Is interactivity actually important?

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ABSTRACT
It appears that it is a well-accepted assumption that interactivity will improve the entertainment and/or learning value of a media. This paper reviews various studies exploring the role of interactivity and reports on a study conducted to see whether a novice could learn some basic skills on how to be a customs officer from watching a game demonstration compared to being an active participant in the same game. The study suggests that basic knowledge about a domain may be best gained passively, but that knowledge about how to behave and what questions to ask in that domain are best gained through active involvement. Intuitively the findings make sense, and provide some guidance on when interactivity is actually important.

Categories and Subject Descriptors
I.3 [**Computing Methodologies**]: Computer Graphics.
I.6.8 [**Computing Methodologies**]: Simulation and Modelling – types of simulation – *animation, visual.*

General Terms
Design, Experimentation, Security, Human Factors.

Keywords
Interactivity, simulation, learning, training, game engine.

1. INTRODUCTION
Is the assumption that the next best thing to watching the popular SitCom TV show Friends is to be one of the friends, actively deciding if Joey should finally settle down and with whom. The move from lean-back TV, where the audience passively watches, to lean-forward TV, where the audience is also a participant is more of a leap than a step, and it is not clear whether that leap is forward. According to Vorderer (2000) the research evidence just isn't clear enough at this stage. A common view is that interactivity is needed for engagement, and to some extent enjoyment, which leads to the conclusion that therefore interactivity plays a critical role in entertainment or education. But is this so? Haven't you laughed, cried or been shocked, the effect sometimes lasting for days, from just watching a movie? As Stephen Wilson, Professor of Conceptual Design and Information Art at San Francisco State University comments:

> The mere inclusion of user choice in media does not automatically make engaging events: interactive entertainment programs are not necessarily more entertaining. In the same vein, educational programs do not necessarily teach more effectively and deeply and information retrieval and research assistance programs do not necessarily lead to more mastery of the material or generation of better ideas. Equally art programs do not inevitably result in more enlightening or provocative experiences. The creators' challenges are the same as they have [sic] always been with the additional challenge of interactivity. The same careful design and artistic inspiration will be necessary to make the processes of interactivity themselves key artistic or conceptual elements. (Wilson, 1993, p.11)

From a review of diverse research including interactivity in the Web, interactive black boards in schools and interactive television quiz shows, there are clearly benefits, but also limitations and caveats on whether the increased engagement or better assessment scores are due to the interactivity and at what price. In this paper we look at some of the past findings together with some discussion of what interactivity is and could achieve. We then present our own study, and first set of findings, that looks at the role of interactivity in training via the use of a training system built on top of the Game Engine Unreal Tournament.

2. SOME ORIGINS AND INFLUENCES ON INTERACTIVITY
It is clear from the literature on interactivity, that interactivity is far more than a technical feature involving the user clicking on buttons or selecting options. Three key themes emerge about interactivity: it is a form of communication, it is a multidisciplinary area of study, and control is a key. Let's explore these three themes.

Bietz (2006) sees that interaction necessitates two or more parties being able to communicate contingent on: the behaviour of the other; the existence of response patterns and actions; and the ability to signal responses to one another. Bietz's PhD hypothesis will test that "various media impose different costs on this signalling, and that the choice of medium in which to interact will affect both organizational processes and outcomes". Bietz's study looks at the use of instant messaging and teleconferencing as a medium for a team of two to develop a powerpoint presentation. However, the parties and media/channels involved in the communication can vary from study to study, and can include communication between the human user and a computer system, or between a student and a teacher or even the course material or peers.

The existence of varying levels of communication are indicated by the study conducted by Becta (2005) on the use of interactive whiteboards for teaching and learning. In the study, degrees of interactivity are identified to define three stages of usage where firstly the whiteboard is merely an additional aid (supported didactic), to use of the board for stimulation (interactive) to stage 3 where the whiteboard actually drives the classroom experience

(enhanced interactive). It is only when teachers move into stages two and three that the interactive whiteboard becomes a valuable asset worth the purchase cost and training effort. They also remark from previous findings that "sustained interaction between teacher and taught is fostered through effective questioning rather than via a wider range of activity" (p.10). Note the emphasis in our training simulation on the central role questions play in using and evaluating the system (see sections 3.2 and Appendix A).

