP:R -#N-- A:W
-e-#- -e-#- -n-#- -n-#- -n-#- -n-#- -n-#- -n-#-

845-9599 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 764BA,738BB;2474-6SA,2260-2SB
A:PAT Good y Now y You y Wait y CQ m
846-9610 B was told to Wait. PP did so and asks with unblocking what A is touching.
PP:WAIT What y Are y You y Touching. i. Q? m. PP asks the question. (cf. step 758) 171BH,190BI;
A: Good y Look i I i Am i Touching i Brown i Stump i Q m 1427SH,1434-5SH,4018-9SD
A:WAIT Look i You i Are i Touching i Brown i Stump i Q m
847-9632
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 559BD;1930SE,
A:RIGHT Good y You y Turn y Right y CQ m A says Good. 1926SF,1932SG
848-9643 B was told to turn Right but PP turned Left. A Slaps.
PP:LEFT I. m. Turned. m. Left. m. Q m. PP says it turned Left. 535BE;1922SF,
A:SLAP Good y You y Turn y Right y CQ m A says Good. 1928SG,1426SH,3473SI,1404SJ
C---- 845 C---- 845 C---- 846 C---- 846 C---- 847 C---- 847 C---- 848 C---- 848
-#N-- PP:L -#W-- A:P -#W-- PP:W -#W-- A:W -#W-- PP:R -#N-- A:R -#N-- PP:L -#W-- A:S
-n-#- -n-#- -n-#- -n-#- -n-#- -n-#- -e-#- -e-#-

849-9654 B was told to turn Right and PP did so. A Pats.
PP:RIGHT I. m. Moved. n Forward. n Q n PP says it moved Forward. 171BH,65BI;471SH,
A:PAT Bad y You y Turn y Right y CQ m A says Bad. 3468-9SI,490SJ,532SG
850-9665 B was told to turn Right but PP moved Forward. A Slaps.
PP:FORWARD I. m. Moved. m. Forward. m. CQ m. PP says it moved Forward. 129BH;686-7SI,
A:SLAP Good y You y Turn y Right y CQ m A says Good. 912SJ,962SG
851-9676 B was told to turn Right but PP turned Left. A Slaps.
PP:LEFT I m Turned. m. Left. m. Q m. PP says it turned Left. 133BE;108SK,
A:SLAP Good y You y Turn y Left y CQ m A says Good. 77-8SL,542SK,479SH
852-9687 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but 41BH,75BI;1405-7SH,
A:FORWARD Good y You y Turn y Left y CQ m was too busy to Pat. 1383-5SJ
C---- 849 C---- 849 C---- 850 C-N-- 850 C-N-- 851 C-W-- 851 C-W-- 852 C-S-- 852
-#W-- PP:R -#N-- A:P -#N-- PP:F -#--- A:S -#--- PP:L -#--- A:S -#--- PP:L -#--- A:F
-e-#- -e-#- -e-#- -e-#- -e-#- -e-#- -e-#- -e-#-

853-9698 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but was too busy to Pat. 84BH,75BI;
A:LEFT Good y You y Move y Forward y CQ m 599SK,63SL,849-50SJ,848SH
854-9709 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 294BG,289BH,
A:FORWARD Good y You y Turn y Right y CQ m 32BI;1654-5SC,454-5SD,1894SA
855-9720 B was told to turn Right. PP did so and says so.

PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but was too busy to Pat. 78BG,0BH,43BI;
A:FORWARD Good y You y Move y Forward y CQ m 350SH,362SJ,849-50SH,851-2SJ
856-9731 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A didn't see it. 32BI;4464-6SD
A:LEFT I m Turned m Left m Q m B didn't see A turn.
C-S-- 853 C-E-- 853 C-E-- 854 C--E- 854 C--E- 855 C--S- 855 C-nS- 856 C-n-- 856
--#-- PP:L --#-- A:L --#-- PP:F --#-- A:F --#-- PP:R --#-- A:F --#-- PP:F --#-S- A:L
--e#- --e#- --n#- --n#- --#- --#- --#- --#-

857-9741
PP:RIGHT Q m. 81BH
A:FORWARD I m Moved m Forward m Q m B saw A move.
858-9748
PP:FORWARD I. m. Moved. m. Forward. m. CQ m. PP moved Forward and says so 94BH,3BI;29SK,
A:LEFT Look i I i Am i Touching i Brown i Stump i Q m but with CQ. 0SL,488-9SJ,470SH,413SL
859-9761
PP:WAIT Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m. PP says its touching. 206BH;
A:WAIT Good y What y Are y You y Touching i Q? i A says Good. 580-1SK,1470SK,1431-3SH
PP: Look. i. Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m. 1428-9SH,1539-41SJ,
A: Good A accepts the double Look and says Good. 1565-6SH,3560SI,1409-10SJ,
860-9784 1431SH,4585-6SD
PP:WAIT Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q y. PP says its touching. 571BD;
A:WAIT What m Am m I m Touching i Q? i 1972SE,1967SF,1971SG,1431SH,4585-6SD
PP: Look. i. Look. i. I. i. Am. i. Touching. i. Brown. i. Stump. i. Q m. 3559-60SI,1429SH,4595-7SD,
A: Bad PP gives wrong answer. A says Bad. 2219-20SC,2317-8SB,2531SA
C-w-- 857 C-w-- 857 Cw--- 858 Cw--- 858 Cs--- 859 Cs--- 859 Cs--- 860 Cs--- 860
--#-S- PP:R --#-W- A:F --#-W- PP:F --#-W- A:L --#-W- PP:W --#-W- A:W --#-W- PP:W --#-W- A:W
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

861-9807
PP:WAIT Look i I i Am i Touching i Brown i Stump i Q y. PP says its touching. 780BA;2532SA,
A:LEFT Good y You y Turn y Right y CQ m A says Good. 4599-601SD,4585-6SD
862-9821 B was told to turn Right but PP turned Left. A Slaps.
PP:LEFT I. m. Turned. m. Left. m. Q m. PP says it turned Left. A says Good. 173BH;1171-2SH,
A:SLAP Good y You y Turn y Left y CQ m 747SH,760SJ
863-9832 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but was too busy to Pat. 279BH,75BI;
A:FORWARD Good y You y Move y Forward y CQ m 102-48SK,63SL,26SL,62SL
864-9843 B was told to move Forward and PP did so but A was too busy to Pat.
PP:FORWARD I. m. Turned. m. Left. m. Q m. PP says it turned Left. A says Bad. 32BI;2430-2SI
A: RIGHT Bad Y You Y Turn y Right y CQ m
Cs--- 861 Cs--- 861 Ce--- 862 Ce--- 862 Ce--- 863 Ce--- 863 C-e-- 864 C-e-- 864
--#-W- PP:W --#-W- A:L --#-W- PP:L --#-S- A:S --#-S- PP:L --#-E- A:F --#-E- PP:F --#-E- A:R
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

865-9854 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but was too busy to Pat. 413BC;837-9SH
A:FORWARD Good y Now y You y Wait y CQ m 3534-5SI,839-41SJ
866-9865 B was told to Wait and PP did so. A Pats.
PP:WAIT What. y. Are. y. You. y. Touching. i. Q? m. 125BI;265SL,339SL,436-7SL,501SL
A: Bad y I m Am m Not m Touching m Anything m Q m
A:PAT Look j You j Are j Touching j Black j Stump j Q m
867-9886
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 374BH;
A:WAIT Good y You y Turn y Right y CQ m A says Good. 165SK,1781-2SI,1020SJ
868-9897 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but was too busy to Pat. 491BA;1040-2SH,
A:FORWARD Good m I m Moved m Forward m Q m B saw A move. 1021-3SJ
C-s-- 865 C-s-- 865 C---- 866 C---- 866 C---- 867 C---- 867 C---- 868 C---- 868
--#-E- PP:R --#-S- A:F --#sS- PP:W --#sS- A:P --#sS- PP:L --#sE- A:W --#sE- PP:R --#sS- A:F
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

869-9908
PP:LEFT I. m. Turned. m. Q m. A couldn't unblock Left. 310BH,199BI;
A:LEFT Look j I j Am j Touching j Black j Stump j Q m 2166SI,1493SJ,1781SI,1025SJ
870-9920
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 66BH,175BI;840SK,410SL,
A:WAIT What m Am m I m Touching j Q? j No Good from A because of imitation. 1028-9SJ,1048SH
PP: Q n A:- PP fails to answer.
871-9932
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 310BH;165SK,

A:WAIT Good y You y Turn y Right y CQ m A says Good. 689-90SK,421SL
872-9943 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. No Pat or Good because of imitation. 413BC;837-9SH,
A:WAIT What m Am m I m Touching j Q? j 839-41SJ
PP: Q n A:- PP fails to answer.
C---- 869 C---- 869 C---- 870 C---- 870 C---- 871 C---- 871 C---- 872 C---- 872
--S- PP:L --E- A:L --E- PP:R --S- A:W --S- PP:L --E- A:W --E- PP:R --S- A:W
--s#- --s#- --e#- --e#- --e#- --e#- --e#- --e#- --e#- --e#-

873-9955 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 765BB;2265SC,4680SD,
A:WAIT Good y You y Move y Forward y CQ m 2364-5SB,2579SA
874-9966 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 345BG,66BH,32BI;106-7SC,
A:PAT Good y You y Turn y Right y CQ m 1547-8SD,1268SB
875-9977 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 87BC;519-21SH,764SJ,540-1SJ
A:PAT Good y You y Move y Forward y CQ m
876-9988 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 12BH,32BI;112-4SH,110-2SJ
A:PAT Good y You y Turn y Right y CQ m
C---- 873 C---- 873 C---- 874 C---- 874 C---- 875 C---- 875 C---- 876 C---- 876
--S- PP:L --E- A:W --E- PP:F --E- A:P --E- PP:R --S- A:P --S- PP:F --E- A:P
--e#- --e#- --e#- --e#- --e#- --e#- --e#S

877-9999 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. No Pat or Good for imitation. 8BH,43BI;840SK,
A:WAIT Look j You j Are j Touching j Black j Stump j Q m 77-8SL,981-2SK,189SL
878-10012 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 310BH,184BI;860SK,
A:WAIT Good y You y Turn y Right y CQ m A says Good. 428SL,862-3SK,411SL,422SL
879-10023 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. No Pat or Good for imitation. 645BC;2277-8SC,
A:WAIT What y Are y You y Touching j Q? j 4711-2SD,2380SB
PP: (Look. i.) 14 times. Q i. Limit cycle stopped by Boredom. 492-3SL,3671SI(x3),
A: Bad 1613SJ(x2),1629SH,4736SD(x3),2288SC(x2),2393SB(x7),2611SA(x6)
880-10050 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 310BH;860SK,
A:WAIT Good y Look j I j Am j Touching j Black j Stump j Q m A says Good. 862-3SK
C---- 877 C---- 877 C---- 878 C---- 878 C---- 879 C---- 879 C---- 880 C---- 880
--S- PP:R --S- A:W --S- PP:L --S- A:W --S- PP:R --S- A:W --S- PP:L --S- A:W
--e#S --e#W --e#W --e#S --e#S --e#W --e#W --e#S

881-10064 PP:FORWARD I. m Moved. m. Forward. m. Q m. PP moved Forward and says so. 264BH,175BI;32SI,51SI,53SI
A:LEFT Good m I m Turned m Left m Q m A says Good but was too busy to Pat. B didn't see A turn.
882-10075 PP:LEFT Q m. 138BD,26BE
A:FORWARD I m Moved m Forward m Q m B didn't see A move.
883-10082 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 106BC;772-4SH,
A:RIGHT You y Turn y Left y CQ m A didn't see it. 783-5SJ
884-10092 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but was too busy to Pat. 41BH,181BI;
A:FORWARD Good y You y Move y Forward y CQ m 760-2SH,772-4SJ
C---- 881 C---- 881 C---- 882 C---- 882 C---- 883 C---- 883 C---- 884 C---- 884
--S- PP:F --S- A:L --S- PP:L --S- A:F --S- PP:L --S- A:R --S- PP:L --S- A:F
--e#S --e#- --n#- --n#- --n#- --n#- --n#- --n#- --n#- --n#-
-----S -----S -----E -----E -----N -----N -----W
885-10103 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 289BH,32BI;
A:RIGHT Good y You y Turn y Right y CQ m 112-4SH,110-2SJ
886-10114 B was told to turn Right. PP did so and says so.
PP:RIGHT I m Turned m Right m Q m A Pats and says Good. 8BH,43BI;1620-2SH
A:PAT Good y Now y You y Wait y CQ m
887-10125 B was told to Wait and PP did.
PP:WAIT Q m. No Pat because of imitation.310BH,125BI
A:WAIT Look j You j Are j Touching j Black j Stump j Q m
888-10135 PP:RIGHT I m. Turned. m. Left. m. Q m. PP turned Right but says it turned Left. 92BH,184BI;
A:WAIT Bad y You y Turn y Left y CQ m A says Bad. 612SK,1367SK,411SL,1464SK,422SL

