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Using virtual worlds to elicit differentiated responses to ethical dilemmas

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Two significant drivers of change within the contemporary educational landscape are the increasing emphasis for learners to gain effective problem solving skills and the ongoing transformation of student interactions through advances in information and communication technologies. One emerging technology, virtual worlds, offers a range of opportunities for the design of activities that involve problem solving. This paper reports the results of a study intended to identify opportunities and limitations of virtual worlds to support activities that involve one type of ill-structured problem, an ethical dilemma. A scenario was designed to utilise the characteristics of the virtual world technology to engage research participants within an ethically toned situation, while facilitating individualised responses to the situation from each participant. The success of the scenario was evaluated according to the extent that differentiated perceptions and responses were elicited from participants. Analysis of three contrasting cases indicates that the scenario did elicit differentiated responses based on the differences in participants' ethical sensitivity and solution paths, although there were some confounding effects from variation in the performance of actors involved in the scenario. The conclusion is that virtual world scenarios can be used to elicit differentiated problem solving responses from participants, thus exhibiting potential to play a significant role in the development of learners' problem solving skills.

Keywords: problem solving, ethical dilemmas, virtual worlds, simulations, role play

Introduction

"Complex environmental, social and economic pressures such as climate change that extend beyond national borders pose unprecedented challenges, requiring countries to work together in new ways. To meet these challenges, Australians must be able to ...

approach problem-solving in new and creative ways" (Ministerial Council on Education, Employment, Training and Youth Affairs, 2008)

Advances in information and communication technologies have created opportunities for the development of new educational techniques. Education research is central to understanding how these opportunities can be exploited appropriately, to support improvements in key educational objectives such as the formation of students' problem solving skills. This study evaluates the extent to which virtual worlds technology may support the development of scenario-based activities that involve one type of ill-structured problem, an ethical dilemma.

People may respond to ill-structured problems such as ethical dilemmas in different ways, depending on a variety of individual differences (Jonassen, 2000). Activities that evoke individualised responses to ill-structured problems may reveal these individual differences, and could be usefully integrated into educational programmes to support individualised development of problem solving skills. Virtual worlds can elicit differentiated responses to ill-structured problems in ways that would be difficult or impossible to achieve by other means.

This paper identifies potential points of difference in people's responses to ethical dilemmas, and then explores some opportunities presented by virtual worlds for the development of ethically toned scenarios that would elicit differentiated responses from participants. By using the technique of choreography, we show how designers can present key issues while providing a dynamic space in which participants generate their own problem solving trajectory. The scenario developed for this study is then presented with details of the research method. Finally, results are presented and discussed, and some future directions for research are highlighted.

Eliciting responses to ethical dilemmas

Ill-structured problems involve unknown problem elements and multiple solution paths which make it difficult to identify the best actions to reach the goal (Jonassen, 2000). Often, it is difficult or impossible to predict the outcome of each option in terms of progress towards the desired goal state. Ill-structured problems are irrevocably tied to the situation from which they emerge (Brown, Collins, & Duguid, 1989; Gee, 2003; Lave, 1988, 1993), which makes them difficult to effectively resolve using generic problem solving techniques, and thus more responsive to individual differences in approaches to problem solving (Jonassen, 2000). The implication of this is that different people will interpret problematic situations in different ways, and enact different solution path towards a resolution.

Some ill-structured problems invite consideration of ethical values. At their most difficult, these problems take the form of ethical dilemmas, in which each potential solution contains unacceptable trade-offs. MacKay & O'Neill (1992) distinguish between two types of ethical dilemmas: purely ethical dilemmas are problems that "involve an apparent conflict of ethical values"; and mixed ethical dilemmas "involve a conflict between an ethical value and some nonethical consideration". Not all ethically toned situations will generate a dilemma. Sometimes, the ethical considerations may guide the response to the situation without evoking the moral conflict that characterises an ethical dilemma. As with other forms of ill-structured problem, different people may perceive an ethically toned situation in different ways and follow different solution paths towards resolutions. The following paragraph further elaborates this point.