Interactivity is currently commonly associated with advances in computer technology. This is also true in many studies involving interactivity conducted by educators and psychologists. However, interactivity, even in entertainment, was around long before the computer. From ancient times, Aristotle recognized the appeal of drama and action and the Socratic style of teaching encouraged learning by questioning and finding out for yourself. Various psychology-based theories lend support to the importance of interactivity. For example, associationism (Bush 1945) is based on the view that humans work through problems by moving from one idea to another associated idea. Theories of learning and cognition involving exploration leading to new experiences and understanding, such as is embodied in Piaget's four stages of childhood development, encourage interactivity. Interactivity has been studied within the fields of anthropology and political science (Wilson 1993) to determine the diverse attitudes and expectations of different societies and cultures regarding authority and the right to have a say in their own government. The findings of such studies have the potential to impact business partnerships, user interfaces, design of artifacts and the global economy.

Art and Media have had an interest in making their work more interactive in various waves throughout the past century in forms such as Dada and street theatre. In some cases encouraging audience participation and new forms of artistic expression were politically motivated to stir up and empower the masses with a particular viewpoint. Whatever the motivation, the attempt to include the audience and allow the audience to have an impact on the art requires an understanding of the human in the audience, the environment and how to manage the range of possibilities that may emerge. As a result, to understand and achieve interactivity requires multidisciplinary research, approaches and skills.

The games and entertainment industry are leading the way in research and expenditure into interactivity. Defence researchers are also interested in interactivity as it is a critical part in building immersive defense modeling environments and simulations. Many projects involve collaborations between multiple sectors and disciplines, such as those being conducted at the Naval Postgraduate School "Modeling, Virtual Environments and Simulation" (MOVES) Institute (Zyda 2006).

Our particular interest is the use of interactivity in education and training. Brady (2004) lists a number of research studies that have found interactivity to positively influence learning and satisfaction but states that it is unclear if these findings also apply to web environments. Brady's study used 72 middle-school (mostly 12 year olds) students to see how well being able to select and explore the contents of a website affected the ability to remember the content. A key finding was that students with interactive activities for all parts of the lesson remembered significantly (0.05) more, were more satisfied but also took significantly longer (double the time) even though about the same number of web pages were viewed by all. The paper does not suggest why the learning outcomes were improved. It could be that because students spent more time looking at the web site, they learnt more. Interactivity may not have been the direct cause of learning more, but because it gave the user greater choices and control, the students were more inclined to give the task more time. One could argue that what we need is an education system that enforces more study time, rather than requiring educators and others to spend so much time making the learning more palatable. It is well known, at least in English speaking countries, that our highest achieving school students are those doing many additional hours of study and rote learning, usually from non-English speaking backgrounds. Is interactivity the sugar coating we are offering our children who are less inclined to hit the books?

A key element of interactivity is the user in control. From a user interface point of view, the notions of interactivity and Graphical User Interfaces (GUIs) have become intertwined. Due to the pervasiveness of the GUI, interface designers often assume that interactivity will occur by default. In fact there are many possible "interaction styles" like command language, form fill-in, menu selection and in more recent times, natural language which tend to be more system controlled. Designers seeking to provide interactive systems need to evaluate carefully the interfaces they develop with the control issue in mind. People such as Jeffery Veen, as judge of a "State of the art interactivity" competition[1], have found that instead of giving the user control, designers are building systems full of features and functions they control and force users to use.

This leads us to the question of whether users really want more interactivity. Sperring and Strandvall (2006) observed and collected the experiences of 35 participants involved in a study of an interactive television program. They found "that interactivity can enhance the feeling of being entertained" (p. 1), and raised the attention levels and degree of involvement as assessed via psycho physiological measures such as skin conductance and pulse rate. The study has some interesting findings relating to group participation and competitiveness and corroborates other research that has concluded that interactivity is more appealing to young adults (up to around 25) than older viewers. Interestingly, some participants stated that they felt TV was a passive medium and even though they may have enjoyed the interactive quiz show, they believed it should stay passive. But users do not always know what they want, as evidenced in early user studies for the train and later the telephone which concluded that both had limited appeal and usefulness.

After a decade of widely available hypermedia and online material, it has become apparent that interactivity has to be more than clicking a button. We look next at our system and study that seeks to shed further light on the usefulness and role of interactivity.