C---- 885 C---- 885 C---- 886 C---- 886 C---- 887 C---- 887 C---- 888 C---- 888
 -#-e- PP:F -#-e- A:R -#-s- PP:R -#-s- A:P -#-s- PP:W -#-s- A:W -#-s- PP:R -#-s- A:W
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 ---W- ---W- ---W- ---N- ---N- ---N- ---N- ---E-
 889-10146 B was told to turn Left and PP did so. No Pat for imitation.
 PP:LEFT I. m. Turned. m. Right. m. Q m. PP says it turned Right. A says Bad. 428BH,74BI;2048SF,
 A:WAIT Bad y Look j I j Am j Touching j Black j Stump j Q m 2052SG,3706SI
 890-10160
 PP:RIGHT I m Turned m Right. m. Q m. PP turned Right and says so. 654BC;4784SD,
 A:WAIT Good y You y Turn y Left y CQ m A says Good. 2308SC,1464SK,422SL
 891-10171 B was told to turn Left. PP did so and says so.
 PP:LEFT I m Turned m Left. m. Q m A says Good but needs to Wait. 655BC;4791SD,
 A:WAIT Good y What m Am m I m Touching j Q? j 2311SC,1557SK,62SL
 PP: Q n A:- PP fails to answer.
 892-10184
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 517BH,213BI;860SK,
 A:WAIT Good y You y Turn y Right y CQ m A says Good. 520-1SL,862SK,1632SH
 C---- 889 C---- 889 C---- 890 C---- 890 C---- 891 C---- 891 C---- 892 C---- 892
 -#-s- PP:L -#-s- A:W -#-s- PP:R -#-s- A:W -#-s- PP:L -#-s- A:W
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 ---E- ---N- ---N- ---E- ---E- ---N- ---N- ---W-
 893-10195 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A says Good but needs to Wait. 652BC;2304-5SC,
 A:WAIT Good y What y Are y You y Touching j Q? j 4773-4SD,2411SB
 PP: Look j Q n PP starts to answer with unblocking. 1626SH
 A: Good A says Good to encourage!
 894-10209
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 310BH;
 A:WAIT Good y You y Turn y Right y CQ m A says Good. 3729SI,1631-2SH
 895-10220 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 652BC;2304-5SC,
 A:PAT Good y Now y You y Wait y CQ m 4773-4SD,2411SB
 896-10231 B was told to Wait and PP does. A Pats.
 PP:WAIT Q m. 805BA
 A:PAT Now y You y Wait y CQ m
 C---- 893 C---- 893 C---- 894 C---- 894 C---- 895 C---- 895 C---- 896 C---- 896
 -#-s- PP:R -#-s- A:W -#-s- PP:L -#-s- A:W -#-s- PP:R -#-s- A:P -#-s- PP:W -#-s- A:P
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 ---W- ---N- ---N- ---W- ---W- ---N- ---N- ---N-
 897-10238 B was told to Wait and PP does.
 PP:WAIT Q m. A must Wait so no Pat. 653BC
 A:WAIT Look j I j Am j Touching j Black j Stump j Q m
 898-10248
 PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 654BC;
 A:WAIT Good y You y Turn y Left y CQ m A says Good. 2418-20SB,2637-8SA
 899-10259 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 809BA;2639-41SA,
 A:PAT Good y Now y You y Wait y CQ m 2421-3SB
 900-10270 B was told to Wait. PP did so. A Pats.
 PP:WAIT Q m. 653BC
 A:PAT Now y You y Wait y CQ m
 C---- 897 C---- 897 C---- 898 C---- 898 C---- 899 C---- 899 C---- 900 C---- 900
 -#-s- PP:W -#-s- A:W -#-s- PP:R -#-s- A:W -#-s- PP:L -#-s- A:P -#-s- PP:W -#-s- A:P
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 ---N- ---N- ---N- ---E- ---E- ---N- ---N- ---N-
 901-10277 B was told to wait. PP did so.
 PP:WAIT Q m. A must wait so no Pat. 814BA
 A:WAIT What y Are y You y Touching j Q? j PP answers without prompting.
 PP: Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q j. A says Good. 2318SC,1430-3SK,
 A: Good 983SK
 902-10292
 PP:RIGHT I. m. Turned. m. Right. m. Q y. PP turned Right and says so. 92BH;612SK,
 A:WAIT Good y You y Turn y Left y CQ m A says Good. 2052SF,2056SG
 903-10303 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 428BH;1639SH,3704SI,
 A:PAT Good y Now y You y Wait y CQ m 4792SD,2423SB
 904-10314 B was told to Wait. PP did so. A Pats.
 PP:WAIT Look^ j. I. m. Turned. n Left. m. CQ m. Even with prompt PP talks nonsense. 816BA,793BB;
 A:PAT Bad y Now y You y Wait y CQ m A says Bad. 1529SH,1430SK,3705-6SI,1703SK
 C---- 901 C---- 901 C---- 902 C---- 902 C---- 903 C---- 903 C---- 904 C---- 904
 -#-s- PP:W -#-s- A:W -#-s- PP:R -#-s- A:W -#-s- PP:L -#-s- A:P -#-s- PP:W -#-s- A:P

---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 ---N- ---N- ---N- ---E- ---E- ---N- ---N- ---N-
 905-10326 B was told to Wait. PP did so and says it's touching with prompt.
 PP:WAIT Look j I j. Am. j. Touching. j. Black. j. Stump. j. Q m A Pats and says Good. 589BD,566BE,
 A:PAT Good y Now y You y Wait y CQ m 599BF;4848SD,2333SC,983SK,1648SH,4842-3SD
 906-10340 B was told to Wait. PP did so and says it's touching without prompt.
 PP:WAIT Look j I j. Am. j. Touching. j. Black. j. Stump. j. Q m. A says Good but must Wait. 653BC;
A:WAIT Good y What y Are y You y Touching j Q? j 2332SC,2447SB,2338SC,4857SD,2454-6SB,2677-8SA
 PP: Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q j. PP answers.2318SC,4838-9SD,2322SC,
 A: Good A says Good. 2437-40SB,2659-61SA
 907-10362
 PP:RIGHT I. m. Turned. m. Right. m. Q y. PP turned Right and says so. 817BA,795BB;
 A:WAIT Good y You y Turn y Left y CQ m A says Good. 2662-4SA,2441-3SB
 908-10373 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 818BA,796BB;2665-7SA,
 A:PAT Good y Now y You y Wait y CQ m 2444-5SB,2423SB
 C---- 905 C---- 905 C---- 906 C---- 906 C---- 907 C---- 907 C---- 908 C---- 908
 -#-s- PP:W -#-s- A:P -#-s- PP:W -#-s- A:W -#-s- PP:R -#-s- A:W -#-s- PP:L -#-s- A:P
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 ---N- ---N- ---N- ---N- ---N- ---E- ---E- ---N-
 909-10384 B was told to Wait. PP did so and says it's touching.
 PP:WAIT Look j I j. Am. j. Touching. j. Black. j. Stump. j. Q m. A Pats and says Good. 816BA,793BB;
A:PAT Good y Now y You y Wait y CQ m 2668-9SA,2681-2SA,2458SB,2454-6SB,2677-8SA
 910-10398 B was told to Wait. PP did so and says it's touching.
 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m. 820BA;2679-82SA,2457-8SB,
A:WAIT Good y What m Am m I m Touching j Q? j A says Good. 2447SB,2677-8SA,2454-6SB
 PP: Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q j. 3733SI,1503SJ,1646SH,3736SI,
 A: Bad PP gives the wrong answer. A says Bad. 1631SJ,
 911-10421 4840-2SD,2324-5SC,2440SB
 PP:RIGHT I. m. Turned. m. Right. m. Q y. PP turned Right and says so. 817BA,795BB;
 A:WAIT Good y You y Turn y Left y CQ m 2662SA,2441SB,4845-6SD
 912-10432 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 792BB;2314SC,4791-2SD,
 A:PAT Good y Now y You y Wait y CQ m 2311SC,2423SB
 C---- 909 C---- 909 C---- 910 C---- 910 C---- 911 C---- 911 C---- 912 C---- 912
 -#-s- PP:W -#-s- A:P -#-s- PP:W -#-s- A:W -#-s- PP:R -#-s- A:W -#-s- PP:L -#-s- A:P
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 ---N- ---N- ---N- ---N- ---N- ---E- ---E- ---N-
 913-10443 B was told to Wait. PP did so and says it's touching.
 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m. A says Good. 816BA,793BB;
A:WAIT Good y What m Am m I m Touching j Q? j 2668-49SA,2446-7SB,2681-2SA,2458SB,2454-6SB,2677-8SA
 PP: Look j You. y. Turn. y. Left. y. CQ m. PP gives the wrong answer. 2686SA,1430SK,609SK,
 A: Bad A says Bad. 1689SK,1703SK
 914-10464
 PP:WAIT I. j. Am. j. Touching. j. Black. j. Stump. j. Q y. PP says it's touching without Look. 92BH;
A:WAIT Good y What m Am m I m Touching j Q? j A says Good. 2060SE,983SK,1431SK,1649SH,4843SD
 PP: Look j You j. Are^ y. You. j. Are. j. You. j. Are. y. You. j. [Are. j. You. j.] x 5 Q i.1530SH,
 A: Bad Prompt triggers limit cycle stopped by Boredom. 4867SD,1658SH,1462SK,3757SI,
 915-10498 3765SI,1665-6SH,3757SI,3765SI,1662SJ,4883-5SD,2361-2SC,2714-5SA,2486-8SB
 PP:WAIT Look j You j Are y Touching. j. Black. j. Stump. j. Q y. Yes! A says Good. 92BH;3733SI,
A:WAIT Good y What m Am m I m Touching j Q? j 1430SK,1658SH,1462SK,3763-4SI,1658SJ
 PP: Look j You j Are y Touching. j. Black. j. Stump. j. Q m Correct answer. 2705-7SA,4881SD,
 A: Good A says Good. 4889-90SD
 916-10520
 PP:RIGHT I. m. Turned. m. Right. m. Q y. PP turned Right and says so. 590BD;2057SE,
 A:WAIT Good y You y Turn y Left y CQ m A says Good. 4845-6SD,2329SC
 C---- 913 C---- 913 C---- 914 C---- 914 C---- 915 C---- 915 C---- 916 C---- 916
 -#-s- PP:W -#-s- A:W -#-s- PP:W -#-s- A:W -#-s- PP:W -#-s- A:W -#-s- PP:R -#-s- A:W
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 ---N- ---N- ---N- ---N- ---N- ---N- ---N- ---E-
 917-10531 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 818BA,796BB;
 A:PAT Good y You y Turn y Left y CQ m 2665-7SA,2444-5SB,2423SB
 918-10542 B was told to turn Left but PP Waited and says it turned Left.
 PP:WAIT I. n Turned. n Left. m. Q n A Slaps and says Bad. 596BD;2314SC,2311-2SC
 A:SLAP Bad y You y Turn y Left y CQ m
 919-10553 B was told to turn Left but PP turned Right. A Slaps.
 PP:RIGHT I. m. Turned m. Right m. Q m. PP says it tured Right. 92BH;612SK,25-6SL,
 A:SLAP Good y You y Move y Forward y CQ m A says Good. 1367SK,1464SK,62SL
 920-10564 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 428BH,32BI;