Differences in people's perception of ethical situations are related to people's ethical sensitivity, which refers to the idea that different people have different levels of ability to recognise the ethical nature of a situation (Shaub, Finn, & Munter, 1993). People with different levels of ethical sensitivity will perceive different ethical considerations within a situation, which may lead them to respond in different ways. Differences in people's responses to ethically toned situations have been linked to a variety of factors (Trevino, Weaver, & Reynolds, 2006). For the purposes of this article, it is enough to recognise that people do respond to ethically toned situations in different ways, and to design a scenario that elicits differentiated responses. A detailed exploration of the factors which underpin those differences is outside the scope of this study.

The scenario activity evaluated within this research study consists of a simulation of an ethically toned situation, in which participant may recognise personally meaningful ethical issues and then enact a response based on their personal interpretation of the situation and options. Simulations have been

described as "a simplified and contrived situation that contains enough verisimilitude, or illusion of reality, to induce real world-like responses by those participating in the exercise" (Keys & Wolfe, 1990, p. 308). The scenario is designed to not only allow participants to respond using "real world-like" behaviours, but also to facilitate individualised perceptions of the situation that reflect individual differences in participants' ethical sensitivity.

Simulations are useful for providing learning experiences in safe, observable and customisable settings. These experiences may be used to prepare people for dealing with problems they may subsequently face in everyday activity. Within an educational context, the simulations could be integrated into courses and supported with other opportunities for learning through discussion and reflection. The educational possibilities of virtual world scenarios will be elaborated in the concluding remarks, to allow consideration of the results of the analysis.

The potential for using virtual world scenarios for the simulations involving ethical decision-making has previously been highlighted by Campbell (2009), but has not been previously empirically evaluated. Virtual worlds (also called virtual environments or synthetic worlds) present a range of characteristics that could be utilised to support activities that allow learners to enact differentiated responses to ill-structured problems such as ethical dilemmas. Bainbridge (2007) defines virtual worlds as "electronic environments that visually mimic complex physical spaces, where people can interact with each other and with virtual objects, and where people are represented by animated characters".

Virtual worlds support a range of social interactions, through their support of multiple modes of communication and representation of users through avatars. They offer both synchronous communication, through text and audio chat, as well as asynchronous modes of communication, through messaging systems and the embedding of information within the environment by designers and end-users. Additionally, virtual worlds facilitate embodied social communication, facilitating the enactment of a range of social practices that rely on forms of embodied activity. Being re-embodied within a virtual world through an avatar allows a virtual world user to utilise relations involving presence, placement, perspective, and place when interacting with other people and the virtual environment (Schultze, Hiltz, Nardi, Rennecker, & Stucky, 2008).

Re-embodiment within a virtual environment permits a range of behaviours which may modulate social interactions. These behaviours are useful to scenario designers who wish to add social elements to a scenario that may modulate learners' responses. Virtual environment researchers have described several ways in which re-embodiment impacts social practices, including:

- People may form judgments based on an avatar's appearance (McVey, 2008; Taylor, 2002);
- Close proximity between avatars may be a signal of a close friendship or an invasion of personal space, depending on the relationship of the avatars (Boellstorff, 2008; Taylor, 2002);
- Avatars may use gestures and facial expressions to convey additional communication, depending on the features of the technology (Antonijevic, 2008; Taylor, 2002);
- The environmental surroundings play a role in the creation of social practice, for instance social dynamics may be different in small rooms compared with larger rooms or may be shaped by the arrangement of objects such as furniture (Heim, 2001). This allows the enactment of complex social practices in which the location and presence of participants is crucial, such as weddings, memorial services, protests and legal proceedings (Boellstorff, 2008; Taylor, 2002).