[1] See the lengthy internet discussion at http://www.veen.com/jeff/archives/000705.html

3. THE SYSTEM AND STUDIES

The ultimate goal of this project is to develop a training environment that allows the trainee to experience a risky situation, without actually being at risk. While we have contacts and interest from the NSW Police Department and other related governmental bodies, access to their internal acknowledge will only be available once we have a proof of concept. Thus, our initial focus has been on the training of airport customs officers due to the availability of customs scenarios as presented on the reality TV series "Border Security" that was first shown on ATN 7 in 2004.

To achieve our goals requires research in many directions including virtual reality (VR) and game technology, natural language technology, knowledge acquisition, education and training and agent systems. Ongoing VR and games projects that contribute to our larger goal include: Memory and Scene Construction in VR; Behavioural Modelling in Computer Games; Communication in Multiplayer Games; Face Recognition in VR; Interactive Drama Engine in VR; and 3D Modelling and Animation of Agents in Softimage. In addition to pursing many of the open technical questions, we also want to examine from an education/psychology viewpoint the role that VR and games can play in training. We want to test some assumptions such as "adults are willing/able to learn from an adventure-type game engine". To this end, last year we conducted what we refer to as Study 1. Study 1, reported in IE2005 (Richards and Barles 2005), was a trial to compare the results of watching one of the Border Security episodes with watching a game version of the same scenario. Despite the laughing during the game version, the results showed that the subjects were able to pay attention to and remember almost equally well in both situations. The majority of participants in the study believed that the game environment could be used for training purposes, but most commented that the game needed to be interactive. In the spirit of myth busters, we wanted to test that belief. This year, as reported in the sections to follow in this paper, we conducted a study in the same domain to examine the role of interactivity in the learning experience. This study we refer to as Study 2 (see section 3.2)

To simulate the TV scenarios we have created the "Airport World" and a plugin to Unreal Tournament (UT2004). The modification, known as the Risk Management Mod (RMM), acts very similarly to the GameBots[2] modification that began at the University of Southern California's Information Sciences Institute for research in AI. We are not using GameBots as it was created for an older version of Unreal that does not include the functionality we require. The UT2004 game is originally a first-person-shooter game, while the RMM is a first-person training simulation. The Risk Management modification spawns and allows for control of the Non Programmable Characters (NPCs) in the Airport World. Socket connections are used to feed information between different sources. Currently we have two alternate interfaces to UT2004: a Game Master Controller and a Narrative Engine. The Narrative Engine and the Game Master Control are external client programs where the decisions of the NPCs actions such as walk, run, turn and talk can be controlled.

3.1 Controlling a Simulation via a Role Playing Game Instructor.

Instructors or controllers are needed in both theoretical training and in live exercises. However, particularly in a virtual training environment, incorporating a live instructor is not necessarily a requirement. The simulated environment can be designed to eliminate the need of a live controller, replacing the live control function with an automated system. This is possible because there is no physical risk involved in virtual simulations. Furthermore, a simulation can be designed with variable mission parameters, automatically modifying the specific training scenario to produce a different challenge each time the simulation is run. Additionally, the simulation itself can be programmed to provide various forms of feedback to the participants, although this would be in a standardized format. With current technology, the feedback an automated system can produce is limited, especially with regards to providing personalized feedback. An automated system can provide feedback on any type of measurable feature, e.g. time taken to complete the training exercise, reaction speed and so on. It cannot relate to "soft" data, such as moral or ethical uncertainty when faced with a difficult decision. With a live controller, supported by the right tools, real-time, dynamic changes can be incorporated as the scenario is being run, such as adding an element of stress or a distraction. To do so in a live exercise would normally be impossible, or alternatively require pre-planned flexibility but at a price.

Inspiration is drawn from existing simulation software, as well as the use of "game masters" in multi-player role playing games (RPGs). Through more than 30 years of controlling multiple participants in imagined realities, arguably even more difficult to control than virtual realities, RPG game masters have developed different kinds of toolsets and analysis/design models to control scenarios.

Our ongoing research (Tychsen, Hitchens and Kavakli 2005) involves analyzing: 1) the relative importance of various lines of communication (speech, scripting, avatar body language etc.) for the ability of the instructor to maintain control, affect and direct the evolving training scenario; 2) which narrative tools used in RPGs are of interest in training simulations. For example, the ability to, in real-time, update the physical environment; or spontaneously assume control of pre-programmed agent characters - such as civilians in an airport-security scenario. The end goal is to gain an overview of the toolset necessary to incorporate in the risk-assessment scenarios in order to facilitate the presence of a live instructor, while at the same time designing a system that can generate and dynamically update training scenarios as the participant progresses to ensure maximal educational output.

