

# Traveller – Intercultural training with intelligent agents for young adults

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## ABSTRACT

In this paper we describe Traveller, an intercultural training tool for young adults. Traveller is based on an original theoretical framework which focuses on key concepts of intercultural training. By progressing through a creative story, users are able to engage via a novel interaction paradigm with intelligent virtual characters that incorporate different simulated cultures which can lead to misunderstandings and sometimes conflicts. Through the use of an innovative evaluation approach, users will gain a greater understanding of the behavioural differences between these characters, and thereby learn to become more effective at dealing with misunderstandings due to differences in culture.

## Categories and Subject Descriptors

K.3.0 [Computers and Education]: General

## General Terms

Design, Human Factors, Theory.

## Keywords

Intercultural Training, Virtual Environment, Intelligent Agents, Interaction.

## 1. INTRODUCTION

In 21st century Europe, many cultural, ethnic, and religious groups must live and work together. Such integration is not always a smooth process and cultural differences can lead to social stresses and sometimes outright conflict. Intercultural training has been proven to be a valuable tool for helping people to deal with such misunderstandings in an affective, cognitive and behavioural manner.

Traditionally, intercultural training requires professional trainers to lead the training session, and professional actors, or fellow learners, to participate; see [1–3] for an overview. Also, all those involved are required to be in the same location at the same time. This can lead to training sessions being very expensive, time-consuming, and difficult to organise.

Recently, researchers have been looking into creating digital intercultural training tools (for an overview, see [4]). Not only are such tools more easily accessible than non-digital materials, but they also have the added possibility of being able to incorporate virtual (intelligent) characters, which can be used to replace real life participants or professional actors. The end result is a complete intercultural training package that can be accessed by anybody, at any time. By adding game-like characteristics, such as narrative and innovative interaction, such a training package can ensure that users stay motivated throughout the training.

In this article we describe the development of *Traveller* (Train for Virtually Every Locality), an intercultural training tool for young adults, between 18 and 25 years old. In Traveller, users will be able to interact with intelligent characters embodying models of cultural-specific behaviour (these models are based on differences between existing cultures). These interactions will happen as part of a larger narrative, in which the user travels to different countries to follow in the footsteps of his or her grandfather in search of a hidden ‘treasure’.

The aim of Traveller is to break down the existing interpretation rules of the user. Based on their own upbringing, the user has a set of rules that help him to interpret the affective state of another person (i.e. ‘he acts in a certain way, so he must be mad at me’). It is very likely, if they have had few interactions with people from another culture, that this interpretation is incorrect, as each culture has their own guides to appropriate behaviour. Such an incorrect interpretation of emotions can lead to prejudice, mistrust, or even conflicts.

In the first two sections we discuss the theoretical background on intercultural training, and the resulting intercultural learning framework that we have created based on this theory. In the third section, we describe the narrative and educational flow of Traveller. Section four expands on the interaction modalities that are used to interact with the virtual characters. In section five we discuss the underlying agent architecture that is used to embody culturally-varying behaviour in these characters. In the sixth section we discuss the embedding of the intercultural training tool into a larger evaluation approach. We end this article with some short conclusions.

## 2. THEORETICAL BACKGROUND

Adept management of intercultural encounters poses great demands on people who are to interact with representatives of groups that do not share their verbal and nonverbal communication styles, as well as live adhering to different rules and customs. A psychological framework for behavioural components of such interactions is provided by culture learning theory [5]. In contrast to other theories (i.e., stress and coping approach, social identification approach) this theory draws on social and experimental psychology, and especially on work on social skills and interpersonal behaviours [5], to describe social processes taking place between people new to a given culture and members of that culture. Furthermore, it highlights the characteristics of the process of learning for acquiring skills that are essential to effective communication in new environments.