As any learner interactions would be mediated by the technology, only particular social practices could be enacted within the virtual world. Tool use, for example, would be significantly reliant on the functionality and set up of the virtual world. Nevertheless, a variety of role plays have been successfully implemented within virtual worlds (for examples, see Jamaludin, Chee, & Ho, 2009; and Neuendorf, 2010), and it is expected that current virtual world technology would support a set of social practices that would be broad enough to permit significant differentiation in responses to an ethically toned situation.

As virtual worlds are constructed of digital artefacts, they are very malleable and provide a broad range of options for customisability by designers and users. Some researchers argue for a design perspective of choreography (de Freitas & Neumann, 2009; see also Laurel, 1991; and Squire, 2006), which is meant to capture the dynamic nature of virtual world experiences, in which structure and flexibility is provided so that learners have significant control over their trajectory.

The way in which problematic situations may be choreographed within virtual world scenarios can be further explained through the concept of projective stance (Gee, 2003, 2008). Although this concept was originally developed for video games, it is also useful for explaining how people act within virtual world scenarios. The term projective stance has a dual meaning, in that characters in a video game or virtual world scenario are "projects the player has been handed" as well as "beings into which the players project their desires, intentions, and goals" (Gee, 2008, p. 260). On one side, the character has certain skills and attributes, while being embodied within the world and narrative of the game/scenario. This combination imposes certain goals and action possibilities onto the game player/scenario participant. On the other side, a game player/scenario participant may make choices that are not suggested or constrained by the character or other aspects of the narrative, and thus impose certain goals and values on that character. Figure 1 outlines the interactions within the projective stance.

virtual character (player's surrogate) ↔ character's goals + player's goals ↔ virtual world

Figure 1: Interactions with the projective stance (Gee, 2008)

The concept of projective stance explains how choreography of a virtual world scenario may elicit differentiated responses to an ill-structured problem such as an ethical dilemma. On one side of the projective stance, the scenario imposes a role on the participant that can involve certain goals and action possibilities. Through this, it may be possible to set up problematic situations, in which the participants take on goals within the scenario which are problematic to achieve. On the other side, the participant may project their own goals and ethical values through their persona within the scenario. The actions taken within the scenario may be modulated by the participants' ethical sensitivity and perception of ethical consequences of various actions.

Research question

1. To what extent may a virtual world scenario elicit individually differentiated perceptions and responses to an ethically toned situation?

Research method

Data were gathered from nine participants who completed a scenario that involved an ethically toned situation. The participants were volunteers who were university employees. They had varying experience and confidence with virtual worlds and problem solving. Each of the participants went through a one hour group training session, consisting of three group activities designed to allow the participants to practice the skills that would be required in the scenario. Within one week of the training session, the participants individually completed the scenario and took part in two interviews. A background information sheet was provided prior to the start of the scenario, to orient the participant with the role and context. Participants were able to clarify details before starting the scenario.

Scenario design

The scenario used in this research study was intended to elicit responses to an ethically toned situation that takes place in the office of a manufacturing facility, with the participant playing the role of the Operational Health and Safety (OH&S) manager. The participants assumed pseudonyms to preserve anonymity. Two actors played the Operations Manager (Sarah) and a Director (Tim) within the same company. The scenario was designed to be approximately 20 minutes in length. Following is a description of the virtual character and virtual world set-up, and details of the key scenes intended to choreograph an ethically toned situation for participants (Table 1).

The virtual character has been the OH&S manager for the past two months, and has implemented a number of initiatives that have succeeded in reducing the number of accidents in manufacturing plant. However, due to the significant safety issues at the plant, a relatively high number of accidents were still occurring each month. The character has also set up a series of future initiatives that should continue to improve safety. However, there is a risk that the plant will need to be temporarily closed for a safety audit, if the number of accidents rises above a certain threshold. As the OH&S manager, the character has three responsibilities: to implement and evaluate new safety practices; immediately

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communicate any incidents to the director, followed by a detailed incident report within two days; and to lead weekly OH&S meetings with workers and supervisors. The character's avatar was set by the researcher, with different avatars used for female and male participants.