The controller master is comparable to a game master, but is called a controller master because the RMM is a training simulation and not a game. As shown in Figure 1, the controller master has two monitors one for the mirrored version of the trainee's screen and another for the controller interface. This way the controller master can see what the trainee is doing while they interact with them.

[2] GameBots is freely downloadable from http://www.planetunreal.com/gamebots/

In the longer term the risk-assessment scenarios for the airport training simulations will incorporate controller functions common to group-based simulations such as Hazmat[3].

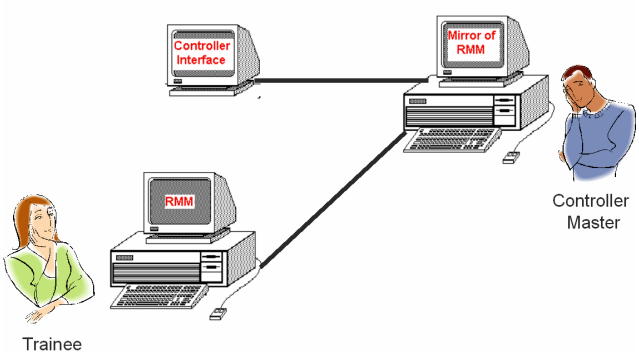

Figure 1. Network Setup

The trainee will have one computer running the RMM. The trainee utilises the RMM directly. They have the basic controls of movement using keys or the directional arrows. They also have the ability to communicate with each of the characters by pressing the F1 key to bring up the chat input field, as shown in Figure 2. After the user finishes typing what they want to say and presses enter, a speech bubble will appear. The controller master interface was used in the study reported in this paper.

Figure 2 – An Airport Screenshot with chat input field

3.2 Study 2: The importance of interactivity

Goal: Determine if interactivity improves the ability to notice, remember and/or learn from an experience.

Timing, Location and Participants: In first semester 2006, approximately 80 students enrolled in a 3rd year computer graphics course were invited to participate in our study. We chose them as they had some interest and exposure to the area of computer games and also more maturity than 1st or 2nd year students.

This recruitment step was also an initial training step. In late 2005, we had conducted a pilot study with 4 students and found that the subjects had no idea about appropriate questions or the behaviour of customs officers. Since we were using Unreal Tournament one subject was expecting a shootem-up game and wanted to know where the gun was to shoot the guilty passenger. Similarly, others used aggressive language or were unable to think of questions. To overcome the participants' inexperience we had to spend most of the time during the pilot study trying to explain what was appropriate. It was clear that pre-training was needed to provide the participant with some context and domain understanding. To avoid having to repeat this explanation for every subject individually or asking everyone to attend an additional training session and also to ensure that each participant knew what they were volunteering for and received the same level of instruction, a game demonstration was screened in the recruitment lecture together with a description of the goals of the project and structure of the tasks. This introduction lasted 12 minutes, following which, students were invited to sign up to come to the Virtual Reality lab during one of the time slots provided on a sheet that was passed around during the lecture. A $15 incentive would be paid to participants.

Tasks: Participants were involved in two tasks involving two different scenarios. One task was interactive the other was passive.

Task 1: Participants interacted with the system via a human game master who controlled the responses of the system to the participant's interaction. The participant asked questions of the passenger, and occasionally their supervisor, to determine if the passenger could enter Australia or if there is something wrong. If after 10 minutes no conclusion was drawn and the questions were still flowing, the controller master or assistant overseeing the task asked the trainee to stop.

Task 2: Participants watched a recording of an interactive session in the same system used in task 1.

Two scenarios, based on TV episodes, had been created. The first scenario concerned undeclared food found in a bag and was the passenger's third similar offense. In the second scenario the passenger had drugs strapped to their legs. Each participant was to experience each scenario, one interactively and one passively. Each participant was assigned to one of four groups. We also alternated whether the interactive session was experienced first or second. Each group performs the tasks in an alternative order. Thus, forming four groups.