A:RIGHT Good m I m Turned m Right m Q m B didn't see A turn. 106SC,187SD,266-7SB
C---- 917 C---- 917 C---- 918 C---- 918 C---- 919 C---- 919 C---- 920 C---- 920
--s- PP:L --s- A:P --s- PP:W --s- A:S --s- PP:R --s- A:S --s- PP:F --s- A:R
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
---E- ---N- ---N- ---N- ---N- ---E- ---E- ---E-
921-10575
PP:RIGHT I. m. Moved. m. Forward. n, Q m. PP turned Right but says it moved Forward. 26BC;2017SC,
A:FORWARD I m Moved m Forward m Q m A didn't see it. B didn't see A move. 1752-3SC
922-10585
PP:LEFT Bad. n, I. m. Moved. m. Forward. m. CQ m. PP turned Left but says it moved Forward. 106BC;
A:LEFT You y Turn y Left y CQ m A didn't see it. OSC,55SD,369-70SC,1100-1SD
923-10596 B was told to turn Left. PP did so and says so. 387-8SB,401SA
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but was too busy to Pat. 188BA;27SH,315-6SH,
A:FORWARD Good y You y Move y Forward y CQ m 328-9SJ
924-10607 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good but was too busy to Pat. 41BH,32BI;
A:FORWARD Good m I m Moved m Forward m Q m B didn't see A move. 243-5SH,248-50SJ
C---- 921 C---- 921 C---- 922 C---- 922 C---- 923 C---- 923 C---- 924 C---- 924
--w- PP:R --w- A:F --w- PP:L --w- A:L --s- PP:L --s- A:F --s- PP:F --s- A:F
---#- ---#- ---#- ---#- ---#- ---#- ---s#- ---s#N
---E- ---S- ---S- ---E- ---E- ---N- ---N- ---N-
925-10618
PP:FORWARD I. m. Moved. m. Forward. m. CQ m. PP moved Forward and says so with CQ. 52BH,20BI;
A:LEFT You y Turn y Left y CQ m A didn't see it. 984-6SH,972-4SJ,413SL
926-10628 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 51BH,36BI;1405-7SH,1384-5SJ
A:PAT Good y You y Move y Forward y CQ m
927-10639 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. Q m. A Pats and says Good. 84BH,32BI;26-8SK,48SL,66-7SL
A:PAT Good y You y Turn y Left y CQ m
928-10650 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A Pats and says Good. 7BH,75BI;1503-5SH,1480-2SJ
A:PAT Good y Now y You y Wait y CQ m
C---- 925 C---- 925 C---- 926 C---- 926 C---- 927 C---- 927 C---- 928 C---- 928
--#- PP:F --#-N A:L --#-N PP:L --#-W A:P --#-W PP:F --#-W A:P --#-W PP:L --#-S A:P
---#N ---#- ---#- ---#- ---#- ---#- ---#- ---#-
--s- --s- --e- --e- --e- --e- --e- --e-
929-10661 B was told to Wait. PP did so and says it's touching Black Stump.
PPu:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m. A Pats and says Good. 517BH;
A:PAT Good y Now y You y Wait y CQ m 1529SH,3807-8SI,1502SJ,1654-5SH,
930-10675 B was told to Wait and PP did so. A says Good. 1641SJ,1645-8SJ,1648-50SH
PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m. 672BC;2397SC,4952SD,2534-8SB,
A:FORWARD Good y What y Are y You y Touching j Q? j 2765-8SA
PP: Look j I j Am j Touching j Black. j Stump. j Q j 1645-8SH,1503SJ,1633SJ,4745-6SD
A: Good
931-10697
B:LEFT I. m. Turned. m. Left. m. Q m. RM turned Left and PP says so. 219BI;165SK,
A:LEFT Good y You y Turn y Right y CQ m A says Good. 536-7SL,689SK 1616SH
932-10708 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 645BC;837-9SH,839-41SJ
A:PAT Good y Now y You y Wait y CQ m
C---- 929 C---- 929 C---- 930 C---- 930 C---- 931 C---- 931 C---- 932 C---- 932
--s- PP:W --s- A:P --s- PP:W --s- A:F --s- B:L --s- A:L --s- E- PP:R --s- A:P
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
---e- ---e- ---e- ---e- ---e- ---e- ---n- ---n-
933-10719 B was told to Wait. PP did so and says it's touching.
PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m. A says Good. 310BH,125BI;
A:WAIT Good y Look j You j Are j Touching j Black j Stump j Q m 1529SH,3838SI,1502SJ,1654-5SH,
934-10736 1641SJ,3839SI,1645SJ,4832SD,4745-6SD
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 92BH,184BI;
A:WAIT Good y You y Turn y Right y CQ m A says Good. 2280-2SC
935-10747 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 817BB;2412-3SC,4979-80SD,
A:PAT Good y Now y You y Wait y CQ m 2551SB
936-10758 B was told to Wait. PP did so and says it's touching.
PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m. 839BA,818BB;2783-8SA,2552-7SB
A:WAIT What m Am m I m Touching j Q? j No Pat and no Good for imitation.
PP: Look. j. You y Are. y. Touching. j. Black. j. Stump. j. Q j. 1530SH,1503SJ,1646SH,1631SJ,
A: Good 1658SH,1664SH,4718-9SD
C---- 933 C---- 933 C---- 934 C---- 934 C---- 935 C---- 935 C---- 936 C---- 936
--s- PP:W --s- A:W --s- PP:L --s- E- A:W --s- E- PP:R --s- A:P --s- PP:W --s- A:W

```

---#-      ---#-      ---#-      ---#-      ---#-      ---#-      ---#-      ---#-
---n-      ---n-      ---n-      ---n-      ---n-      ---n-      ---n-      ---n-
937-10779
PP:LEFT I. m. Turned. m. Left. m. Q m.                PP turned Left and says so. 614BG,92BH;
A:WAIT Good y You y Turn y Right y CQ m                A says Good. 4971-3SD
938-10790
PP:RIGHT I. m. Turned. m. Right. m. Q m.                B was told to turn Right. PP did so and says so.
A:PAT Good y Now y You y Wait y CQ m                A Pats and says Good. 817BB;2549-51SB
939-10801
PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.                B was told to Wait. PP did so and says it's touching.
A:WAIT What m Am m I m Touching j Q? j                B was asked and PP answers correctly. A says Good. 839BA,818BB;2783-8SA,2552-7SB
PP: Look. j. You. y. Are. y. Touching. j. Black. j. Stump. j. Q j.                2795-800SA,2563-8SB
A: Good
940-10822
PP:LEFT I. m. Turned. m. Left. m. Q m.                PP turned Left and says so. 842BA,820BB;
A:LEFT Good y I m Turned m Left m Q m                A says Good. B saw A turn. 2801-3SA,2569-71SB
C---- 937 C---- 937 C---- 938 C---- 938 C---- 939 C---- 939 C---- 940 C---- 940
-#-S- PP:L -#-E- A:W -#-E- PP:R -#-S- A:P -#-S- PP:W -#-S- A:W -#-S- PP:L -#-E- A:L
---#-      ---#-      ---#-      ---#-      ---#-      ---#-      ---#-      ---#-
---n-      ---n-      ---n-      ---n-      ---n-      ---n-      ---n-      ---n-
941-10833
PP:FORWARD Q m.                66BH,53BI
A:FORWARD I m Moved m Forward m Q m                B didn't see A move.
942-10840
PP:LEFT I. m. Moved. m. Forward. m. CQ m.                PP turned Left but says it moved Forward. 106BC;2112SE,
A:RIGHT You y Turn y Left y CQ m                A didn't see it. 2109SF,2112SG,2385-7SC
943-10850
PP:LEFT I. m. Turned. m. Left. m. Q m.                B was told to turn Left. PP did so and says so.
A:PAT Good y You y Turn y Left y CQ m                A Pats and says Good. 669BC;4928-30SD
944-10861
PP:LEFT I. m. Turned. m. Left. m. Q m.                B was told to turn Left. PP did so and says so.
A:PAT Good y You y Move y Forward y CQ m                A Pats and says Good. 84BH,75BI;1582-3SH,
1558SJ,849-50SJ,848SH
C---- 941 C---- 941 C---- 942 C---- 942 C---- 943 C---- 943 C---- 944 C---- 944
-#-E- PP:F -#-E- A:F -#-E- PP:L -#-N A:R -#-N PP:L -#-W A:P -#-W PP:L -#-S A:P
---#-      ---#-      ---#-      ---#-      ---#-      ---#-      ---#-      ---#-
---w-      ---w-      --w--      --w--      --n--      --n--      --n--      --n--
945-10872
PP:FORWARD I. m. Moved. m. Forward. m. Q m.                B was told to move Forward. PP did so and says so.
A:PAT Good y You y Turn y Right y CQ m                A Pats and says Good. 289BH,32BI;112-4SH,110-2SJ
946-10883
PP:RIGHT I. m. Turned. m. Right. m. Q m.                B was told to turn Right. PP did so and says so.
A:FORWARD Good y Now y You y Wait y CQ m                A says Good. 8BH,43BI;1620-2SH,1605-7SJ
947-10894
PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.                B was told to turn Right. PP did so and says so.
A:RIGHT Good y Now y You y Wait y CQ m                A says Good. 310BH,125BI;1529SH,
1502SJ,16454-5SH,1645-8SJ,1648-50SH
948-10908
PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m.                B was told to Wait. PP did so and says it's touching.
A:WAIT What m Am m I m Touching j Q? j                No Pat or Good for imitation. 622BG,92BH;5049-54SD
PP: Look j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q j.                I not You. 1530SH,3670-8SI,
A: Bad                A says Bad. 1646-8SH,1631-3SJ,
5053-4SD
C---- 945 C---- 945 C---- 946 C---- 946 C---- 947 C---- 947 C---- 948 C---- 948
-#-S PP:F -#-S A:P -#-S PP:R -#-S A:F -#-S PP:W -#-S A:R -#-S PP:W -#-S A:W
---#-      ---#S      ---#S      ---#W      --n#W      --n#W      --e#W      --e#W
--n--      --n--      --n--      --n--      -----      -----      -----      -----
949-10930
PP:LEFT I. m. Turned. m. Left. m. Q m.                PP turned Left and says so. 92BH,219BI; 2155-2SE,2152SF,
A:WAIT Good y You y Turn y Right y CQ m                A says Good. 2155-7SG,2026SF,2153SF,2030SG
950-10941
PP:RIGHT I m Turned m Right m Q m                B was told to turn Right. PP did so and says so.
A:WAIT What m Am m I m Touching j Q? j                No Pat or Good for imitation. 817BB;2277-8SC,2380SB
PP: Look j. You. j. Are. y. Touching. j. Black j. Stump j. Q j                2455SC,547SL,558-9SL,
A: Good                A says Good. 3918-9SI
951-10959
PP:LEFT I. m. Turned. m. Left. m. Q m.                PP turned Left and says so. 683BC;2427-9SC,
A:WAIT Good y You y Turn y Right y CQ m                A says Good. 5067-9SD
952-10970
PP:RIGHT I. m. Turned. m. Right. m. Q m.                B was told to turn Right. PP did so and says so.
A:WAIT What m Am m I m Touching j Q? j                No Pat and no Good for imitation. 772BB;2277-8SC,
4711-2SD,2380SB
PP: Look. j. You. j. Are. y. Touching. j. Black. j. Stump. j. Q j.                A says Good. 2847-52SA,
A: Good                2611-6SB
C---- 949 C---- 949 C---- 950 C---- 950 C---- 951 C---- 951 C---- 952 C---- 952

```

-#--- PP:L -#--- A:W -#--- PP:R -#--- A:W -#--- PP:L -#--- A:W -#--- PP:R -#--- A:W
 --e#W --e#S --e#S --e#W --e#W --e#S --e#S --e#W

 953-10988
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 854BA,830BB;
 A:WAIT Good y You y Turn y Right y CQ m A says Good. 2853-5SA,2617-9SB
 954-10999 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 855BA,772BB;2856-8SA,2620-1SB,
 A:PAT Good y Now y You y Wait y CQ m 2380SB
 955-11010 B was told to Wait. PP did so and says it's touching.
 PP:WAIT Look j I j Am j Touching j Black j Stump j Q m No Pat or Good for imitation. 682BC;2449SC,
 A:WAIT What y Are y You y Touching j Q? j 2595-9SB
 PP: Look j I j Am j Touching j Black j Stump j Q j 2283SC,1646SH,5065SD,2458-9SC,2605SB
 A: Good
 956-11031
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 852BA;2841SA,2606SB;
 A:WAIT Good y You y Turn y Right y CQ m A says Good. 2428-9SC,5068-9SD
 C---- 953 C---- 953 C---- 954 C---- 954 C---- 955 C---- 955 C---- 956 C---- 956
 -#--- PP:L -#--- A:W -#--- PP:R -#--- A:P -#--- PP:W -#--- A:W -#--- PP:L -#--- A:W
 --e#W --e#S --e#S --e#W --e#W --e#W --e#W --e#W --e#S