According to the culture learning theory, intercultural interactions closely resemble any other type of social interactions in that they can be easily disrupted when the parties engaged fail to regulate the interaction appropriately. Generally, this occurs when they are not familiar with conventions that guide the other’s behaviour. Foreign etiquette has a variety of components one should get acquainted with if the intercultural interaction is to develop smoothly. These entail norms concerning expression of emotions, proper use of posture, gaze and silence for communicating nonverbal messages, and performance of various routines, for example greetings [6]. When people from different cultural backgrounds violate each other’s expectations as to the above mentioned activities, effective intercultural interactions may be endangered.

The culture learning theory points to culture-specific knowledge as being the main predictor of adaptation to a new social context. This kind of knowledge has to be paired with certain skills that bring about an overall improvement of people’s performance in situations taking place in intercultural context [7]. Such advancement can be generated out of changes in three spheres. First, learners should undergo a cognitive change, recognising the impact that their own culture has on their interactions with members of different cultures, and gather as much information as possible about those cultures. In other words, they need to develop intercultural awareness. Second, constituents of training that target emotional development of the learners ought to enable changes in affective reactions to people of unfamiliar cultural background. This can be labelled as the development of intercultural sensitivity. Last, learners’ behavioural repertoire should be expanded to include skills that facilitate effective communication with people from another culture [7]. This can be seen as intercultural communication.

## 3. LEARNING FRAMEWORK

Based on the description of intercultural learning above, we have developed an overview of the necessary learning goals. These can be found in Figure 1 and are in order of increasing difficulty. The

Type of Learning Goal	Emotional goals	Cognitive goals	Behavioural goals
Stage of learner			
<b>Beginner</b> <i>(conscious incompetence)</i>	Be able to recognize your emotions (for example fear and anxiety) when dealing with strange behaviours of another group	Start learning the specific practices and values of another group	Be fully present in attending to the other's verbal and non-verbal messages
<b>Journeyman</b> <i>(conscious competence)</i>	Be able to observe the behaviour of another group without feeling prejudice	Understand on a basic level the differences and similarities between another group and your own	Practice skills learned in the previous stage and experiment with different forms of behaviour
<b>Expert</b> <i>(unconscious competence)</i>	Be able to share the emotions (such as sadness or happiness) of a member of another group and other's experiences through empathy	Players should be able to discriminate and select appropriate strategies in cultural contexts	Be able to unconsciously participate in a group as a native

Figure 1: Intercultural Learning Framework developed for Traveller

underlying assumption of this table is that learners are aware that there are differences between themselves and people from other cultures. However, they do not yet know what these differences are, or how to deal with them.

This first stage focuses on learners becoming aware of their own emotions and those of others during interactions, becoming aware of the practices that people from another group use, and paying full attention to the verbal and non-verbal behaviour of those people. In the second stage learners will now have a basic understanding of the behavioural tendencies of the other group, but they are not yet able to intuitively interact with people from that group (conscious competence). In this stage they will have to learn to observe the behaviour of people from that group without prejudice, understand the differences in behaviour and interpretation of the other group and their own, and practice and experiment with skills learned in the first stage. In the final stage they will have become an expert at interacting with people from the other group (unconscious competence). This will allow them to develop a sense of empathy for the members of that group, and will be able to unconsciously adapt to new situations. Their behaviour will be pretty much undistinguishable from that of a native.

Depending on the focus of the training tool, i.e. culture-general or culture-specific, you could respectively focus more on the top-left side, which focuses on more abstract learning goals that apply to people from many different cultures, or the bottom-right side, which focuses on more specific learning goals that will only apply to people from specific cultures. If one wants to become a true native however, they will have to master both sides of the framework.

## 4. TRAVELLER

Traveller starts with the learner selecting an avatar. In this guise, the user will encounter and interact with virtual intelligent characters. Throughout the story, the user will travel to three different countries, and the characters there will follow different rules for behaviour; the characters from each country will have a different synthetic culture [8].

At the moment, Traveller consists of three different types of sequences: *narrative sequences*, *emergent agent sequences*, and *evaluation sequences* (see Figure 2 for the flow of sequences).