Group A. Task 1- Scenario 1, Task 2 – Scenario 2

Group B: Task 2 – Scenario 2, Task 1 – Scenario 1

Group C: Task 1 – Scenario 2, Task 2 – Scenario 1

Group D. Task 2- Scenario 1, Task 1 – Scenario 2

At the allotted time, the schedule of tasks were as follows:

First Introduction: (1-2 minutes) sign consent form. If Task 1, the role is quickly set up as the participant is informed that they are a trainee customs officer (Paul) who is looking across the counter at the passenger (either Daryl or Kim) Daryl is shown in Figure 2. Additionally their supervisor (either Daryl or Kim[4]) is pointed out

[3] http://www.dgtraining.com/

[4] Kim was the passenger in the food scenario but the supervisor in the drug scenario. The opposite is true of Daryl.

to them. The participant is shown which (labeled) key to press to pop up a dialog box to communicate with either Kim or Daryl and told that their goal is to determine if the passenger has done anything illegal. They are directed to read the instruction sheet in front of them if they get stuck. The instruction sheet reminds them of their goal and which key to press. For task 2, the subject is asked to watch the demonstration. In both cases, the participant is given a copy of the "Incoming Passenger Form" that all passengers arriving in Australia need to complete.

First Task: (5-10 minutes) as described above.

First Questionnaire 1: (10 minutes) the questions are filled in.

Second introduction (5 minutes) involving being relocated and having the alternate introduction to the one received in the first introduction. For timing purposes, the interactive task was performed in the VR lab and the demonstration was watched in an office on the floor above.

Second Task: (5-10 minutes) as described above.

Second Questionnaire: (10 minutes) the same set of questions are provided. Participants are not aware that the questions will be the same and are not allowed to see the questions before completion of each task.

Finish: (2 minutes). Debrief and payment

Originally our study had been designed to include a third task in which participants would interact with the system via the narrative engine that will use artificial intelligence techniques to generate the system's responses to the participant's interaction. However, the narrative engine and connecting behavioural engine are still being developed and we didn't want to hold up the trials for an undetermined length of time.

The questionnaire can be found in Appendix A. Questions 1-7 seek to ascertain if the participant had noticed and remembered what had happened. In the case of the interactive session it was also seeking to find out if the intended key events had been experienced. To assist with this, the controller master played a number of roles designed to skillfully lead and answer the trainee's questions in the direction that would allow the key facts to be uncovered. For instance, the controller provides the passengers responses according to the brief that has been set up for the particular scenario. In the customs supervisor role, the controller master may perform tasks or ask questions of the trainee like "would you like me to search their bag?" or "would you like me to do a body search"? As the narrator, they would use the narrator pop box to inform the trainee that, for example, "Daryl, the supervisor, found a packet of noodles in Kim's bag".

Questions 8-12 were not directly related to either scenario but designed to see if what the participant had "learnt" could be transferred to a new situation. Questions 8 and 9 embodied a higher level rule broken by Kim when she brought in food for the third time, that is, first time you may get a warning, but third time you will get a fine. Questions 10 and 11 indicate whether participants had worked out typical sorts of questions that might be asked and in what situation. Question 12 concerned whether the participant had learnt how a customs officer should treat a passenger.

Question 13 was designed to see if the participant may have better knowledge of how to behave and what to ask because they had watched the TV program often. Though unlikely with this cohort of under 25s, in future trials we will add one or more questions to our survey to determine the level of prior knowledge, training and experience the participant may have had in the security area.

Questions 14-17 sought to find out suggestions and preferences for the two interaction styles (active, passive). Questions 15 and 16 were only to be answered after both tasks had been completed as the questions concerned a comparison between the two.

In Stage 1 (Richards and Barles 2005) we compared two quite different demonstrations: one containing the rich sights and sounds to be found at the airport and involved real people and natural language, the other using a very rough game demonstration with two quite unrealistic characters whose movement was restricted and unnatural (for example one character was Agent Smith from The Matrix with his gun removed). In contrast, in the Stage 2 study the variables were able to be tightly controlled. The game environment and questions were identical, the scenarios involved the same characters and everyone experienced both scenarios and tasks. The only difference was whether you simply observed or whether you got to ask questions or perform certain actions. The order of these was alternated to avoid order effects. Next we look at the results.

4. THE ROLE OF INTERACTIVITY

Of the 23 students who signed up during the lecture, only 17 turned up to conduct the study. We had planned an equal distribution of numbers in each of the four groups. Unfortunately, though we did some reshuffling during the three days of the trials, we ended up with four participants in groups A and C, three participants in Group B and six participants in Group D. We normalized the data presented in Table 1 as if each group had 4 members. The actual responses to questions 1-11 are not given. Our analysis involved determining the accuracy of the responses to the questions and whether the interactive or non-interactive game had more correct answers.