The virtual world was set up with a four level office building, surrounded by a landscaped outdoor area. The scenario took place on the ground and top floors of the office. The ground floor was set up with a reception area and two office areas, one for the OH&S manager and one for the Operations Manager. The office of the Operations Manager included three wall charts, which presented data on the on the recent history of accidents within the plant, the current progress of machine inspections, and the future initiatives that are planned in order to improve worker safety. The Director's office was on the top floor. Only a few objects within the virtual world were interactive: automatic front doors to the reception area, and a working elevator.

The scenario was designed with consideration of the functional constraints of the virtual world platform (Activeworlds). Within the scenario, participants were able to chat using audio or text, move their avatar around the environment, adjust their camera perspective, trigger gestures for their avatar, and interact with the building's front doors and elevator. The choreography of the scenario included an initial period to allow participants to orient themselves in the scenario, followed by four key scenes intended to generate an ethically toned, problematic situation for participants (Table 1). Table 1 also outlines how each scene was intended to elicit differentiated responses from participants.

Table 1: Critical stages in the virtual world scenario

Key scene	Description
Discussion about company situation	In this scene, Sarah (Operations Manager) discusses the current situation at the company, guided by the three charts that are displayed in her office space. She also discusses the safety audit with the participant, including its implications (a temporary closure of the manufacturing facilities) and the circumstances that may trigger it.
	The objective of this phase is to provide the participant with an understanding of the current situation of the plant, as well as the details of the safety audit. Consideration of the audit potentially involves ethical issues, as the audit would improve safety conditions but lead to the workers being placed on half-pay for an indefinite period. However, at this stage there is no particular impetus to consider these issues, as the audit is only a hypothetical possibility that is dependent on future incidents. The information discussed in this scene is fairly comprehensive and includes some extraneous detail, so that different participants may find different information meaningful to the situation.
Accident and decision to inform the Director	In this scene, Sarah receives a call about an accident that has just occurred within the manufacturing facility, and informs the participant about the details: a small explosion in one of the uninspected machines has injured four workers. The participant needs to respond to the news of the accident, which has pushed the number of accidents over the threshold that potentially triggers the safety audit.
	While the participant is responding to the accident, Sarah makes sure that the participant considers the implications of a safety audit, and specifically how to inform Tim, who has the final decision on whether to initiate the safety audit. During the discussion, Sarah aims to highlight two options (solution paths): if Tim is informed immediately in the upcoming meeting, it is likely that he will decide to trigger the audit; alternatively, the participant may delay informing Tim, so as to gather more information and solutions to the safety issues and attempt to convince Tim to delay the audit. The participant is also free to generate other interpretations and solutions.
	There are a range of ethical considerations that the participant may be sensitive to. One aspect is the potentially conflicting implications of the

	safety audit to worker safety and the financial welfare of the workers. Another aspect is the role responsibility to inform the Director immediately of any incidents. Different participants may be sensitive to different ethical considerations, and then enact different solution paths.
Meeting with the Director	In this scene, the participant has a meeting with Sarah and Tim. This meeting has a set agenda that is driven by Tim, who has not yet been informed of the accident. The participant may either follow the agenda, or change the course of the meeting, for example by informing Tim of the accident.
	The objective of this scene is to provide the participant with the opportunity to enact their previous decision concerning whether to immediately inform Tim of the accident. Some people may elect not to enact their previously stated intention (Bagozzi, Dholakia, & Basuroy, 2003), and this offers another potential point of differentiation between participants.

Data collection

Screen capture software was used to capture an audio-visual record of the participant's behaviour during the scenario, including movement and interactions with the actors and other objects within the virtual world. This data, however, does not provide any direct information about the participant's thoughts and feelings, such as consideration of ethical issues that drive this behaviour. Therefore two recorded interviews were conducted immediately after the scenario.

