REVIEW

That PEGs the Question: Is it a Game?

Personalized Educational Games
Developing agent-supported scenario-based training
Marieke Peeters
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Reviewed by Dap Hartmann

Many professions critically depend on people making the right decision in stressful situations, because human lives are at stake. Think of medical doctors, law enforcement, fire fighters, and the military, which often have to deal with emergency situations. It also applies to lines of work in which there is no direct emergency, but where mistakes can have disastrous consequences. Examples are pilots and plant operators in the chemical or nuclear industry. As with most things in life, practice and training improves the skills that are necessary to carry out these daunting tasks. However, unlike practicing playing the piano, most of these high-risk professions cannot be practiced in real life situations. Not only would that be too dangerous, it is also prohibitively expensive. In most cases, the only alternative is to use scenario-based training (SBT) in which real situations are staged in a simulated environment. The participants engage in role playing and acting out specific (emergency) scenarios. One major drawback of this method is that many people are involved (for acting out the various roles in the scenario, as well as for monitoring and evaluating the entire exercise) and that suitable locations must be found and prepared, all of which is expensive and time consuming. A second drawback is that the scenarios are usually quite rigid, which means that there is little room for changes and deviations once the training is underway. This inflexibility also instills a one-size-fits-all approach whereby all trainees find themselves in pretty much the same situations. SBTs do not consider specific personal requirements of each individual trainee. In addition, it is not possible to train specific aspects more frequently than others. To use the piano analogy again: in SBT you cannot rehearse the more difficult parts without playing the entire sonata.

To overcome these problems, Marieke Peeters developed an automated SBT which is staged in a virtual environment where artificial intelligence replaces many (or all) of the activities currently performed by humans. By combining educational games and intelligent tutoring systems she created a so-called Personalized Educational Game (PEG) which enables trainees to engage in interactive scenarios in the virtual environment. These scenarios can be personalized by the artificial intelligence to suit the specific needs of individual trainees, which allows them to train at their own level and at their own pace.

Situated Cognitive Engineering
To address her main research question – what is the best design for such a PEG? – Peeters applied situated Cognitive Engineering (sCE), which is a structured user-centered approach in which a system is iteratively designed, prototyped and evaluated. The sCE method was developed by Mark Neerincx for the European Space Agency (ESA) to help establish the requirements for a Mission Execution Crew Assistant (MECA) which can be used in manned deep space missions, for example to Mars. It is also applied in the ALIZ-e project[2] that attempts to increase the time between (consecutive) human-robot interactions from minutes to days, with the aim of improving robot autonomy.

According to Peeters, the significance of sCE is that "designs can be tested regarding their feasibility and effects through user-based studies and experiments, formal specifications, and human-in-the-loop simulations." Applying sCE to the design of suitable PEGs, resulted in a list of 19 requirements. For example, 'R02: Scenarios must be interactive' and 'R09: Scenarios must not include any unnecessary distractions.' Each requirement was reviewed against the human factors literature on the SBT requirements to yield both positive claims (indications of desired effects) and negative claims (indications of undesired effects) which might occur after implementing that specific requirement. In the case of R09, the positive claim is that omitting unnecessary distractions prevents a cognitive overload, while the negative claim is that it may be too difficult to determine whether or not a distraction is unnecessary. It is worthwhile to think about this for a minute, because my initial

[1] This thesis can be downloaded from:
https://www.dropbox.com/s/kc532a62fwfrk16/PhD%20thesis%20-%20M.%20Peeters.pdf
[2] See http://www.aliz-e.org/

reaction was that the adjective ‘unnecessary’ had already settled the issue. However, in stressful situations any distraction is unwanted, but that is not the same as unnecessary. A PEG that simulates an emergency situation should include the same kinds of distractions that might occur in real life. The question which distractions are unnecessary becomes almost a philosophical conundrum.

No matter how many times a trauma surgeon (to name just one high-risk profession) has trained with PEGs to improve his/her skills in saving the virtual life of a virtual person who is wheeled into the virtual emergency room with a severed virtual artery, and no matter how often this scenario was rehearsed with an actor who actually bled fake blood from the bag that was concealed under his armpit, the *moment supreme* is when that surgeon encounters a real person who is bleeding profusely from a real severed artery. How well will the PEG or the SBT have prepared her for this moment of truth?

Interesting and interesting remarks

Marieke Peeters wrote an interesting thesis on a topic that has important real-life implications. She applied cognitive engineering and artificial intelligence to design Personalized Educational Games which simulate emergency situations for high-risk professions. However, this reviewer struggled with the relevance of such PEGs to the ICGA community. That hinges on my personal conception and definition of a game. To me, a game in the ICGA context is a challenge that can be won, and for which there exist unambiguous criteria that define what constitutes a win as well as a metric that rates the relative performance of players. In addition to the obvious traditional games such as Chess, Checkers and Go, this ‘definition’ includes Card Games, Arcade Games and Role-Playing Games. And it also applies to intelligent puzzles such as Rubic’s Cube and Sokoban, because solving the puzzle is the equivalent of winning the game. By this same definition, PEGs do not qualify as games. PEGs are simulations rather than games, and it is a bit of a stretch to consider saving the patient, extinguishing the fire, or safely landing the plane as winning the game. Moreover, the computer is itself not *playing* the game. The computer (and the artificial intelligence implemented on it) merely facilitate humans to play the game.

I end on a lighter note. The motto on the dedication page of this thesis is very appropriate: *Tell me and I’ll forget; show me and I may remember; involve me and I’ll understand.* I once used this famous saying in a paper published in Technology Innovation Management (TIM) Review, which has the interesting requirement that each paper must start with a suitable quotation. As far as I know, it is a Chinese proverb after a saying by Confucius (551-479 BC), and therefore I attributed the quotation to Confucius. But you also find claims that it is a native American saying or that it was (first) said by Aristotle, Voltaire and Benjamin Franklin. That may be the reason that Marieke Peeters does not provide any reference for her motto. So, in a hundred years from now, it may be attributed to her as well.