### 4.1 Narrative Sequences

At the beginning of the game, the user receives word that his/her grandfather has passed away. This grandfather, a well-known traveller during his younger years, has left the user a letter, and some very old pages. In this letter, grandfather mentions that he started travelling because he heard rumours of a long lost treasure. He was never able to find the treasure, so he encourages his grandchild to finish what he started. To do so, the user must find the pages of his grandfather's journal, which have been scattered all over the world; he will have to travel to a few different countries to find these missing pages.

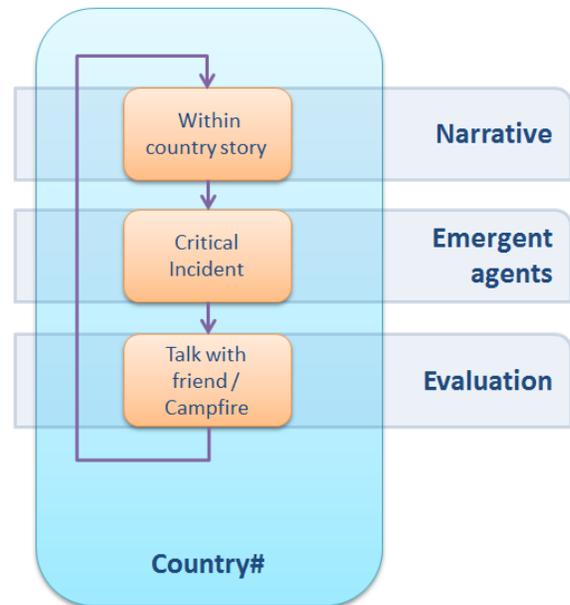


Figure 2: Flow of sequences in Traveller

Within each country, there will be multiple narrative sequences. During these sequences, the user will receive information about his progress and help to bridge the sections between the other sequences. The story also acts as a framing device, to give meaning to the actions of the users in the other sequences and to help them establish their goals. There will be no user interaction during these sequences.

### 4.2 Emergent Agents Sequences

During his travels, the user will have to interact with virtual characters to progress. We call these interactions 'critical incidents' and they only happen during emergent agent sequences. Each critical incident features a specific context, a certain problem, and a set of actions that he can use to deal with this problem.

For example, in one incident the user has just arrived in a new town, and cannot find a hotel. The user will go into a bar, in the hopes that somebody there can help him out. Here he can choose actions that might be considered appropriate within a bar environment: buying yourself/somebody else a drink, greeting people, asking how they are, etc. Depending on his interactions with the people in the bar, and their synthetic culture, he can, for example, become friends with them, be invited to sleep at their place, or leave without getting any help.

The behaviour of the user determines the response of the characters. This means that if they act appropriately, there will be few misunderstandings and conflicts. However, the incidents are set up to be quite diverse, and because they will encounter a range of different behaviours, users will get into quite a few misunderstandings. Also, the incidents will get increasingly problematic in each country. For example, in the first country, they get into no real troubles, but in the second country they will be accused of breaking laws/customs.

### 4.3 Evaluation Sequences

Each critical incident is followed by an *evaluation sequence*. Because the user might encounter different behaviour than he expected, the user may end up confused or frustrated after interacting with the virtual characters. The evaluation sequences are meant to help the user to understand the behaviour of the virtual characters.

At the moment, we have two different ways of creating an embedded evaluation within the story. These provide important input for independent assessment of the user's progress in a larger context of intercultural training:

#### 4.3.1 Campfire-type evaluations

Users can sit around a (metaphorical) campfire with friendly characters and talk about their experiences. These characters will be natives of the country that the user is visiting, and can help the user to understand things from a different perspective. By doing so, we are able to give the user 'expert feedback' without breaking the magic circle.

#### 4.3.2 Talking to a friend type evaluations

The user can talk to a friend back home about their experiences. Their friend will then ask him/her questions about the events that happened that day, or in the country he just visited. Their friend is also quite knowledgeable, as she is able to clarify intercultural misunderstandings by asking questions about the user's perceptions and interpretations ("why do you think they would act in this way?").