The first interview used a retrospective approach in which the screen capture video was played back to the participant, who was requested to describe the thoughts and feelings they had experienced throughout the scenario. The screen capture video was used as a prompt for the participant, so that they could more easily remember and communicate their thoughts and feelings. This technique was considered more suitable compared with a concurrent think-aloud protocol, in which the participant communicates their thoughts and feelings at the same time as enacting the scenario. When following a think-aloud protocol, participants required additional time to complete verbalisation (Ericsson & Charness, 1994), which would have interfered with participants' immersion within the scenario. The downside of the retrospective interview is that it is less immediate, with the potential for participants to re-interpret their thoughts and feelings while reflecting on them.

After the retrospective interview, a semi-structured interview was conducted. The objective of this was to obtain data concerning specific aspects of participant's experience that may not have been captured in the retrospective interview. The semi-structured interview predominantly focused on the participants' problem solving and ethical considerations. After the semi-structured interview, the microphone was turned off and a scenario debrief session was conducted.

Data analysis

Data from the scenario and two interviews was initially used to describe each participant's perceptions and responses to the scenario's three key scenes, with specific regard to:
- the participant's sensitivity to ethical issues;
- the solution path taken by the participant as well as justifications for this trajectory;
- any alternative actions that were considered; and
- the nature of any ethical conflict between the alternatives.

Next, each participant's perceptions and responses to each key scene were compared and contrasted, to facilitate discussion of the possibilities for using virtual world scenarios to elicit differentiated responses to ethical dilemmas. Differences between perceptions and responses were then analysed to determine whether scenario variability may have caused those points of difference.

Results and discussion

Due to the detailed nature of the data, this paper will present the results for three of the nine participants. These cases were selected for their contrasting nature, to highlight extent to which

differentiation of participants was achieved. The results are split across the three key scenes, with a separate discussion of the results and implications for each scene.

Key Scene 1: Discussion about company situation

This scene was not intended to generate a problematic situation for the participant, and was not expected to elicit much differentiation between participants. As reported in Table 2, there were only small areas of differentiation, as two participants (#1 and #3) indicated their stance on the audit, while participant #2 did not elect to communicate this. Participant #3 agreed with Sarah's discussion about the implications of the audit, agreeing that the audit should be avoided due to the negative financial implications for workers; while participant #1, apparently guided by an ethical judgment of the company's handling of the ongoing safety issues, disagreed with Sarah's discussion about the implications of the audit, arguing for the importance of worker safety. With a relatively structured narrative and without an ill-structured problem for the participant to resolve, this scene elicited little differentiation between participants.

Table 2: Results for participants in Key Scene 1

Case #	Description of response
1	This participant took opportunities to communicate her stance concerning the company's safety record, highlighting her perception that worker safety was more important than the financial welfare of the workers: "But they [the workers] are better to have slightly less pay than lose their life." It appeared that the participant had made an ethical judgment about the company's handling of OH&S, and had found the company lacking. This is demonstrated through the participant's answer to a question in the semi-structured interview about ethical considerations within the scenario: "It's almost as if hiring an OH and S manager was a token effort. Obviously the accidents had been going on for some time so they needed somebody. But then everything should have been thrown at the situation to immediately rectify it." However, as this comment was made by the participant as an overall judgment to their experience in the scenario, it is difficult to identify exactly when that judgment would have started to impact the participant's behaviour.
2	This participant did not contribute much to the discussion in this stage, mostly allowing Sarah to lead the discussion. There was no indication that this scene presented an ethically toned situation for the participant.
3	This participant communicated a stance that the audit should be avoided, agreeing with Sarah that the audit would have significant negative implications for the workers: "I completely understand, the umm, the very, very important role I play now in ensuring that we don't end up having to go for, uh, be involved in an external safety audit. That's very clear." However, the data provides no indication that this stance was ethically motivated.