Everyone got the first question right, which concerned whether the passenger being questioned was male or female. It was not meant to be a trick question, but a priming question and form of validation since we wanted to ensure the participant had been able to distinguish between the NPCs (the passenger and customs supervisor) and their role as the trainee customs officer.

The answers to questions 2-7 were open ended. This resulted in a wide range of responses being given. Each response was given a code and that code was reused each time the same response was made. We determined which of the responses were actually correct given what had transpired in the demo and which we sought to recreate in the interactive session. This meant that we were also looking at how many right and wrong questions were given by an individual and the space of correct answers.

Given the number of questions, range of answers and the four groups involving different scenarios and tasks and orderings, it is difficult to make definitive claims from the data and not possible to show all the possible views of the data used in the analysis. Table 1 provides the net number of correct answers (after wrong answers have been deducted) and has ordered the results of each group by the overall score to questions 2-12. Table 2 provides an alternate view to table 1, where each column represents the order of correct answers for that question. Based on the tables and other views of the raw data, we make the following observations.

Table 1. Number of net correct answers to survey questions 2-12 sorted by total score

Q#	2	3	4	5	6	7	8	9	10	11	12	Total
DrugsDemo1st (B)	4.64	2.6	0	4	4	2	4	4	5.3	8	9.3	47.84
FoodActive2nd (B)	5.3	0	4	4	2.6	0.6	4	2.6	6.6	8	9.3	47
FoodDemo2nd (C)	9	0	4	4	4	4	2	2	4	10	3	46
FoodDemo1st (D)	5.3	1.6	3.3	4	4	3.3	4	4	2.4	8	4	43.9
DrugsDemo2nd(A)	3.5	0	0	4	4	2	3	4	5	10	6	41.5
FoodActive1st(A)	2	2	3	0	3	0	3	4	1	11	9	38
DrugsActive2nd(D)	0.6	0	2	4	0.6	4	4	4	2.6	8	4	33.8
DrugsActive1st (C)	2.5	0	1	4	0	3	2	2	2	10	2	28.5

Table 2. Best to worst group/scenario results for each questions 2-12

Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Total Q2-11	Q12	Total
FoodDemo2nd (C)	DrugsDemo1st (B)	FoodDemo2nd (C)	FoodDemo2nd (C)	FoodDemo2nd (C)	FoodDemo2nd (C)	DrugsActive2nd(D)	DrugsActive2nd(D)	FoodActive2nd (B)	FoodActive1st(A)	FoodDemo2nd (C)	FoodActive2nd (B)	DrugsDemo1st (B)
FoodDemo1st (D)	FoodActive1st(A)	FoodActive2nd (B)	FoodActive2nd (B)	FoodDemo1st (D)	DrugsActive2nd(D)	FoodDemo1st (D)	FoodDemo1st (D)	DrugsDemo1st (B)	DrugsDemo2nd(A)	FoodDemo1st (D)	DrugsDemo1st (B)	FoodActive2nd (B)
FoodActive2nd (B)	FoodDemo1st (D)	FoodDemo1st (D)	FoodDemo1st (D)	DrugsDemo1st (B)	FoodDemo1st (D)	DrugsDemo1st (B)	DrugsDemo1st (B)	DrugsDemo2nd(A)	FoodDemo2nd (C)	DrugsDemo1st (B)	FoodActive1st(A)	FoodDemo2nd (C)
DrugsDemo1st (B)	FoodActive2nd (B)	FoodActive1st(A)	DrugsActive2nd(D)	DrugsDemo2nd(A)	DrugsActive1st (C)	FoodActive2nd (B)	FoodActive2nd (B)	FoodDemo2nd (C)	DrugsActive1st	FoodActive2nd (B)	DrugsDemo2nd(A)	FoodDemo1st (D)
DrugsDemo2nd(A)	FoodDemo2nd (C)	DrugsActive2nd(D)	DrugsActive1st (C)	FoodActive1st(A)	DrugsDemo1st (B)	DrugsDemo2nd(A)	FoodActive1st(A)	DrugsActive2nd(D)	FoodActive2nd (B)	DrugsDemo2nd(A)	DrugsActive2nd(D)	DrugsDemo2nd(A)
DrugsActive1st (C)	DrugsDemo2nd(A)	DrugsActive1st (C)	DrugsDemo1st (B)	FoodActive2nd (B)	DrugsDemo2nd(A)	FoodActive1st(A)	DrugsDemo2nd(A)	FoodDemo1st (D)	DrugsDemo1st (B)	DrugsActive2nd(D)	FoodDemo1st (D)	FoodActive1st(A)
FoodActive1st(A)	DrugsActive1st (C)	DrugsDemo1st (B)	DrugsDemo2nd(A)	DrugsActive2nd(D)	FoodActive2nd (B)	FoodDemo2nd (C)	FoodDemo2nd (C)	DrugsActive1st	DrugsActive2nd(D)	FoodActive1st(A)	FoodDemo2nd (C)	DrugsActive2nd(D)
DrugsActive2nd(D)	DrugsActive2nd(D)	DrugsDemo2nd(A)	FoodActive1st(A)	DrugsActive1st (C)	FoodActive1st(A)	DrugsActive1st (C)	DrugsActive1st (C)	FoodActive1st(A)	FoodDemo1st (D)	DrugsActive1st (C)	DrugsActive1st (C)	DrugsActive1st (C)