## 5. USER INTERACTION

By taking novel interaction techniques into account, we decided to use full body gestural interaction as it offers an intuitive way to implement cultural differences in gestures and it should be an engaging way of interaction to the target group.

To achieve full body interaction, we used the 'Full Body Interaction Framework' (FUBI), described in [9], that we use in combination with the Microsoft Kinect for Windows low-cost depth sensor<sup>1</sup>, and the Kinect for Windows SDK<sup>2</sup> for user tracking. For Traveller we currently use two basic types of full body interaction, based on work from [10]. Our current setup is depicted in Figure 3, and consists of interaction with a graphical user interface (GUI) and general gesture recognition.

#### 5.1.1 GUI Interaction

GUI interaction is implemented according to the well-known point-and-click paradigm with a mouse. The user can move a cursor across the screen by moving his dominant hand in the air. We use a relative mapping between the hand and cursor position, so the user does not have to point directly at the desired position on the screen, but the hand movements in a more comfortable

position are filtered for smoothing, scaled, and translated to cover the screen coordinates as e.g. described in [11].

The GUI interaction allows the user to select arbitrary items of the GUI similar to using a mouse: items are selected by holding the cursor over it and performing a pushing gesture in downwards direction with the other hand (other-push selection). This type of interaction is mainly used for triggering out-of-game actions, such as proceeding through the story. It would of course have been possible to use a mouse and keyboard for GUI interactions. However, switching back and forth between different interaction modalities can be very disruptive. That is why we try to keep the full body interaction 'hands-free' for the whole scenario.

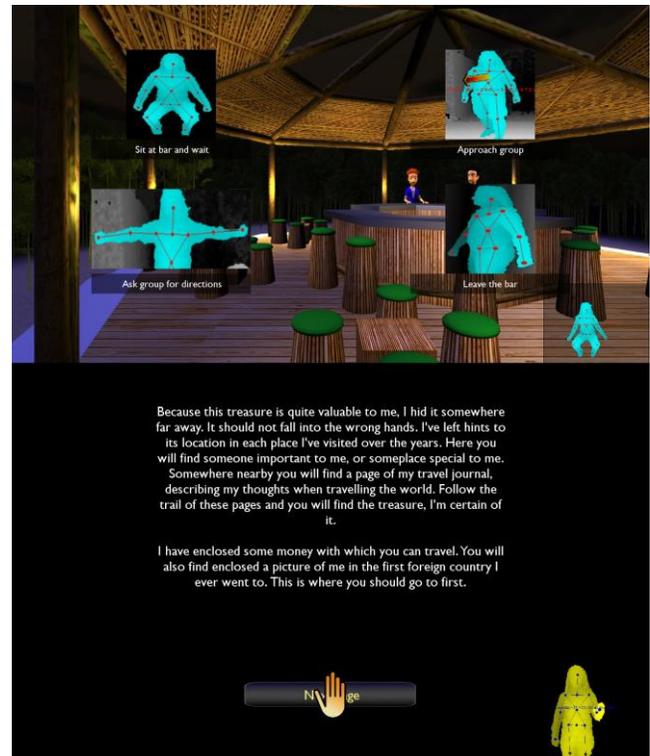


Figure 3: Interaction in Traveller

#### 5.1.2 General Gesture Interaction

General gestures are applied for more meaningful interactions in our scenario. For example, in Traveller, the user sometimes has to choose the correct greeting gesture in a specific situation after watching virtual agents that perform different greeting gestures depending on their simulated culture and the person he is greeting. There are, based on the cultural configuration of the characters, two different, but still similar greeting gestures: a small bow with hands near the hips, and a deep bow with both hands above the head.