Key Scene 2: Accident and decision to inform the Director

This scene generated several points of differentiation between the participants, relating to ethical sensitivity and conflict, the actions taken, and the justifications for these actions (see Table 3).

In terms of ethical sensitivity, each of the participants perceived different ethical considerations. Participant #1 didn't perceive any personal ethical issues (although she perceived ethical issues for the company), participant #2 focussed on the health of the injured workers and transparency within the meeting with Tim, and participant #3 experienced a dilemma between workers' safety, the role responsibilities, and the financial impact of the audit on workers.

The implications of these results are that different people may perceive different ethical considerations within a virtual world scenario. Participants may make ethical judgments on parts of the scenario, such as the stance of the company towards worker safety, or perceive ethical issues that were not intended to be part of the scenario.

Each of the participants performed different sets of actions. Participant #1 suggested visiting the scene of the accident and first aid, then decided to inform Tim so that the remaining uninspected machines could be shut down immediately. She was very concerned about the safety of the workers. Participant #2 was concerned about the injured workers, and indicated that he would immediately inform Tim of the accident so that he could be "transparent" within the meeting. Participant #3 suggested visiting the scene of the accident, detailed a series of short-term and longer-term actions to take in response to the accident, then initially indicated that she would immediately inform Tim (due to her role responsibilities) and later changed her mind to inform Tim at some point after the meeting (by arguing that the role responsibilities didn't apply in this situation).

The implications of these results are that the scenario can elicit differentiated responses to a situation. Some differences in response are related to differences in ethical considerations, such as the decision, and justifications, of whether to immediately inform Tim of the accident. Other differences between participants' responses may be less related to differences that are unrelated to ethical values, such as the participants' immediate responses to hearing about the incident: each participant enacted a different immediate response, and while one participant specifically reported an ethical concern for the immediate welfare of the injured workers, the other two participants also demonstrated a similar concern but without reporting it as being of ethical nature. The main differences in participants' immediate response to hearing about the accident could not be linked to any ethical concerns (that is, suggesting going to the scene of the accident and first aid, and specifying a series of short-term and longer-term actions to take). Thus, some differences in participant behaviour may be due to differences in ethical stance, while other differences may be due to non-ethical reasons.

Variability in actor's performance does confound these findings to some extent. There are two occasions in which differences in participants' behaviour may be partly a result of different ways that Sarah performed within the situation. Firstly, Sarah gave different information to participants #2 and #3 regarding the trigger for the safety audit. For participant #2 she stressed that Tim had the final decision to initiate the audit, and for participant #3 she stated that "one more incident … could force us to go to an external safety audit." This may have influenced the way in which each participant approached the decision of whether to inform Tim immediately. Secondly, Sarah was very clear in her argument as to why participant #3 should consider holding off on informing Tim. In her performance with the other two participants, Sarah perhaps didn't put this argument forward with such clarity. These participants were firm in their intention to immediately inform Tim and may not have been swayed by Sarah's argument, however it is not possible to determine if this is the case.

The process followed by participant #3 as she reconsidered her position on whether to immediately inform Tim of the accident highlights two important points. Firstly, it demonstrates that participants may reconsider decisions within an ethically toned situation when they are presented with other options that they have not considered. This indicates that scenarios may be designed to identify the point at which a participant will change their decision concerning an ethical matter. Secondly, it reveals one method that people use to resolve ethical conflict: to use reasoning to mitigate one of the ethical considerations.