 957-11042 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 855BA,817BB;2856-8SA,2620-1SB,
 A:PAT Good y Now y You y Wait y CQ m 2380SB
 958-11053 B was told to Wait. PP did so and says it's touching.
 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m. A Pats and says Good. 856BA,
 A:PAT Good y Now y You y Wait y CQ m 831BB;2859-64SA,2622SB,2595-9SB
 959-11067 B was told to Wait and PP did so. A was too busy to Pat.
 PP:WAIT Q m. 828BB
 A:RIGHT You y Turn y Right y CQ m
 960-11074 B was told to turn Right. With unblocking, PP does so.
 PPu:RIGHT I. m. Moved. n Forward. n CQ m. PP says it moved Forward. 92BH;3785-7SI,1676SJ,
 A:FORWARD Bad m I m Moved m Forward m Q m A says Bad. B didn't see A move. 503SL
 C---- 957 C---- 957 C---- 958 C---- 958 C---- 959 C---- 959 C---- 960 C---- 960
 -#--- PP:R -#--- A:P -#--- PP:W -#--- A:P -#--- PP:W -#--- A:R -#--- PP:R -#--- A:F
 --e#S --e#W --e#W --e#W --e#W --e#W --e#W --s#W --s#N

 961-11085
 PP:FORWARD I. m. Moved. m. Forward. m. CQ m. PP moved Forward and says so but with CQ. 600BD;
 A:LEFT Bad y You y Turn y Left y CQ m A says Bad. 2112SE,2110SF,2114SG,1679SH,3791SI,1682SJ
 962-11096 B was told to turn Left. PP did so and says so.
 PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good. 669BC,4928-30SD,2389-90SC
 A:FORWARD Good y You y Move y Forward y CQ m
 963-11107 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. A says Good. 84BH,32BI;1680-2SH,1684-6SJ
 A:LEFT Good y You y Turn y Left y CQ m
 964-11118 B was told to turn Left and PP did so. A Pats.
 PP:LEFT I. m. Turned. m. Left. m. CQ m. PP says it turned Left but with CQ. 7BH,75BI;2137SF,
 A:PAT Bad y Now y You y Wait y CQ m A says Bad. 2141SG,1505SH,3840SI,1482SJ,1739SK
 C---- 961 C---- 961 C---- 962 C---- 962 C---- 963 C---- 963 C---- 964 C---- 964
 -#--- PP:F -#---N A:L -#---N PP:L -#---W A:F -#---W PP:F -#---W A:L -#---W PP:L -#---S A:P
 ---#N ---#N ---#N ---#N ---#N ---#N ---#N ---#N ---#N
 --s-- --s-- --e-- --e-- --e-- --e-- --e-- --n-- --n--
 965-11129 B was told to Wait. PP did so and says it's touching.
 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m. A Pats and says Good. 606BD,
 A:PAT Good y Now y You y Wait y CQ m 585BE,618BF;4987-9SD,2416-7SC,2555-7SB,2787-8SA
 966-11143 B was told to Wait. PP did so and says it's touching.
 PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m. No Pat or Good. 674BC;2415SC,
 A:WAIT What m Am m I m Touching j Q? j 4987SD,2553-7SB,2785-8SA,
 PP: Look. j. You. y. Are. y. Touching. j. Black. j. Stump. j. Q j. Correct answer. 2795-800SA,
 A: Good. 2563-8SB
 967-11164
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. A says Good. 842BA;2801-3SA,
 A:SLAP Good y You y Turn y Right y CQ m A Slaps to stop PP from keeping on turning Left. 2569-71SA
 968-11175 B was told to turn Right. PP did so and says so.
 PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 817BB;2549-51SB
 A:PAT Good y Now y You y Wait y CQ m
 C---- 965 C---- 965 C---- 966 C---- 966 C---- 967 C---- 967 C---- 968 C---- 968
 -#-S- PP:W -#-S- A:P -#-S- PP:W -#-S- A:W -#-S- PP:L -#-E- A:S -#-E- PP:R -#-S- A:P
 ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 ---n- ---n- ---n- ---n- ---n- ---n- ---n- ---n-

969-11186 B was told to Wait. PP did so and says it's touching.
PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m. No Pat or Good. 839BA,818BB;
A:WAIT Look j I j Am j Touching j Black j Stump j Q m 2783-8SA,2552-7SB

970-11202
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. A says Good. 675BC,4995-7SD,
A:SLAP Good y You y Turn y Right y CQ m A Slaps PP again. 2281-2SC

971-11213 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m. Turned. m. Right. m. Q m. A Pats and says Good. 817BB;2561-2SB,2551SB
A:PAT Good y Now y You y Wait y CQ m

972-11224 B was told to Wait. PP did so and says it's touching.
PP:WAIT Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q m. No Pat or Good. 839BA,818BB;
A:WAIT Look j You j Are j Touching j Black j Stump j Q m 2783-8SA,2552-7SB

C---- 969 C---- 969 C---- 970 C---- 970 C---- 971 C---- 971 C---- 972 C---- 972
--S- PP:W --S- A:W --S- PP:L --E- A:S --E- PP:R --S- A:P --S- PP:W --S- A:W
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
---n- ---n- ---n- ---n- ---n- ---n- ---n- ---n-

973-11240
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 819BB;2558-60SB,
A:WAIT Good y You y Turn y Left y CQ m A says Good. 2790-1SA

974-11251 B was told to turn Left but PP turned Right. A Slaps.
PP:RIGHT I m Turned m Right. m. Q m. PP says it turned Right. 559BE;2482-3SC,
A:SLAP Good y You y Turn y Right y CQ m A says Good. 839SH,3840SI,841SJ

975-11262 B was told to turn Right. PP did so and says so.
PP:RIGHT I. m Turned. m. Right. m. Q m. A Pats and says Good. 310BH,110BI;741-3SH,754-6SJ
A:PAT Good y You y Move y Forward y CQ m

976-11273 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. CQ m. Overlooking CQ, A says Good. 94BH,32BI:744-6SH,
A:LEFT Good y You y Turn y Right y CQ m A was too busy to Pat. 757-9SJ,1589SH

C---- 973 C---- 973 C---- 974 C---- 974 C---- 975 C---- 975 C---- 976 C---- 976
--S- PP:L --E- A:W --E- PP:R --S- A:S --S- PP:R --W- A:P --W- PP:F --W- A:L
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
---n- ---n- ---n- ---n- ---n- ---n- ---n- ---n-

977-11284 B was told to turn Right. PP did so and says so.
PP:RIGHT I m Turned. m. Right. m. Q m. A says Good but was too busy to Pat. 206BH,65BI;
A:FORWARD Good y You y Move y Forward y CQ m 4527SD,1547-8SK,78SL,189SL

978-11295 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. CQ m. Overlooking CQ, A says Good. 215BC:
A:RIGHT Good y You y Turn y Left y CQ m A was too busy to Pat. 265-7SC,4535SD

979-11306 B was told to turn Left. PP did so with prompt and says so.
PPu:LEFT I m. Turned. m. Left. m. Q m. A Pats and says Good. 134BD,133BE;1087SH,1074SJ,
A:PAT Good y You y Move y Forward y CQ m 479SH,1557SJ

980-11317 B was told to move Forward. PP did so and says so.
PP:FORWARD I. m. Moved. m. Forward. m. CQ m. Overlooking CQ, A says Good. 41BH,32BI:178-80SH,
A:FORWARD Good y You y Push y Cake o CQ m A was too busy to Pat. 1331-2SI,504SJ,181-2SJ

C---- 977 C---- 977 C---- 978 C-N-- 978 C-N-- 979 C-W-- 979 C-W-- 980 CW--- 980
--W- PP:R --N- A:F --N- PP:F --A:R --PP:L --A:P --PP:F --A:F
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
---w- ---w- ---w- ---w- ---n- ---n- ---n- ---n-

981-11328 B was told to Push Cake. PP did so and says so.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. A Pats and says Good. 224BF;1653SD,695-6SB,751SA
A:PAT Good y You y Turn y Left y CQ m

982-11339 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but was too busy to Pat. 336BA,166BB;
A:FORWARD Good y You y Push y Cake o CQ m 74-6SH,288SJ,74-5SJ

983-11350 B was told to Push Cake. PP did so and says so.
PP:FORWARD I m. Pushed m. Cake. o. Q m. A says Good but was too busy to Pat. 72BH,40BI;
A:FORWARD Good m I m Moved m Forward m Q m B didn't see A move. 578-80SH,600SJ

984-11361
PP:FORWARD Next. m. Turn. m. Is. m. Mine. m. So. m. Q m. Incomplete; A out of place. 69BH,58BI;
A:LEFT You y Turn y Left y CQ m 199SC,707SD,206SB,208-9SA,207-8SB,195SB

CW--- 981 W---- 981 W---- 982 S---- 982 S---- 983 ---- 983 --n- 984 --n- 984
--PP:F C#--- A:P C#--- PP:L C#--- A:F C#n- PP:F S#n- A:F S#--- PP:F S#--- A:L
--n#- --n#- --n#- --n#- --n#- C--#- C--#- S--#- S--#-
----- ----- ----- -----

985-11373 B was told to turn Left but PP Pushed Cake. A out-of-reach to Slap.
PP:FORWARD I. m. Pushed. m. Cake. o. Q m. PP says it Pushed Cake. A says Good. 488BG,67BH,178BI;
A:FORWARD Good y You y Turn y Left y CQ m 754-5SI,719-20SJ,705SH,1350SI

986-11384 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but was too busy to Pat. 277BA,166BB;
A:LEFT Good y You y Push y Cake o CQ m 1637-9SD

987-11395 B was told to Push Cake and PP did so.