Whenever user interaction is requested by the application, the currently available actions are displayed on screen via gesture symbols accompanied with the action texts as depicted in Figure 3. The user should choose one of the options by performing the gesture as visualised by the corresponding symbol, that can either consist of a single image or an animation sequence. As soon as a

<sup>1</sup> <http://www.hcm-lab.de/fubi.html>

<sup>2</sup> <http://www.microsoft.com/en-us/kinectforwindows/>

symbol is displayed on screen, FUBI automatically checks the corresponding gesture defined via XML and – if the recognition has been successful – triggers an event related to that symbol. The FUBI gesture definitions can contain three types of basic gesture recognisers:

1. Joint orientation recognisers are defined by a minimum and/or a maximum angle for a specific joint;
2. Joint relation recognisers look at the position of a joint in relation to a second one, e.g. whether and how much a joint is above a second one or how large the distance between those two is;
3. Linear movement recognisers are defined by a specific direction and a minimum and/or maximum speed.

In addition, those three types of recognisers can be combined to sequences in so-called combination recognisers. A combination recogniser consists of several states that contain sets of the above mentioned basic recognisers. For each state there is a minimum and maximum duration defined that those recognisers have to be fulfilled for the recognition process to get into and stay in this state. For the transition to the next state there is also a maximum duration defined. In this way, relatively complex gestures can still be added quickly to the application without requiring large training data or machine learning knowledge.

To find intuitive gestures for the actions in our ‘emergent agent sequences’, we applied a process inspired by [12] and previously tested in [13] for the creation of a user-defined gesture set. We therefore present our application to study participants with real interaction disabled, but with hints about what actions currently would be requested. The participants then should perform gestures which they think is most intuitive. All gesture performances are recorded on video and later analysed for determining gesture candidates for each action by categorising the gestures performed for this action and looking at the occurrences of the same gestures.

#### 4. CULTURALLY-SENSITIVE AGENT ARCHITECTURE

Developing characters that react in an environment in a believable and autonomous way is a challenge that is being pursued by many researchers in the AI community. Several agent architectures have been proposed, investigated and developed, which address different issues, goals and particularities in those agents. In Traveller, we aim at creating autonomous characters that not only react and behave in a believable way (as they are meant to socially interact with humans) but also do so according to a particular cultural configuration.

Figure 4 shows the overall diagram of the architecture that has been applied in Traveller. It was built on top of FATiMA [14], a well-established architecture for emotionally intelligent agents that follows the OCC Appraisal Theory [15]. The reason we have chosen this particular architecture is because it already endowed the characters with the capability of ‘feeling’ emotions in response

to events. It also has the capacity for agents to have reactive and deliberative behaviours. Such qualities are essential to create characters that seem believable and autonomous. However, in order to create culturally-adaptive agents as it is intended in Traveller, an explicit model of culture was integrated in the architecture.

Overall, the architecture works in the following manner. When an event is perceived, it passes through a ‘Symbol Translator’ that translates the meaning of the event according to the culture’s predefined symbols, using a simple association mechanism. This process was added because agents should be capable of ‘interpreting’ the actions of other agents in a culturally-biased way. This means that when creating agents for a specific culture, one must consider the fact that there may be shared understandings of particular gestures, words, etc., constituting the ‘symbols’ of that culture.

After the event is translated, it is then appraised by the agent, which can lead to a change in its emotional state. As shown in the diagram, the appraisal is divided in two processes. The first is the ‘Appraisal Derivation’, in which appraisal variables, such as Desirability or Praiseworthiness, are determined in relation to the event that happened. As marked by the arrows in the diagram, several existing components contribute to this process, including Culture. The second process, termed ‘Affect Derivation’, generates emotional states based on the previous variables, according to the OCC Theory (for instance an event that is appraised as highly desirable will generate an emotion of Joy).