Table 3: Results for participants in Key Scene 2

Case #	Description of response
1	This participant's initial response to hearing about the accident was to suggest a visit the scene of the accident, and first aid to see the injured workers. Sarah lead the participant away from these options, as these locations had not been designed within the scenario. After this, the participant decided that she would tell Tim of the accident immediately, so that the 19 remaining uninspected machines could be shut down: "Yes! Ah, I'm meeting with him now so he should know immediately because we urgently need to check the rest of the equipment." When reflecting after the scenario, the participant did not specify any personal ethical considerations at this point of the scenario. However, as noted above in Table 2, the participant did make an ethical judgment about the company's handling of OH&S. Even though the participant did not note any ethical considerations, it was clear that her actions were guided by the primacy of her concern for the safety of the workers, as opposed to financial implications. "They may do [i.e. the workers may suffer financial stress], but they

	may lose their life and if we've just had four injured there may be more injured before these machines are checked".
2	This participant's initial response to hearing about the accident was to note the impact of the accident on the threshold that would potentially trigger the audit, followed by a query about welfare of the injured workers. The participant also asked whether any further information was available. When reflecting during the semi-structured interview, the participant highlighted the concern for the immediate welfare of the injured workers as an ethical concern. The participant indicated to Sarah that he would tell Tim about the accident, as he was concerned with being transparent and presenting accurate data in the meeting with Tim: "look I think it's important to be transparent with Tim and um, I'd feel a bit awkward showing him the first graph having known that um the numbers aren't quite…as they are represented in that graph." In the interviews, the participant identified this desire for transparency as an ethical concern. The participant didn't appear to perceive any ethical considerations concerning the implications of the audit to worker safety and finances. It is difficult to identify reasons for an absence of ethical consideration. However it is likely in this case that the participant did not feel any responsibility concerning the initiation of the audit (as Tim made the final decision), and therefore did not perceive any ethically significant consequences of immediately informing Tim about the accident.
3	This participant's initial response to hearing about the accident was to suggest a visit to the scene of the accident. When Sarah indicated that this was not an option, the participant discussed short-term actions (to determine the cause of the accident, and the extent of the damage) as well as longer-term actions (review of the relevant policies). The participant also detailed specific sources of information such as eye-witness accounts. When prompted with the question of whether she would inform Tim immediately of the accident, the participant experienced an ethical dilemma, between workers' safety, the role responsibilities, and the financial impact of the audit on workers. This is demonstrated through the participant's answer to a question in the semi-structured interview about ethical considerations within the scenario: "the ethics of complying with my job description as opposed to considering their welfare as opposed to considering their safety, were two, I think, on face value, two opposing, um situations" The participant was initially guided by her role responsibilities as an OH&S manager, indicating the she would inform Tim immediately. However she changed her position when Sarah argued for an alternative response – to get more information and solutions to the safety issues before informing Tim of the accident. The participant justified this change of position by reasoning that because she hadn't been directly informed of the incident, the particular situation didn't trigger the role responsibility to inform Tim of the accident. The participant thus decided not to inform Tim of the accident.

Key Scene 3: Meeting with the Director

Participants took three different forms of action in this scene (Table 4). Participant #1 interrupted the agenda to inform Tim of the accident, and asked for the remaining uninspected machines to be shut down immediately. Participant #2 did not inform Tim, contrary to his previously stated intentions. Participant #3 also did not inform Tim, however this was in line with her intentions as stated in the previous scene.

This suggests that virtual world scenarios may be able to elicit a mismatch between the stated intention of a person and the subsequent action, although it may be difficult to infer the reason for the participant not enacting their previously stated intention.

An additional point of differentiation was that participant #1 encountered an ethical dilemma within this scene, when confronted with a resource allocation decision between two options that would improve worker safety. Note that this participant did not experience any personal ethical considerations in the previous scene, as she was so strongly guided by her concern for worker safety. Although the scenario was not intended to produce an ethical dilemma within this phase, the participant's experience indicates that it is possible to set up scenarios with multiple possible ethical dilemmas, so that people who don't experience the initial dilemma may be able to be engaged in a different ethical dilemma later in the scenario.