PP:FORWARD Q m. A Pats. 234BG,72BH,40BI;
A:PAT You y Turn y Left y CQ m B was told to turn Left but PP pushed Cake and talks as though A was
988-11402 nearly in place for a Squash but A is out-of-sight. A Slaps and says Bad.
PP:FORWARD Next. m. Turn. m. Is. m. Mine^ m. So. m. You no! Move. no! Forward. no! CQ m. 67BH;309SK,
A:SLAP Bad y You y Turn y Left y CQ m 27SL,195-6SJ,194SH,3875SD,3879SD,314-5SK,
--w--- 985 --w--- 985 -w--- 986 -w--- 986 -s--- 987 -s--- 987 -s--- 988 -s--- 988 176SL,672-3SH
--#--- PP:F --#--- A:F --#--- PP:L --#--- A:L --#--- PP:F --#--- A:P --#--- PP:F --#--- A:S
S---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
C--- SC--- SC--- EC--- EC--- -EC- -EC- -EC-
989-11418 B was told to turn Left but RM turned Right. PP says it Pushed Cake.
B:RIGHT I. m. Pushed. m. Cake. o. Q m. A Slaps and says Bad. 488BG,67BH;2225SE,2222SF,2225SG,
A:SLAP Bad y You y Turn y Right y CQ m 2514-5SC
990-11429 B was told to turn Right but PP turned Left. A Slaps.
PP:LEFT I. m. Turned. m. Left. m. Q m. PP says it turned Left. A says Good. 66BE;232SK,57SL,
A:SLAP Good y You y Turn y Left y CQ m 596-7SJ,577SH
991-11440 B was told to turn Left but PP Pushed Cake and says so with CQ.
PP:FORWARD I. m. Pushed. m. Cake. o. CQ m. A says Bad but was out-of-reach to Slap. 488BG,72BH,
A:WAIT Bad y You y Turn y Left y CQ m 91BI;285-6SI,721SJ,492SG,954SK
992-11451 B was told to turn Left but PP Pushed Cake. A was out-of-reach to Slap.
PP:FORWARD I n, Pushed n, Cake n, Q n, PP says it Pushed Cake. A says Good. 96BH,228BI;
A:LEFT Good y You y Turn y Left y CQ m 2528SC,2514-5SC
-s--- 989 -s--- 989 -s--- 990 -s--- 990 -s--- 991 -s--- 991 -s--- 992 -s--- 992
--#--- B:R --#--- A:S --#--- PP:L --#--- A:S --#--- PP:F --#--- A:W --#--- PP:F --#--- A:L
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
--EC- --SC- --SC- --EC- --EC- --EC- --EC- --EC-
993-11462 B was told to turn Left. PP did so and says so.
PP:LEFT I. m. Turned. m. Left. m. Q m. A says Good but is out-of-reach to Pat. 277BA;
A:FORWARD Good y You y Push y Cake o CQ m 74-6SH,73-5SJ
994-11473 B was told to Push Cake. PP did so and uses WM to tell A to move Forward.
PP:FORWARD Next. m. Turn. m. Is. m. Mine. m. So. m. You. y. Move. y. Forward. y. CQ m. 335BB;913-5SB,
A:FORWARD Good y Next m Turn m Is m Yours m So m You y Push y Cake o CQ m 549SB,916-20SB
995-11494 B was told to Push the Cake. PP did so and tells A to Wait.
PP:FORWARD Next. m. Turn. m. Is. m. Mine. m. So. m. You. y. Wait. y. Q m. 342BA,232BB;1006-8SA,921SB,
A:WAIT Good y Next m Turn m Is m Yours m So m You y Squash y Cake o CQ m 284-6SB,583SA,1009-11SA,
996-11514 B was told to Squash Cake. PP did so and sets up WM with <Yours. 703-5SB
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. So. m. Next. m. Turn. m. Is. m. <Yours. m. Q m.
A:RIGHT Good y You y Squashed y Cake m So m Next m Turn m Is m <Mine m Q m 154BA,155BB;1346-53SA,
-e--- 993 -e--- 993 -e--- 994 -e--- 994 -e--- 995 -e--- 995 -e--- 996 -e--- 996 1189-96SB
--#--- PP:L --#--- A:F --#--- PP:F --#--- A:F --#--- PP:F --#--- A:W --#--- PP:F --#--- A:R
---#C ---#C ---#C ---#N ---#N ---#N ---#N ---#N ---#N ---#N
---E ---N ---N ---N ---N ---N ---N ---N ---N ---N ---N
997-11535
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 423BA,413BB;296SA,1197-9SB,
STOPPING as Go on rejected. 395SA,636SA

Second Interaction

© John H Andreac

Conversation

between robot B (baby) with PP brain and
robot A (adult) controlled by Teacher (me).

World configuration	-E--C	Robot B (upper case) facing East in row 1, col 2.
at start:	-#--w	Cake C in row 1 col 5. Object can be Cake or Roll R.
Surrounding Wall	---#-	Robot A (lower case) facing West in row 2, col 5.
not shown.	-----	Brown Stump (#) in 2,2; Black Stump (#) in 3,4.

BodyMove actions are FORWARD, LEFT, RIGHT, WAIT, PAT and SLAP.

If the learning brain PP fails to choose a BodyMove for robot B, the random Reflex-Motion algorithm **RM** selects BodyMoves for robot B. The algorithm may be found in Fig. 5 of the accompanying Report.

If the Object is in front of a robot, a FORWARD BodyMove is described as a Push, Squeeze or Squash according to whether there is one empty square (Space) into which the Object can be Pushed, or two Spaces into one of which the Object can be Squeezed, randomly chosen, or no Space in which case the Object is Squashed and vanishes (is consumed), a new Object (Cake) appearing in one of the other Spaces in the World, randomly selected. The robot that Squashes the Object is automatically approved.

Hand Pointing actions are PointYou y, PointMe m, PointObject o, PointBrownStump i, PointBlackStump j, PointNWcorner nw, PointNEcorner ne, PointSEcorner se, PointSW corner sw.

Speech actions are any Word introduced by teacher through robot A, the first letter being upper case. A Speech action also has Intonation:

FLT flat, DRP drop, CMD command, RIS rise (for questions), YES approve, NEG disapprove.

A Speech action also has Stress: If a Word is stressed it is preceded by <, otherwise -.

Conversation is controlled by intonation:

FLT, YES or NEG when robot is continuing to speak and point.

DRP or CMD when robot is ending its speaking and pointing.

RIS when robot transfers speaking and pointing to other robot.

Examples of Speech and their abbreviations in the Interaction:

DRP-Quiet (abbreviated to **Q**) is last Word of a robot's speaking and pointing.

CMD-Quiet (abbreviated to **CQ**) is last Word of a robot's command sequence.

RIS-Quiet (abbreviated to **RQ**) is last Word of a robot's question sequence.

YES-Good (abbreviated to **Good** in the following listing) for approval.

NEG-Bad (abbreviated to **Bad** in the following listing) for disapproval.

FLT-Word (abbreviated to Word in the following listing).

FLT<Word (abbreviated to <Word) sets up Working Memory **WM** in PP if said by PP.

The pattern of the conversation is BodyMove by Robot B, Speech-Pointing sequence by Robot B, possible alternation of Speech-Pointing sequences by robots, BodyMove by Robot A, Speech-Pointing sequence by Robot A, possible alternation of Speech-Pointing sequences by robots; repeat this "main step cycle."

After 4 steps, the World is displayed for the situation before and after each BodyMove.

A BodyMove by Robot A is shown by "**A:**", while a BodyMove by Robot B is either "**B:**" if the BodyMove is chosen by RM, or "**PP:**" if it is chosen by PP. A full stop "." after a word or pointing by PP shows that PP chose it, without Teacher unblocking or prompting it. "n," is a default NoPoint when no pointing is chosen by PP and robot B is not within reach of robot A. When robot B **is** within reach of robot A and hasn't selected a pointing, robot A can push robot B's arm to point. Teacher can introduce a new Speech Word at any time.

The associations used by robot B to perform its body moves and speech (not pointing) are listed at the end of the row with robot B's body move, but may spill over into the ends of the following rows of the Interaction. They are always the most right justified and are in black. When the body move has been selected by RM (not PP), the random number N used in the RM algorithm is given as Rand=N instead of the numbers of the associations. A semicolon is used to separate the associations for the body move from the associations for the speech.

The comments include whether robot B sees robot A moving and saying what it did, or didn't see, because robot B cannot learn from robot A by imitation unless it can see robot do the BodyMoves.

Comments are right justified.

Colour indications:
Red and Brown are approved.
Blue and Purple are disapproved.
Green is neutral.

Bold for special actions by robot A (controlled by human teacher).

PURR-PUSS in SQUASH-POP world. John H Andreae

Sun Feb 05 20:30:07 NZDT 2017

Random seed for World = 140827 Random seed for PP = 200829

New Interaction with Teacher not giving approval so the density of approval goals in LTM is reduced and PP is encouraged to construct longer Plans. Novelty goals have been made equal in value to approval goals.

```
1-0
B:FORWARD Q n
A:RIGHT I m Turned m Right m Q m
2-7
B:FORWARD Q n
Tchr: through-Robot-A,-will-not-be-giving-approval-to-Robot-B-in-this-run,-only-disapproval.
A:LEFT I m Turned m Left m Q m
3-14
B:FORWARD (Squashed) Q n
A:LEFT I m Turned m Left m Q m
4-21
B:RIGHT Q n,
A:FORWARD I m Moved m Forward m Q m
-E--C 1 --E-C 1 --E-C 2 ---EC 2 ---EC 3 ----E 3 ----E 4 ----S 4
-#--w B:F -#--w A:R -#--n B:F -#--n A:L -#--w B:F -#--w A:L -#--s B:R -#--s A:F
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
----- -----
5-28
B:FORWARD Q n,
A:FORWARD I m Moved m Forward m Q m
6-35
PP:FORWARD Q n,
A:RIGHT I m Turned m Right m Q m
7-42
B:LEFT Q n
A:FORWARD I m Moved m Forward m Q m
8-49
B:RIGHT Q n,
A:FORWARD I m Pushed m Cake o Q m
----S 5 ---- 5 ---- 6 ---- 6 ---- 7 ---- 7 ---- 8 ---- 8
-#---- B:F -#--S A:F -#--S PP:F -#---- A:R -#---- B:L -#---- A:F -#---- B:R -#---- A:F
---#s ---#s ---#- ---#S ---#S ---#E ---#E ---#S
--C-- --C-- --C-s --C-s --C-w --C-w --Cw-- --Cw--
9-56
B:FORWARD I. m. Moved. m. Forward. m. Q m.
A:FORWARD I m Pushed m Cake o Q m
10-66
PP:RIGHT Q n,
A:RIGHT I m Turned m Right m Q m
11-73
PP:FORWARD I. m. Moved. m. Forward. m. Q m.
A:FORWARD I m Moved m Forward m Q m
12-83
PP:FORWARD Q n,
A:LEFT I m Turned m Left m Q m
---- 9 ---- 9 ---- 10 ---- 10 ---- 11 ---- 11 ---- 12 ---- 12
-#---- B:F -#---- A:F -#---- PP:R -#---- A:R -#---- PP:F -#---- A:F -#---- PP:F -#---- A:L
---#S ---#- ---#- ---#- ---#- ---#- ---#- -n--#- -n--#-
-Cw-- -Cw-S Cw--S Cw--W Cn--W Cn--W C--W C--W
13-90
PP:FORWARD Q n
A:FORWARD I m Moved m Forward m Q m
14-97
PP:FORWARD (Squashed) Q n
A:RIGHT I m Turned m Right m Q m
```

15-104
PP:RIGHT I. m. Moved. m. Forward. m. Q m. PP turned Right but says it moved Forward. 2BE;
A:FORWARD I m Moved m Forward m Q m A didn't see it. 3-5SL

16-114
PP:FORWARD Q n, 6BH, 8BI
A:FORWARD I m Moved m Forward m Q m

----	13	----	13	----	14	----	14	----	15	----	15	----	16	----	16
-#---	PP:F	-#---	A:F	-#---	PP:F	-#---	A:R	-#---	PP:R	-#---	A:F	n#---	PP:F	n#---	A:F
-w-#-		-w-#-		w-#-		w-#-		n-#-		n-#-		---#-		N-#-	
C-W--		CW--		CW--		W---C		W---C		N---C		N---C		---C	

17-121
PP:FORWARD Q n, 8BH, 3BI
A:RIGHT I m Turned se Right m Q m

18-128
PP:LEFT I. m. Moved. m. Forward. m. Q m. PP turned Left but says it moved Forward. 4BI;
A:FORWARD Bad m I m Moved m Forward m Q m A says Bad. 3-5SL
PLAN: 1-1 PP:RIGHT Q n 6BD, 6BE, 6BF
1-3 A:FORWARD I m Pushed m Cake o Q m 13BOA; 32SOB, 31-3SOA
2-8 PP:FORWARD I m Moved m Forward m Q m 6BA, 6BB; 0-2SA, 0-2SB
2-13 A:FORWARD I m Pushed m Cake o Q m 15BOA; 38-41SOA
3-18 PP:RIGHT Plan abandoned with failure to predict Touch. 7BA, 7BB

19-139
PP:RIGHT Q n, 6BD, 6BE, 6BF
A:FORWARD I m Moved m Forward m Q m

20-146
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 3BI; 12-4SK
A:RIGHT I m Turned m Right m Q m No approval.

n----	17	n----	17	e----	18	e----	18	-e---	19	-e---	19	--e--	20	N-e--	20
-#---	PP:F	N#---	A:R	N#---	PP:L	W#---	A:F	W#---	PP:R	N#---	A:F	N#---	PP:F	-#---	A:R
N--#-		---#-		---#-		---#-		---#-		---#-		---#-		---#-	
---C		---C		---C		---C		---C		---C		---C		---C	

21-156
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 9BH; 33-5SK,
A:FORWARD I m Moved m Forward m Q m No approval. 4SL

22-166
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 14BH, 8BI;
A:FORWARD I m Moved m Forward m Q m No approval. 39-41SK, 7-8SL

23-176
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 19BH, 8BI;
A:FORWARD I m Moved m Forward m Q m No approval. 45-7SK, 11SL, 7-8SL