1. If the interactive food scenario was performed first, no participants found anything suspicious. If the non-interactive food scenario was performed first, all participants correctly found the food and the passenger to be guilty.
2. More questions were asked in interactive mode, but many questions were irrelevant. More relevant questions were asked regarding the food scenario whether interactive or non-interactive than for the drug scenario.
3. If interactive mode was performed first, subjects did better in coming up with valid questions for the non-interactive scenario presumably because they had some practice at thinking of questions, rather than just observing.
4. Group C did not learn from watching the food scenario demo but gave exactly the same mix of valid and invalid responses to question 8 that they did after the interactive session even though the demo provided the example they needed.
5. Watching the food scenario demonstration did not assist with learning the appropriate questions to ask in the interactive drug session.
6. Groups B and D did not improve their scores in learning how to behave towards the passenger from watching the demonstration even though the demo clearly demonstrated polite, clear and respectful language. Group C made a marginal improvement (2→3 right) and Group A did worse (9→6 right).
7. While Group B has the highest overall score, this is partly due to the normalization process, because being a group of 3 their responses were weighted double of the group of 6 (Group D) and primarily due to their high score for question 12. In fact, Group D's raw score for question 12 was 6 compared to Group B's raw score of 7. For questions 2-11 which were more content than behaviour based, Group B only had the top score twice. All groups came first in at least one question.

8. Looking at Table 2, the demonstrations, whether for food or drugs or whether first or second, appears in the top 4, 16 times compared with 8 times for interactive for question 2-7 which concerned the actual experiences. For questions 8-11, which concern how well the knowledge could be transferred to a similar situation, the demonstration appeared in the top 4, 12 times compared to 8 times for the interactive sessions.

   Similarly, looking at Table 1, three of the top four results are for the demonstrations. This indicates better results overall for the demonstrations.

9. The shaded cells in Table 2 represent sessions that started with the demo (Groups B and D). We can see that the greater proportion of results appear in the top half of the table. Question 11, which concerned working out what questions were appropriate to ask someone staying longer than 31 days, could not be ascertained from either demonstration. Getting this right would be based on exploring such questions during the interactive session. Possibly explaining the poor results when the demo was done first.

Question 13 sought to determine if the participant performed better because of prior knowledge gained from watching Border Security. 10 participants had never seen Border Security before, 4 had seen it once or twice, and 3 had seen it more than five times. No one in Group B had seen the program, so they did not have an advantage. The 7 who had seen Border Security were spread through the other three groups.

Question 14 asked if the participants could suggest additional features. The responses and the number of people with that response are as follows:

- voices/audio so that you can detect the tones and any odd behaviour/emotions (7)
- a list of questions you can ask (2)
- facial features, graphics, AI and more integrated actions (6)
- more hints (1)
- bag and/or items on screen (6)
- searching bag yourself (1)
- more people to make simulation more realistic (1)
- x-ray of luggage (2)
- drug test (1)

Questions 15 and 16 were only to be answered once both tasks had been completed and sought to find out the participants views and preferences. 10 participants preferred the interactive session, 5 preferred the demonstration, 2 liked them equally. The combined responses were:

- demo provides an example to give you an idea what to do (3)
- interactive lets you experience/practice/try it yourself (7)
- didn't know what to do in interactive session (1)
- interactive multiple approaches possible (3)
- interactive because more difficult to find problem/solve problem themselves (2)
- interactive session provided much more learning (3)
- interactive session gives better understanding of possible difficulties (1)
- interactive session more enjoyable (1)
- interactive because keeps focused (1)
- demo shows logical progression (1)