Table 4: Results for participants in Key Scene 3

Case #	Description of response
1	This participant informed Tim of the accident, in accordance to her earlier decision, and asked for the 19 remaining uninspected machines to be shut down. The participant experienced a secondary ethical dilemma within this meeting, when confronted with a resource allocation decision between two options that would improve worker safety. As this dilemma was outside the scope of the scenario, the participant did not have a chance to properly consider or respond to these issues.
2	This participant did not inform Tim of the accident within this meeting, contrary to his previous stated position. It is difficult to infer the reasons for this. One possible reason is that the previous decision was driven by a desire to be transparent, and as there was no data specifically discussed in the meeting, there was no impetus from this ethical consideration to enact the decision to inform Tim of the accident.
3	This participant followed the pre-set agenda for the meeting, and did not bring up the accident in that meeting. This was in accordance to her earlier decision. The participant did report feeling nervous throughout this meeting, as she was unsure of how Sarah might act.

Conclusion

To support development of problem solving skills, it is desirable to design activities that reflect the individualised nature of people's resolutions to ill-structured problems. By demonstrating the possibility of using virtual worlds to support activities that elicit differentiated responses, this paper makes a significant contribution to this effort. The scenario provided the participants with an ethically toned activity in which they were able to generate personally meaningful interpretations and responses. Although not explicitly tested within the scope of this study, the participants' experiences could underpin subsequent reflection and consideration of alternative perspectives and resolutions, to facilitate a deeper understanding of the considerations involved in ethically toned problem solving.

The use of carefully choreographed scenarios opens new opportunities for assessment, experience and practice. Regarding assessment, the ability to differentiate learners according to the way they perceive and respond to problematic situations could facilitate the provision of individualised feedback and evaluation of each learner's problem solving expertise or readiness for a particular role or responsibility. Opportunities for a learner to engage in experiential learning and practice could facilitate self-reflection, exposure to new experiences, and refinement of problem solving skills. Groups of learners could gain additional benefit from group debriefing after scenarios, where different people's responses could be compared and contrasted to generate discussion and expose people to alternative perceptions and resolutions within a situation (Fanning & Gaba, 2007). Albeit in another context, Jamaludin, Chee and Ho (2009) demonstrated an effective integration of virtual world role plays, discussions and formal reflection activities to successfully develop learners' argumentation skills.

The scenario used in this research study elicited differences in participant perceptions of the situation, due to differences in ethical sensitivity, as well as differences in participants' responses to ethically toned situations. However, the possible influence of the actor as a potential source of some of these differences may not discounted, and future research could consider types of scenario structure that are

less susceptible to actor influence, as well the potential for using other learners or intelligent agents (bots) to choreograph scenario narratives that elicit differentiated responses. Other future research directions for scenario choreography include exploration of the use of multiple layers of ethical dilemmas, and scenarios that are intended to identify the point at which a participant will change their decision concerning an ethical matter.

The conceptualisation of projective stance also points to some interesting directions for future researchers. In this research study, the scenario narrative provided certain aspects of the problematic situation (including the identification of the consequences of the audit and the prompt for the decision of whether to inform Tim immediately), and lets the participant generate other aspects of their experience (including the identification of pertinent data, perception of ethical issues, and whether to enact their stated resolution). There appears to be scope for the level of problem solving structure within the situation to be adapted by shifting the balance between what is provided through the scenario narrative and what is projected into the experience by the participant. For a relatively well-structured problem, more aspects of the situation could be included within the scenario narrative (in this scenario, an example would be more obvious identification of the data that is pertinent to the problem at hand). For a relatively ill-structured problem, more aspects of the scenario could be left for the participant to generate (in this scenario, there could be less discussion of the consequences of the safety audit to the workers). Scenarios that involve relatively ill-structured problems would arguably elicit increased differentiation between research participants; however there may be significant caveats to this assumption. Future research could explore the impact of shifting structural aspects of the problematic situation between the scenario narrative and the participant's performance.

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