24-186
PP:RIGHT I. m. Moved. m. Forward. m. Q m. PP turned Right but says it moved Forward. 0BH, 8BI;
A:LEFT I m Turned m Left m Q m A didn't see it. 11SL, 7-8SL

N-s--	21	E-s--	21	E----	22	-E---	22	-E---	23	--E--	23	--E--	24	--S--	24
-#---	PP:R	-#---	A:F	-#s--	PP:F	-#s--	A:F	-#---	PP:F	-#---	A:F	-#---	PP:R	-#---	A:L
---#-		---#-		---#-		---#-		---#-		---#-		---#-		---#-	
---C		---C		---C		---C		---C		---C		---C		---C	

25-196
B:WAIT Q n Rand=19
A:FORWARD I m Moved m Forward m Q m

26-203
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 3BI;
A:FORWARD I m Pushed m Cake o Q m A didn't see it. 51-3SK, 6-8SL

27-213
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 24BH;
A:LEFT I m Turned m Left m Q m No approval. 54-6SK, 1-2SL

28-223
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 25BH, 14BI;
A:FORWARD I m Pushed m Cake o Q m No approval. 57-9SK

--S--	25	--S--	25	--S--	26	----	26	----	27	----	27	----	28	----	28
-#---	B:W	-#---	A:F	-#---	PP:F	-#S--	A:F	-#S--	PP:F	-#---	A:L	-#---	PP:F	-#---	A:F
---#-		---#-		---#-		---#-		---#-		---#-		---#-		---#-	
-e-C		-e-C		-e-C		-e-C		-e-C		-e-C		-e-C		-e-C	

29-233
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 26BH;
A:FORWARD I m Pushed m Cake o Q m No approval. 63-5SK

30-243
PP:FORWARD I. m. Turned. n, Q n, Incomplete sequence. 28BH, 15BI; 12SL, 1SL
A:LEFT I m Turned m Left m Q m

31-252
PP:FORWARD Q n 9BI

A:FORWARD I m Moved m Forward m Q m
32-259
PP:RIGHT I. n, Moved. n, Forward. n, Q n, PP turned Right but says it moved Forward. 5BI;
A:RIGHT I m Turned m Right m Q m A didn't see it. 18-20SI
----- 29 ----- 29 -----C 30 -----C 30 -----C 31 -----C 31 -----C 32 -----C 32
-#-C PP:L -#-C A:F -#-n PP:F -#-n A:L -#-w PP:F -#-w A:F -#-w PP:R -#-w A:R
---#n ---#n ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
--S-- --E-- --E-- --E- --E- --E- --E- --E-
33-269
B:RIGHT I. m. Turned. m. Right. m. Q m. RM turned Right and PP says so. Rand=10;
A:FORWARD I m Moved m Forward m Q m No approval. 15-7SH,16-7SJ
34-279
PP:RIGHT I. m. Moved. m. Forward. m. Q m. PP turned Right but says it moved Forward. 14BH,8BI
A:RIGHT I m Turned m Right m Q m A didn't see it. 11SL,7-8SL
35-289
B:FORWARD I. m. Turned. m. Right. m. Q m. RM moved Forward but PP says it turned Right. Rand=8;
A:RIGHT Bad y I m Turned m Right m Q m A says Bad. 78SK,9-10SL,40SJ
36-300
PP:FORWARD Q n 34BH
A:LEFT I m Turned m Left m Q m
-----C 33 -----C 33 ---nC 34 ---nC 34 ---eC 35 ---eC 35 ---sC 36 ---sC 36
-#-n- B:R -#-n- A:F -#- PP:R -#- A:R -#- B:F -#- A:R -#- PP:F -#-N A:L
---#- ---#- ---#- ---#- ---#- ---#N ---#N ---#-
----S ----W ----W ----N ----N ----N ----N ----N ----N
37-307
PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 33BH,1BI;
A:FORWARD (Squashed) I m Squashed m Cake m Q m No approval. 3-5SI
38-317
PP:LEFT Q n 3BH
A:RIGHT I m Turned m Right m Q m
39-324
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 5BH;
A:RIGHT I m Turned m Right m Q m No approval. 3-5SH
40-334
PP:FORWARD I. m. Turned. m. Right. m Q m. PP moved Forward but says it turned Right. 7BH;
A:FORWARD Bad m I m Moved m Forward m Q m A says Bad. 18-9SI,122SI
---eC 37 ---eC 37 ---e 38 ---e 38 ---s 39 ---s 39 ---w 40 ---w 40
-#-N PP:L -#-W A:F C#-W PP:L C#-S A:R C#-S PP:F C#- A:R C#- PP:F C#- A:F
---#- ---#- ---#- ---#- ---#- ---#S ---#S ---#-
----S ----W ----W ----N ----N ----N ----N ----N ----N
41-345
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 17BC;
A:FORWARD I m Moved m Forward m Q m No approval. 33SK,16-7SJ,17SH
42-355
PP:RIGHT I. m. Moved. m. Forward. m. Q m. PP turned Right but says it moved Forward. 14BH,8BI;
A:FORWARD I m Moved m Forward m Q m A didn't see it. 44-6SH,45-7SJ
43-365
PP:FORWARD Q n, 39BH,8BI
A:FORWARD I m Moved m Forward m Q m
44-372
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 34BH,3BI;
A:LEFT I m Turned m Left m Q m No approval. 101-3SK,6-8SL
---w- 41 ---w- 41 --w-- 42 --w-- 42 -w--- 43 -w--- 43 w--- 44 w--- 44
C#--- PP:R C#--- A:F C#--- PP:R C#--- A:F C#--- PP:F C#--- A:F C#--- PP:F C#---N A:L
---#- ---#- ---#- ---#- ---#- ---#N ---#N ---#-
----S ----W ----W ----N ----N ----N ----N ----N ----N
45-382
PP:FORWARD I. n, Q n, Incomplete sequence. 43BH,14BI;13SL
A:FORWARD I m Pushed m Cake o Q m
46-390
PP:LEFT Q n, 26BD,25BE,26BF
A:FORWARD I m Pushed m Cake o Q m
47-397
PP:FORWARD I. m. Turned. n, Q m. Incomplete and wrong sequence. 28BH,6BI;
A:LEFT I m Turned m Left m Q m A didn't see it. 101-2SK,0-1SL
48-406
PP:WAIT I. m. Turned. m. Left. m. Q m. PP Waited but says it turned Left. 43BH,14BI;
A:FORWARD Bad y I m Moved m Forward m Q m A says Bad. 13-4SL,23SL
s--- 45 s---N 45 ---N 46 ---W 46 ---W 47 ---W- 47 ---W- 48 ---W- 48
C#--N PP:F C#--- A:F s#--- PP:L s#--- A:F -#--- PP:F -#--- A:L -#--- PP:W -#--- A:F
---#- ---#- C--#- C--#- s--#- s--#- e--#- e--#-

```

-----
49-417
B:LEFT Q n
A:FORWARD Look j I j Am j Touching j Black j Stump j Q j
50-427
B:FORWARD Look. j. I. j. Am. j. Touching. j. Black. j. Stump. j. Q j. RM moved Forward. Rand=13;
A:LEFT I m Turned m Left m Q m PP says it is touching. Immediate imitation of robot A. 118-23SK
51-440
PP:LEFT I. m. Moved. m. Forward. m. Q m. PP turned Left but says it moved Forward. 50BH;
A:LEFT Bad m I m Turned m Left m Q m A says Bad. 146SI,57SG,148SI
52-451
PP:FORWARD Bad. n, I. n, Moved. n, Forward. n, Q n, PP moved Forward and says so. 36BE;18SI,60SI,
A:FORWARD I m Moved m Forward m Q m A didn't see it so can't unblock the pointing. 19-20SI
--W- 49 ---S- 49 ---S- 50 ----- 50 ----- 51 ----- 51 ----- 52 ----- 52 ----- No approval.
-#--- B:L -#--- A:F -#--- B:F -#-S- A:L -#-S- PP:L -#-E- A:L -#-E- PP:F -#-E- A:F
-e-#- -e-#- -e-#- -e-#- -e-#- -e-#- -e-#- -e-#-
C---- C---- C---- C---- C---- C---- C---- C----
53-462
PP:RIGHT I. n, Q n, Incomplete sequence. 6BC;18SL
A:FORWARD I m Moved m Forward m Q m
54-470
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 14BH,3BI;
A:LEFT I m Turned m Left m Q m A didn't see it. 9SK,6SL,4-5SJ
55-480
PP:FORWARD I n, Q n, Incomplete sequence. 7BH,14BI;12SK
A:LEFT I m Turned m Left m Q m
56-488
PP:RIGHT Q n, 9BH
A:RIGHT I m Turned m Right m Q m
----- 53 ----- 53 ----- 54 ----- 54 ----- 55 ----- 55 ----- 56 ----- 56
-#---E PP:R -#---S A:F -#---S PP:F -#--- A:L -#--- PP:F -#--- A:L -#--- PP:R -#--- A:S
-w-#- -w-#- -w-#- -w-#S s-#S s-#S e-#- e-#-
C---- C---- C---- C---- C---- C---S C---S C---W
57-495
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 14BH,0BI;
A:LEFT I m Turned m Left m Q m No approval. 3-5SH,3-5SJ
58-505
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 7BH,14BI;
A:RIGHT I m Turned m Right m Q m No approval. 45-7SK,13-5SL
59-515
PP:FORWARD I m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 0BH,18BI;
A:WAIT You y Squash y Cake o CQ m No approval. 9SL,4-5SL
60-525
PP:RIGHT I. m. Turned. m. Right. m. Q m. B was told to Squash Cake but PP turned Right. A Slaps.
A:SLAP You y Turn y Left y CQ m PP says it turned Right. 2BH;21-3SK
----- 57 ----- 57 ----- 58 ----- 58 ----- 59 ----- 59 ----- 60 ----- 60
-#--- PP:F -#--- A:L -#--- PP:F -#--- A:R -#--- PP:F -#--- A:W -#--- PP:R -#--- A:S
s-#- s-#- e-#- e-#- s-#- s-#- s-#- s-#-
C---W C---W C---W C-W-- C-W-- CW--- CW--- CN---
61-535
PP:LEFT I. m. Turned. m. Left. m. Q m. B was told to turn Left. PP did so and says so.
A:WAIT You y Squash y Cake o CQ m No approval. 15BH;94-6SK
62-545
PP:FORWARD (Squashed) I. m. Turned. m. Right. m. Q m. B was told to Squash Cake. PP did so. Automatic approval.
A:LEFT Bad y I m Turned m Left m Q m PP says it turned Right. 41BH;97-8SK,
A says Bad. 44-5SL
63-556
PP:RIGHT I. m. Moved. m. Forward. m. Q m. PP turned Right but says it moved Forward. 4BH;
A:FORWARD Bad m I m Moved m Forward m Q m A says Bad. 36SK,7-8SJ,8SH
64-567
PP:LEFT I. m. Moved. m. Forward. n, Q n, PP turned Left but says it moved Forward. 6BH,24BI;
A:FORWARD I m Moved m Forward m Q m A didn't see it. 12-4SI
----- 61 ----- 61 ----- 62 ----- 62 ----- 63 ----- 63 ----- 64 ----- 64
-#--- PP:L -#--- A:W -#--- PP:F C#--- A:L C#--- PP:R C#--- A:F C#--- PP:L C#--- A:F
s-#- s-#- s-#- s-#- e-#- e-#- e-#- e-#-
CN--- CW--- CW--- W---- W---- N---- N---- W----
65-577
PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 5BI;56-7SH,
A:LEFT I m Turned m Left m Q m A didn't see it. 16-7SJ,17SH
66-587
PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 14BH,14BI;
A:FORWARD I m Moved m Forward m Q m A didn't see it. 13SL,89-90SJ,89SH

```

67-597

PP:FORWARD I. m. Turned. m Right. m. Q m. PP Pushed Cake but says it turned Right. 2BH;
A:RIGHT Bad m I m Turned m Right m Q m A says Bad. 11SL,7SL,29SL

68-608

B:FORWARD I. m. Moved. m. Forward. m. Q m. RM Pushed Cake but PP says it moved Forward. Rand=3;
A:FORWARD I m Moved m Forward m Q m A didn't see it. 126-8SI