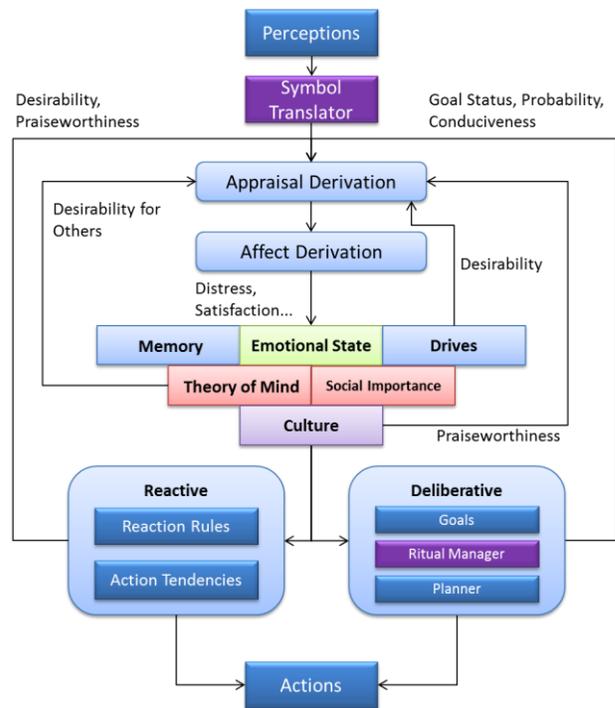


Figure 4: General Diagram of the Agent Architecture Used in Traveller

When the appraisal is concluded, the agent updates its ‘Memory’ and ‘Motivational Drives’<sup>3</sup>. Note that agents also have a ‘Theory of Mind’ component, which allows them to model the other agents’ beliefs and emotional reactions. The agent then selects the next action it should perform, according to different layers. The ‘Reactive layer’ allows the agent to trigger fast reactions in response to a particular emotion (e.g. crying when feeling Distress). On the other hand, the ‘Deliberative layer’ takes longer to react but allows for a more goal-oriented behaviour. It starts by checking if any goal has become active and selects the most relevant one. The agent then forms an intention of achieving that goal and uses the ‘Planner’ component to develop and execute a plan. The architecture has also a ‘Ritual Manager’ for dealing with the activation and execution of cultural rituals, inspired by [16]. The motivation behind modelling rituals is that, as argued in [17], they are a fundamental type of cultural manifestation that is constantly present in micro-social interactions.

Finally, the ‘Social Importance’ component allows us to generalise the social factors of human motivation. The model is based on Kemper’s status-power theory [18], which considers that the social behaviour of humans, including their participation in cultural rituals, is ultimately driven by two behavioural dimensions, referred to as status and power. The proposed model operationalises one of these dimensions, status, in the way that it affects the agent’s perception, deliberation and planning, as described in [19].

Finally, the ‘Culture’ component is closely tied to the ‘Social Importance’ component by adding cultural influences in the way agents attribute status to one another and on how much status is conveyed or claimed by certain actions. Such influences depend on the scores associated to the cultural dimensions of the agent’s profile. For instance, the higher the level of collectivism, the lower the status attributed to out-group members.

## 6. OVERALL EVALUATION APPROACH

With Traveller, our aim is to evaluate the learning through the innovative use of a range of technologies within a game context. Our approach to evaluation is inspired by Transmedia Evaluation [20], an approach which provides users with an experience constructed around the narrative provided by the application. Within that experience, all training for engagement and all instruments used for evaluation purposes are transformed to fit within the theme of the application and are seamlessly embedded within the user experience, as can be found in [21].

The Traveller age group, 18-25 years, readily participates in wide-ranging narratives across multiple media, modalities and platforms. So, we are provided with a flexible user group who will be likely to buy-in to anything we do as long as it engages them and makes sense within their user role and context.

<sup>3</sup> The modelled drives are Energy, Integrity, Affiliation, Certainty and Competence.

For Traveller, we have developed a user experience with a narrative related to the journeying aspects of the application. The role of the user within this narrative is game player. Figure 5 provides the evaluation and interaction experience that the user will engage in with Traveller. This is further described below as a series of Acts. These acts include activities which are context setting for the role play as well as for gathering data for evaluation purposes.