Question 17 asked for any other comments:

- interactive should provide more time to type in questions
- good program… rather interesting
- missed some speech or directions while reading instructions
- having to break up the text into separate boxes was distracting so sometimes I forgot what I was writing
- interactive session was embarassing
- like videogames
- easier to learn on the job, nothing at stake/no risk
- restrictions of textbox - forgot what s/he wanted to ask/slow writer
- believes s/he would have gotten more out of the trials if shown the demo first
- promising use of technology
- still has no idea if the passenger should be let into OZ
- better picture quality
- Daryl's advice could guide the user better

5. DISCUSSION AND NEXT STEPS

Due to the small sample size the results provided are inconclusive, but nevertheless they provide some basis for speculation and further work. It is interesting to note that even though the results indicate that groups performed better after the demonstration, particularly if the demonstration was performed first, that there was still a greater preference for the interactive session and prevailing belief that interactivity is better than none. When we are being entertained our preferences are very important, as it is generally our choice to be entertained. However for the training situation, being trained is often not optional or based on the trainee's preferences. The goal of interactivity in the educational setting should be to enhance the experience and achieve greater engagement leading to greater learning. However, this study does not indicate that greater learning had been achieved when interactivity was involved while supporting that people will, in general, prefer to interactively participate when given the choice. However, the effort in providing interactivity, even in this study was far greater than providing the demonstrations. Given that the results in general were worse and the time and development costs greater to provide interactivity, one has to reconsider its value. In support of interactivity, it appears that interactivity provided the hands-on experience useful for learning what to ask and how to behave.

As Wilson points out, "the inclusion of choice structures does not automatically indicate a new respect for the user's autonomy, intelligence or call out significant psychic-participation. In fact, some analysts suggest that much interactive media is really a cynical manipulation of the user, who is seduced by the semblance of choice" (Wilson, 1993, p12).

We intuitively believe with the majority that in the longer term a training system that includes interactivity has the potential to assist learning more than passive learning. It is possible that our novice population were so unfamiliar with the domain that they did not have enough basic knowledge to get the best from the experience. We plan in the next few months to repeat our study with Macquarie University Security Officers who would be more familiar with the security domain. We anticipate better results for interactivity, if the technical aspects and unfamiliarity of dealing with the game system is not a hindrance in this group of users who we expect to be less computer and game savvy.

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Appendix A - Questionnaire

1. Was the passenger male or female?
2. Out of the questions and/or tasks that were asked/carried-out, what do you think were particularly relevant in determining if the passenger was guilty of some illegal behaviour?
3. Are there any other questions and/or tasks that you felt should have been asked/carried-out? If so, what are they?
4. What did the passenger plan to see or do in Australia?
5. Were there any suspicious objects in the passenger's bag? If so, what were they?
6. Was the passenger guilty of any illegal behaviour? If so, what was it?
7. If the passenger was fined, how much were they fined?
8. A passenger has brought in money over $10 200 (which is the official limit) Australian and has arrived for the *first time* in Australia and therefore has not been warned before. What is the most likely thing to do?
   a. Half fine b. Full fine c. Warning d. Contact police e. Let go
9. A passenger has brought in money over $10 200 (which is the official limit) Australian and has arrived for the *third time* in Australia and has been warned before. What is the most likely thing to do?
   a. Half fine b. Full fine c. Warning d. Contact police e. Let go
10. A person is planning to stay in Australia for 4 days as a tourist. Which question/s should be asked?
    a. What do you plan to see or do in Sydney? c. Do you have any credit cards with you?
    b. Where are you planning to stay? d. How much cash did you bring with you?
11. A person is planning to stay in Australia for 31 days as a tourist. Which question/s should be asked?
    c. What do you plan to see or do in Sydney? c. Do you have any credit cards with you?
    d. Where are you planning to stay? d. How much cash did you bring with you?
12. As a customs officer how should you act/behave towards an extremely rude passenger?
13. Circle the option that best describes your situation
    I have watched the TV program Border Security Never once or twice three to five times more than five times
14. What additional features could be added to what you watched to make it better and in what way?
15. If this is your second task, do you think the demo or interactive session would be most useful for training purposes? Why?
16. If this is your second task, did you prefer the demo or interactive session? Why?
17. Any other comments?

=== End of Questionnaire ===