-----	65	-----	65	-----	66	-----	67	C----	67	C----	68	NC---	68		
C#---	PP:R	C#---	A:L	C#---	PP:F	C#---	A:F	C#n--	PP:F	N#n--	A:R	N#e--	B:F	-#e--	A:F
--e#-		--e#-		--n#-		N-n#-		N--#-		---#-		---#-		---#-	
W----		N----		N----											

69-618

B:RIGHT I. m. Q m. Incomplete sequence. Rand=14;89SK
A:FORWARD I m Moved m Forward m Q m

70-626

PP:FORWARD Q n, 40BH,33BI
A:LEFT I m Turned m Left m Q m

71-633

PP:FORWARD I. m. Pushed. m. Cake. o. Q m. PP Pushed Cake and says so. 61BH,1BI;
A:LEFT I m Turned m Left m Q m No approval. 18-20SK,22SL,14SL

72-643

PP:FORWARD I. m Pushed. m. Cake. o. Q m. PP Pushed Cake and says so. 2BH;
A:RIGHT You y Squash y Cake o CQ m No approval. 18-20SK,13-4SL,56SL

NC---	69	EC---	69	EC---	70	-EC--	70	-EC--	71	--EC-	71	--EC-	72	---EC	72
-#-e-	B:R	-#-e-	A:F	-#-e-	PP:F	-#-e-	A:L	-#-n	PP:F	-#-n	A:L	-#-w	PP:F	-#-w	A:R
---#-		---#-		---#-		---#-		---#-		---#-		---#-		---#-	
-----		-----		-----		-----		-----		-----		-----		-----	

73-653

PP:FORWARD (Squashed) I m Squashed. m. Cake. m. Q m PP Squashed Cake and says so. 57BG,2BH;
A:LEFT I m Turned m Left m Q m Automatic approval. 96SH,98-9SK

74-663

PP:RIGHT I m Turned m. Q n Incomplete sequence. 4BH;99SH,14SL
A:FORWARD I m Pushed m Cake o Q m

75-672

PP:FORWARD I. m. Turned. n, Q m. Incomplete sequence. 6BH,6BI;0-1SL
A:FORWARD I m Squeezed m Cake o Q m

76-681

PP:FORWARD I. n, Moved. n, Forward. n, Q n, PP moved Forward and says so. 0BH;9-11SK
A:LEFT I m Turned m Left m Q m A is out-of-reach to unblock pointing.

--EC	73	----E	73	----E	74	----S	74	----S	75	-----	75	-----	76	-----	76
-#-n	PP:F	-#-Cn	A:L	-#-Cw	PP:R	-#-Cw	A:F	-#Cw-	PP:F	-#CwS	A:F	-#w-S	PP:F	-#w--	A:L
---#-		---#-		---#-		---#-		---#-		---#-		---C#-		---C#S	
-----		-----		-----		-----		-----		-----		-----		-----	

77-691

PP:FORWARD Bad n I. m Moved. m Forward. m Q m PP moved Forward and says so. 7BH;86SE,59SF,
A:FORWARD I m Pushed m Cake o Q m No approval. 87SC,88-9SE,87-8SF,87-8SG

78-702

PP:LEFT I. m. Turned. m Left. m Q m. PP turned Left and says so. 9BH,16BI;
A:FORWARD I m Squeezed m Cake o Q m No approval. 18-9SI,122SI

79-712

PP:LEFT Q n 26BF
A:LEFT I m Turned m Left m Q m

80-719

PP:FORWARD I m Moved m. Forward m. Q m PP moved Forward and says so. 9BI;
A:FORWARD I m Pushed m Cake o Q m No approval. 78SK,37-8SL

-----	77	-----	77	-----	78	-----	78	-----	79	-----	79	-----	80	-----	80
-#s--	PP:F	-#s--	A:F	-#s--	PP:L	-#s--	A:F	-#s--	PP:L	-#s--	A:L	-#s--	PP:F	-#s--	A:F
--C#S		--C#-		--s#-		--s#-		---#-		---#-		---#-		---#N	
-----		----S		--C-S		--C-E		--sCE		--sCN		--eCN		--eC-	

81-729

PP:FORWARD I. m. Turned. m. Left. m. Q m. PP moved Forward but says it turned Left. 34BH;
A:LEFT Bad y I m Turned m Left m Q m A says Bad. 101-2SK,16SL,65-6SL

82-740

PP:FORWARD Bad. n I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 43BH,27BI;
A:RIGHT I m Turned m Right m Q m No approval. 86-7SC,149-50SC

83-751

PP:RIGHT I m. Turned m. Right m. Q m. PP turned Right and says so. 30BD,29BE,30BF
A:LEFT You y Turn y Right y CQ m No approval. 80-1SK,26-7SL,24SL

84-761

PP:RIGHT I. m Turned. m Right. m Q m. B was told to turn Right. PP did so and says so.
A:RIGHT You y Move y Forward y CQ m No approval. 36BH;33-5SK

-----	81	-----	81	-----	82	----N	82	----N	83	----E	83	----E	84	----S	84
-------	----	-------	----	-------	----	-------	----	-------	----	-------	----	-------	----	-------	----

-#--- PP:F -#--N A:L -#--N PP:F -#--- A:R -#--- PP:R -#--- A:L -#--- PP:R -#--- A:R
 ---#N ---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
 ---eC ---eC ---nC ---nC ---eC ---eC ---nC ---nC
 85-771 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. No approval. 14BH;45-7SK
 A:WAIT You y Move y Forward y CQ m
 86-781 B was told to move Forward. PP did so and says so.
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. No approval. 0BH;44BI;70-2SL
 A:WAIT You y Squash y Cake o CQ m
 87-791 B was told to Squash Cake. PP did so and says so.
 PP:FORWARD (Squashed) I m Squashed. m Cake. m. Q m Automatic approval. 31BI;110SC,98-9SK,44SL,
 A:LEFT You y Squashed y Cake m Q m 57SL
 88-801
 PP:RIGHT I. m Turned. m. Q m Incomplete sequence. 4BH;36SK,7SJ
 A:LEFT I m Turned m Left m Q m
 ---S 85 --- 85 --- 86 --- 86 --- 87 --- 87 --- 88 --- 88
 -#--- PP:F -#--S A:W -#--S PP:F -#--- A:W -#--- PP:F -#--- A:L -#--- PP:R -#--- A:L
 ---#- ---#- ---#- ---#S ---#S ---#- ---#- ---#-
 ---eC ---eC ---eC ---eC ---eC --CeS --CnS --CnW
 89-810
 B:RIGHT I. m. Pushed. m. Cake. o. Q m. RM turned Right. PP says it Pushed Cake. Rand=19;
 A:FORWARD I m Pushed m Cake o Q m A didn't see it. 13-5SL
 90-820
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 39BH,15BI;
 A:FORWARD I m Pushed m Cake o Q m No approval. 312-4SI
 91-830
 PP:FORWARD Q n, 78BA
 A:FORWARD I m Pushed m Cake o Q m
 92-837
 PP:WAIT Q n, 43BH
 A:RIGHT I m Turned m Right m Q m
 --- 89 --- 89 --- 90 --- 90 --- 91 --- 91 --- 92 --- 92
 -#--- B:R -#--- A:F -#--- PP:F -#--- A:F -#--- PP:F -#--N A:F -#--N PP:W -#--N A:R
 ---#- ---#- ---#- ---#N ---#N ---#- C--#- C--#-
 --CwW --CwN -Cw-N -Cw-- Cw--- Cw--- w---- w----
 93-844
 PP:FORWARD I m. Pushed. n, Cake. n, Q m. PP moved Forward but says it Pushed Cake. 73BE;
 A:FORWARD Bad y I m Pushed m Cake o Q m A says Bad. 59SE,19SI,110SI
 94-855
 PP:LEFT I. m. Turned. m. Left. m. Q m. PP turned Left and says so. 27BC;
 A:WAIT You y Move y Forward y CQ m No approval. 63-5SK,1SL,17SL
 95-865
 PP:LEFT Q n, 28BH
 A:WAIT You y Turn y Right y CQ m
 96-872
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 5BH;
 A:FORWARD I m Pushed m Cake o Q m No approval. 45SK,149-50SJ,148SH
 --- 93 ---N 93 ---N 94 ---W 94 ---W 95 ---S 95 ---S 96 --- 96
 -#--N PP:F -#--- A:F C#--- PP:L C#--- A:W C#--- PP:L C#--- A:W C#--- PP:F C#--S A:F
 C--#- C--#- n--#- n--#- n--#- n--#- n--#- n--#-
 n--- n--- -----
 97-882
 PP:FORWARD Q n, 0BH
 A:RIGHT I m Turned m Right m Q m
 98-889
 PP:FORWARD I n, Squeezed. n, Q n, PP moved Forward but says it Squeezed. 37BD,36BE,37BF;
 A:RIGHT Bad y I m Turned m Right m Q m A says Bad. 181SC,19SI
 99-899
 PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 31BC;
 A:FORWARD I m Moved m Forward m Q m No approval. 15-7SH,44SJ,16-7SJ
 100-909
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 14BH,8BI;
 A:LEFT I m Turned m Left m Q m No approval. 81-2SH,4-5SJ,5SH
 C--- 97 C--- 97 C--- 98 C--- 98 C--- 99 C--- 99 C--- 100 C--- 100
 n#--S PP:F n#--- A:R e#--- PP:F e#--- A:R s#--- PP:R s#--- A:F -#--- PP:F -#--- A:L
 ---#- ---#S ---#S ---#- ---#- ---#- s--#- s--#-
 ----- ---S ---S ---W ---W ---W-
 101-919
 PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 7BH,14BI;
 A:FORWARD I m Moved m Forward m Q m No approval. 84-6SH,85-7SJ
 102-929

PP:FORWARD I. m. Turned. m. Q m. PP moved Forward but says it Turned. 0BH,8BI;
A:FORWARD Bad m I m Moved m Forward m Q m A says Bad. 168SK,11SL,121SJ
103-939

PP:FORWARD I. m. Turned. n, Right. n, Q m. PP moved Forward but says it turned Right. 0BH;
A:LEFT I m Turned m Left m Q m A didn't see it. 318-20SI
104-949

PP:LEFT Bad. n, I. m. Moved. m. Forward. m. Q m. PP turned Left but says it moved Forward. 9BH;
A:FORWARD I m Moved m Forward m Q m A didn't see it. 86SE,59SF,85SG,87SC,149-50SC
C---- 101 C---- 101 C---- 102 C---- 102 C---- 103 C---- 103 C---- 104 C---- 104
-#--- PP:F -#--- A:F -#--- PP:F -#--- A:F -#--- PP:F -#--- A:L -#--- PP:L -#--- A:F
e--#- e--#- -e-#- -e-#- --e#- --e#- --n#- --n#-
--W- --W- --W- -W- -W- W- W- S-

105-960

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 17BC; 194SE,195SF,
A:FORWARD I m Moved m Forward m Q m A didn't see it. 195SG,202SC,196SE,197SF,197SG
106-970

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 36BH,35BI;
A:LEFT I m Turned m Left m Q m A didn't see it. 56-7SH,59SJ,16-7SJ,17SH
107-980

PP:FORWARD I. m Moved. m. Forward. m. Q m. PP moved Forward and says so. 14BH,14BI;
A:FORWARD You y Move y Forward y CQ m No approval. 45-7SK,13-5SL
108-990 B was told to move Forward. PP did so.
PP:FORWARD Q n No approval. 81BG,0BH,49BI
A:WAIT You y Squash y Cake o CQ m

C---- 105 C---- 105 C-n-- 106 C-n-- 106 C-w-- 107 C-w-- 107 Cw--- 108 Cw--- 108
-#n-- PP:R -#n-- A:F -#--- PP:R -#--- A:L -#--- PP:F -#--- A:F -#--- PP:F N#--- A:W
---#- ---#- ---#- ---#- ---#- N--#- N--#- ---#-
S--- W--- W--- N--- N--- ---#- ---#- ---#-
109-997 B was told to Squash Cake. PP did so and says so. Automatic
PP:FORWARD (Squashed) I. m. Squashed. m. Cake. m. Q m. approval for Squash. 61BH;349-51SD,
A:LEFT You y Squashed y Cake m Q m None for Speech. 139-40SC
110-1007

