

Title	災害ボランティア初心者の倫理的な意思決定スキルの向上を支援するモバイルシリアスゲームに関する研究
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論文の内容の要旨

Many responses of catastrophic natural disaster did not perform properly to an appropriate standard. This often occurred when first responders were involved—especially inexperienced first responder—did not have the accurate decision making skill. One of the main issues is the lack of regular training to develop such skills. It has been pointed out that exercise of the non-technical abilities, such as decision-making has enormous impact on effective disaster response. However, some researches show that there are difficulties to conduct a live practice for the disaster situation similarly. In addition, the inexperienced disaster first responders cannot receive maximum advantages from live training due to feedback limitation where reflection from actual circumstances.

Serious games (SG) may be a suitable approach to address some of the problems associated with training of disaster responders, because SG could give a real-life experience when the use of environments is impossible to establish and costly (Hulst & Ruijsendaal, 2014). However, one of the main issues associated with SG is lack of empirical evidence supporting the approach. This thesis will primarily concern on the application of SG to train inexperienced disaster first responders skill for making a decision ethically.

First of all, a preliminary survey was conducted to assess the awareness of the ethical decision-making skill of the inexperienced disaster first responders from high school and university organizations in Indonesia. The objective of this survey was to identify some issues in disaster response work, especially to recognize how first disaster responders were to the ethical aspects that often appeared in disaster situation. To assess

the awareness, we adopted six components of moral intensity invented by Jones that reflect the ethical consideration in the disaster setting. However, to confirm the basic criteria of the disaster responders, we firstly interviewed some experts from the official search and rescue (SAR) organization in Indonesia. Based on these preliminary surveys and interviews, a game for training called MAGNITUDE has been designed, which enables the inexperienced disaster first responders to develop their ethical decision making skill at all times during official disaster management training inside and outside of class. The study results show that there is a difference awareness of ethical situation between experienced (Ex) and inexperienced (Ix) participants. The result of statistical analysis found that from six components of moral intensity, the components of Magnitude of Consequence (MC), Concentration of Effect (CE), and Probability of Effect (PE) were provided the significant factors of differences.

I performed the evaluation of MAGNITUDE prototype. The conducted test was to evaluate the game quality at a very crude phase. The objective of this evaluation was to collect opinions from the learning subjects' point of view about the MAGNITUDE development progress in early stage.

I also was performed the second survey to measure of learners' viewpoint to the use of games for training. The aim of the survey is to determine which education level will more suitable to provide the potential of the learning subjects. The survey was conducted by collecting information on general demographics, general computer game playing habits, computer game preferences, motivations for playing computer games, motivations for playing computer games in training contexts, online game playing habits and acceptability of a SG approach training program. The survey results present that the university students were the most prospective learning subjects for MAGNITUDE implementation.

Finally, based on the findings of the survey about students' viewpoint to the use of game for training, I performed the second evaluation of MAGNITUDE. The conducted evaluation aimed to measure the effectiveness of MAGNITUDE. The results show that MAGNITUDE was considerably significant to improve the participants' awareness of the ethical issues. Thus the MAGNITUDE game has a potential opportunity to be used as a training method.

In summary, this thesis provides the original contributions to knowledge in the SG field, especially the fundamental implementation of embedding six components of moral intensity for delivering ethical gameplay in SG. Another originality is the important concept how to examine the learners' engagement to the ethical gameplay by measuring learners' concerns to the game dialog. The thesis also gives a large amount of required empirical evidence of game playing preference and experience, and its relation to the use of serious game for training purposes.

Keywords: Mobile serious game, Inexperience disaster responder, Ethical decision making, Disaster

論文審査の結果の要旨

本論文は、自然災害時の非日常的状況下で自己の安全や他者の支援をいかに両立するかに代表される、倫理的な意思決定スキルを対象として、災害支援ボランティアの初心者のスキル向上を目的としたモバイルシリアスゲームによる学習環境を提案するとともに、開発したシステムの有効性について評価・考察したものである。

これを実現するために、関連研究の調査および災害支援の専門家に対するインタビュー、災害支援ボランティアの経験者と初心者に対する調査を通じて、意思決定スキルの効果的な学習環境に求められる要件として、災害状況を表現するシナリオ、災害対応に関する基礎的なルールの埋め込み、ボランティア間の連携・役割分担に関する活動の反映、意思決定に対する結果のフィードバック、スモールステップかつユビキタスな学習環境の提供、といった項目を抽出した。さらに、Jonesによって提唱された Six components of moral intensity のうち、Magnitude of Consequence や Probability of Effect, Concentration of Effect といった要素について、災害支援ボランティアの経験者と初心者で大きく理解度が異なることを示し、これらの要素を中心に学習することとした。当該分野でも新規な領域を対象とするモバイルシリアスゲームである MAGNITUDE を開発した。MAGNITUDE は、近年の 3D ゲーム環境の開発で注目されている Unity3D をプラットフォームとし、シミュレーションゲームおよびロールプレイングゲームの要素から構成されたものであり、ゲームシナリオを Finite State Machines で、NPC とのインタラクション制御を Behavior Trees で定義したものとなっている。また、ゲームによるトレーニングの効果についてインドネシアの高校生と大学生を対象として調査を行い、大学生がより積極的にゲームを学習に活用していることを示した。さらに、開発したシステムの有効性を評価した結果、同じ学習時間の対面講義による学習効果と比較してシステムを利用した学習後の理解度が向上していることを示した。以上、本論文は、災害支援ボランティアの倫理的な意思決定スキルの向上を目的としたモバイルシリアスゲームシステムを開発することで、従来トレーニングが困難であった意思決定スキルに対して、楽しみながら繰り返し学習できる環境を提供するものであり、ゲーム技術を利用した学習支援に対する効果的な応用と災害教育の実質化の観点から学術的に貢献するところが大きい。よって博士（情報科学）の学位論文として十分価値あるものと認めた。