In each act we will use a range of cultural, social and interaction related questionnaires and activities, user generation and consumption, discussion and in-role tasks and experiences. This will include adapted versions of the Cultural Intelligence Scale [22], the General Evaluation Scale [23], the Intergroup Anxiety Scale [24], and the Empathy Index [25].

The adaptation of these questionnaires is achieved through aesthetic and graphical approaches contextualising the instruments in relation to the Traveller narrative. To encourage users to fill in the various instruments, instructions will include factors such as the idea that completion of forms adds to the sophistication of the game experience. This is an approach that has been used with Transmedia in TV productions (e.g. psychology tests on Byzantium.com as part of the BBC’s Hunted Transmedia [26]).

### 6.1 Prelude: Recruitment

Approximately two weeks before the evaluation event, participants (final year students) are asked if they would like take part in a game about travelling, in which the different locations are provided through 3D virtual, fictional spaces at the University of Sunderland. Users will be told that they will engage with large screens and gesture based interaction through the Kinect and that they will be videotaped during their experience so researchers can interpret how well the interaction works.



Figure 5: User's Experience with Traveller

### 6.2 Act 1: Pre-Travel Activities

Participants who wish to participate then take part in an online sign-up activity. The purpose of this activity, for the participants, is to create travel documents to enable them to visit different countries within the application. Through this process a series of

questions are asked, providing descriptive data. This input results in the user being presented with a Passport and the relevant visas needed to travel within the game.

### 6.3 Act 2: Arrival & Preparing to go

On arrival to the event, participants are taken to the departure lounge. The participant is then provided with a series of tickets, travel documents and a pack of postcards. Participants are told that using these postcards will result in greater progress through the game.

Participants are then supplied with a small backpack and asked to continue into the adjacent room where they should select 5 objects from those available. Participants are told that they have 10-15 minutes until departure time and left alone until they receive an announcement that their ship is boarding. In the departure lounge, there is a clearly identified 'tourist information console' which provides tourist information about the proposed locations.

Also within the departure lounge are magazines with quizzes in them. Above the magazines, and tied to the quizzes, are balloons with 'bonus' written on them. The quiz that participants are asked to complete is the 5 factors personality questionnaire. When the cast member returns to the departure lounge to make the announcement they first unlock the cupboards to display a shelf with coloured booklets. When participants present their quiz and documents to the cast member, who in turn provides them with a 'coloured, focused scrapbook' based on an assessment of their responses (all scrapbooks are the same) to the 5-factor questionnaire.

### 6.4 Act 3: Using the Traveller application

In this act participants use the Traveller application. As participants arrive at each country, they are asked a series of questions relating to why they think they are travelling, similar to the types of questions asked at borders and customs. When they've finished a country, participants temporarily leave the application, and return to the departure lounge set. Once back in the lounge, participants are offered an opportunity to create a scrapbook based on their experiences. Key shots of activities, locations and people whom the user engaged with are provided, along with their own photos and media. Participants are asked to rate each experience using a range of approaches, including a staff assessment form provided by the Ship Company, a drinks' mat with a competition (that expresses understanding of the cultural dimensions [27] from the caterers, etc.

### 6.5 Act 4: Going Home

After finishing the application, users are interviewed by a cast member to catch their immediate views of their experiences on camera. In this final act, participants end the scenario and are sent home with some tourism gifts from their experiences.

### 6.6 Epilogue

The gifts that users depart with will include items from the destinations, along with questionnaires and on-line and Transmedia opportunities for the participants to further expand

their Traveller experience. Reminders to complete the interaction will be provided one week after the experience, if instruments remain uncompleted.

## 7. CONCLUSION

In this article we have shown the different aspects of Traveller, an intercultural training experience for young adults. By using an intelligent agent-architecture that is capable of showing cultural differences, and by using innovative interaction devices capable of recognising culturally different gestures, we are able to offer young adults an innovative digital package to increase their intercultural competence through interaction with virtual characters. By adding game-like mechanics, such as interaction and narrative, and by using the tool as part of a larger experience, Traveller is not only educational, but also engaging.

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