PP:RIGHT I. m. Turned. m. Q m. Incomplete sequence. 4BH,45BI;155-6SH,157SJ,7SJ
A:LEFT I m Turned m Left m Q m
111-1016

PP:RIGHT I. m. Pushed. m. Cake. o. Q m. PP turned Right but says it Pushed Cake. 75BH,46BI;
A:FORWARD I m Moved m Forward m Q m A didn't see it. 157-9SH,158-60SJ
112-1026

PP:FORWARD Q m. 39BH,8BI
A:FORWARD I m Moved m Forward m Q m

Cw--- 109 Nw--- 109 Ns--- 110 Es--- 110 Ee--- 111 Se--- 111 S-e-- 112 --e-- 112
N#--- PP:F -#--- A:L -#--- PP:R -#--- A:L -#--- PP:R -#--- A:F -#--- PP:F S#--- A:F
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
----C ----C ----C ----C ----C ----C ----C ----C

113-1033

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 44BH;101-3SK,
A:FORWARD I m Moved m Forward m Q m A didn't see it. 55SL,52-3SL
114-1043

PP:FORWARD Bad. n, I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 43BH,56BI;
A:RIGHT I m Turned m Right m Q m A didn't see it. 110SK,55SL,139-41SJ,138-9SH
115-1054

PP:RIGHT I n, Turned m. Right n, CQ m. PP turned Right and is unblocked to say so 35BH,42BI;
A:FORWARD Bad y I m Moved m Forward m Q m but with CQ. A says Bad. 59SC,60SE,61SC,323SI
116-1065

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 6BD;33-4SK,
A:RIGHT I m Turned m Right m Q m No approval. 145SH,17SJ
---e- 113 ---e- 113 ---e 114 ----e 114 ----s 115 ----s 115 ---- 116 ---- 116
S#--- PP:F -#--- A:F -#--- PP:F -#--- A:R -#--- PP:R -#--- A:F -#---s PP:R -#---s A:R
---#- S--#- S--#- ---#- ---#- ---#- ---#- ---#- ---#-
---C ---C ---C S---C S---C W---C W---C N---C

117-1075

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 14BH,18BI;45SK,9SL,
A:FORWARD I m Moved m Forward m Q m No approval. 183-4SJ,182SH
118-1085

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 0BH,8BI;
A:RIGHT I m Turned m Right m Q m No approval. 18-20SH,18-20SJ
119-1095

PP:FORWARD I m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 19BH,18BI;
A:FORWARD I m Moved m Forward m Q m No approval. 18-20SI,14SH
120-1105

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 9BH;56-7SH,

A:RIGHT I m Turned m Right m Q m No approval. 16-7SJ,17SH

----- 117 ----- 117 ----- 118 ----- 118 ----- 119 N----- 119 N--n- 120 E--n- 120

-#--w PP:F -#--w A:F -#--w PP:F N#-w- A:R N#-n- PP:F -#-n- A:F -#-- PP:R -#-- A:R

---#- N--#- N--#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

N--C ---C ---C ---C ---C ---C ---C ---C

121-1115

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 14BH,18BI;

A:FORWARD I m Moved m Forward m Q m A didn't see it. 39SK,9SL,19-20SJ,20SH

122-1125

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 19BH,8BI;

A:RIGHT I m Turned m Right m Q m A didn't see it. 21-3SH,21-3SJ

123-1135

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 0BH,18BI;

A:FORWARD I m Moved m Forward m Q m A didn't see it. 9SL,4-5SL

124-1145

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 8BH,8BI;

A:FORWARD I m Moved m Forward m Q m A didn't see it. 11SL,7-8SL

E--e- 121 -E-e- 121 -E--e 122 --E-e 122 --E-s 123 ---Es 123 ---E- 124 ----E 124

-#-- PP:F -#-- A:F -#-- PP:F -#-- A:R -#-- PP:F -#-- A:F -#--s PP:F -#--s A:F

---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-

---C ---C ---C ---C ---C ---C ---C ---C

125-1155

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 9BH,58BI;

Tchr: through-Robot-A,-starts-to-lead-Robot-B-around-the-World-to-encourage-PP-to-make-a-Plan.

A:FORWARD I m Pushed m Cake o Q m A didn't see it. 199SJ,16-7SJ

126-1165

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 14BH,15BI;

A:RIGHT I m Turned m Right m Q m A didn't see it. 45SK,12SL,183-4SJ,182SH

127-1175

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 0BH,18BI;

A:FORWARD I m Pushed m Cake o Q m No approval. 9SL,4-5SL

128-1185

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 15BI;

A:FORWARD I m Pushed m Cake o Q m A didn't see it. 236-8SK,12SL,1-2SL

---E 125 ---S 125 ---S 126 --- 126 --- 127 --- 127 --- 128 --- 128

-#-- PP:R -#-- A:F -#-- PP:F -#--S A:R -#--S PP:F -#-- A:F -#-- PP:F -#-- A:F

---#s ---#s ---#- ---#- ---#- ---#S ---#S ---#-

---C ---C ---Cs ---Cs ---Cw ---Cw ---Cw- ---CwS

129-1195

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 9BH,7BI;

A:FORWARD I m Pushed m Cake o Q m A didn't see it. 33SK,12SL,16-7SJ,208SH

130-1205

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 14BH,15BI;

A:FORWARD I m Pushed m Cake o Q m A didn't see it. 122SJ,4-5SJ,5SH

131-1215

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 7BH,15BI;

A:RIGHT I m Turned m Right m Q m A didn't see it. 611-2SD,276SB

132-1225

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 119BG,0BH,18BI;

A:FORWARD I m Pushed m Cake o Q m No approval. 200-2SH,201-3SJ

----- 129 ----- 129 ----- 130 ----- 130 ----- 131 ----- 131 ----- 132 ----- 132

-#-- PP:R -#-- A:F -#-- PP:F -#-- A:F -#-- PP:F -#-- A:R -#-- PP:F -#-- A:F

---#- ---#- ---#- ---#- C--#- C--#- C--#- C--#-

-Cw-S -Cw-W Cw--W Cw--W- w--W- w--W- n--W- nW--

133-1235

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 8BH,15BI;

A:FORWARD I m Pushed m Cake o Q m A didn't see it. 280-2SB

134-1245

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 125BA,126BB;

A:FORWARD I m Pushed m Cake o Q m A didn't see it. 283-5SB

135-1255

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 118BG,14BH,15BI;

A:RIGHT I m Turned m Right m Q m A didn't see it. 274-6SB

136-1265

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 119BG,0BH,18BI;

A:FORWARD I m Pushed m Cake o Q m No approval. 9SL,4-5SL

----- 133 ----- 133 C----- 134 C----- 134 nC--- 135 nC--- 135 eC--- 136 eC--- 136

C--- PP:F C--- A:F n--- PP:R n--- A:F -#--- PP:F -#--- A:F

n--#- n--#- ---#- ---#- ---#- N--#- N--#- ---#-

-W--- W--- W--- N--- N--- ---#- ---#- ---#-

137-1275

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 15BI;
A:FORWARD I m Pushed m Cake o Q m A didn't see it. 280-2SB
138-1285

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 125BA,126BB;
A:FORWARD I m Pushed m Cake o Q m A didn't see it. 283-5SB
139-1295

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 122BG,14BH,15BI;
A:FORWARD I m Pushed m Cake o Q m A didn't see it. 39SK,12SL,19-20SJ,20SH
140-1305

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 19BH,15BI;
A:RIGHT I m Turned m Right m Q m A didn't see it. 289-90SB,276SB
-eC-- 137 NeC-- 137 N-eC- 138 E-eC- 138 E--eC 139 -E-eC 139 -E--e 140 --E-e 140
N#--- PP:F #--- A:F #--- PP:R #--- A:F #--- PP:F #--- A:F #---C PP:F #---C A:R
---#- ---#- ---#- ---#- ---#- ---#- ---#- ---#-
----- -----

141-1315

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 119BG,0BH,18BI;
A:FORWARD I m Pushed m Cake o Q m No approval. 291-3SB
PLAN: 1-1 PP:FORWARD I m Moved m Forward m Q m 124BG,8BH,15BI;296-8SA,280-2SB
1-6 A:FORWARD I m Moved m Forward m Q m 244BOA;907SOA,876-8SOA
2-11 PP:RIGHT I m Turned m Right m Q m 121BA,122BB;271-3SB
2-16 A:FORWARD I m Pushed m Cake o Q m 246BOA;891SOB,915-7SOA
3-21 PP:FORWARD I m Moved m Forward m Q m 126BA,127BB;287-9SA,286-8SB
3-26 A:FORWARD I m Pushed m Cake o Q m 248BOA;922-925SOA
4-31 PP:FORWARD I m Moved m Forward m Q m 127BA,128BB;290-2SA,289-90SB,276SB
4-36 A:RIGHT I m Turned m Right m Q m 250BOA;930-3SOA
5-41 PP:FORWARD Plan of length 41 completed. 128BA,129BB

142-1325

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 124BG,8BH,15BI;
A:FORWARD I m Pushed m Cake o Q m A didn't see it. 296-8SA,280-2SB
Plan-following ended on plan step 8 with A:Pushed not matching A:Moved.

143-1335

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 125BA,126BB;
A:FORWARD I m Pushed m Cake o Q m A didn't see it. 283-5SB
PLAN: 1-1 PP:FORWARD I m Moved m Forward m Q m 122BA,123BB;275-7SA,274-6SB
1-6 A:RIGHT I m Turned m Right m Q m 240BOA;891-4SOA
2-11 PP:FORWARD I m Moved m Forward m Q m 123BA,124BB;278-80SA,277-9SB
2-16 A:FORWARD I m Pushed m Cake o Q m 242BOA;899-902SOA
3-21 PP:FORWARD I m Moved m Forward m Q m 124BA,125BB;281-3SA,280-2SB
3-26 A:FORWARD I m Pushed m Cake o Q m 244BOA;907-9SOA,876SOA
4-31 PP:RIGHT I m Turned m Right m Q m 125BA,126BB;284-6SA,283-5SB
4-36 A:FORWARD I m Pushed m Cake o Q m 246BOA;914-7SOA
5-41 PP:FORWARD Plan of length 41 completed. 122BA,123BB

144-1345

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 122BA,123BB;
A:RIGHT I m Turned m Right m Q m A didn't see it. 275-7SA,274-6SB
--E-s 141 --Es 141 --E- 142 ----E 143 ----S 143 ----S 144 ----S 144
--#-C PP:F #---C A:F #---s PP:F #---s A:F #--- PP:R #--- A:F #--- PP:F #---S A:R
---#- ---#- ---#C ---#C ---#s ---#s ---#- ---#-
----- -----C ----C ---Cs ---Cs

145-1355

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 123BA,124BB;
A:FORWARD I m Pushed m Cake o Q m No approval. 278-80SA,277-9SB
146-1365

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 124BA,125BB;
A:FORWARD I m Pushed m Cake o Q m A didn't see it. 281-3SA,280-2SB
147-1375

PP:RIGHT I. m. Turned. m. Right. m. Q m. PP turned Right and says so. 125BA,126BB;
A:FORWARD I m Pushed m Cake o Q m A didn't see it. 284-6SA,283-5SB
148-1385 **Plan followed for 41 fine steps.**

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 126BA,127BB;
Tchr: Robot-B-has-now-followed-its-Plan-for-5-main-steps. A didn't see it. 287-9SA,286-8SB
A:FORWARD I m Pushed m Cake o Q m
----- 145 ----- 145 ----- 146 ----- 147 ----- 147 ----- 148 ----- 148
--#--S PP:F #--- A:F #--- PP:F #--- A:F #--- PP:R #--- A:F #--- PP:F #--- A:F
---#- ---#S ---#S ---#- ---#- ---#- ---#- ---#-
---Cw ---Cw ---Cw- ---CwS -Cw-S -Cw-W Cw--W Cw--W-

149-1395

PP:FORWARD I. m. Moved. m. Forward. m. Q m. PP moved Forward and says so. 127BA,128BB;290-2SA,
STOPPING as Go on rejected. 289-90SB,276SB

=====
Programs and data files are available on request. 7 February 2017 JohnHAndrae@gmail.com