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Enhancing Inclusion within Responsible Innovation Process through Serious Gaming

Key words: serious games, inclusion, inclusiveness, responsible innovation, gamification
Słowa kluczowe: poważne gry, inkluzja, inkluzywność, odpowiedzialne innowacje, gamifikacja

Introduction

The aim of this article is to investigate theoretical and literature-based arguments for designing a serious game to enhance inclusion within the responsible innovation process. Responsible innovation framework refers to disruptive or radical innovations impacting a great number of people (eg. new information or products that transform the industry). The process aims to align outcomes of innovations with social needs by including relevant stakeholders (i.a. citizens, non-government organizations, academia). However, lack of knowledge and understanding regarding inclusion in this context poses a threat for this democratic process. This article is an attempt to explain why a serious game is a reasonable tool for enhancing inclusion within the responsible innovation process.

The article consists of a theoretical part that develops essential terms (responsible innovation, serious games, inclusion) and analysis of case studies drawn from the systematic review of the Journal Storage (JSTOR) database. The review investigates the intersection between serious games, inclusion and responsible innovation. It aims to answer the research question of why serious gaming is applicable for enhancing inclusion within the responsible innovation process and what should be considered in detail. Special attention is paid to the learning process in serious games as inclusion requires either awareness or behavioral change. The answer for the question may be a further incentive for designing serious games dedicated to inclusion within the responsible innovation process.

Serious Gaming for Broken Reality

Games, intuitively understood even by children as fun, are not associated with serious issues. However, unlike typical games, serious games do not aim (or at least not only) at entertaining. Their seriousness comes from assumed impacts they make on participants. Indeed, belief in the positive impact of goal-oriented games led Jane McGonigal, famous American game designer and researcher, to call it "[…] a chance for repairing broken reality" (McGonigal 2011: 14).

Games were always associated with entertainment, fun and competitiveness. Unlike a play, games are goal-oriented, based on rules, competitive, voluntary and provide some feedback (Ritterfeld et al. 2009: 68–74). Nevertheless, in taxonomic terms, games do not refer to one, commonly recognized paradigm. Fragmentation and variety, although indicating emergence of the game sector, show no single, undisputed factor. According to Wittgenstein (1953: 67), games are rather a "[…] family of resemblances [with no] essence." Further, this statement was supported by others, who admitted that, although not defined, games were easily identified by professionals (Duke 1974: 15). Consequently, the *Circle and Cross* will be as legit game as *The Witcher* for PlayStation, the *Scrabble* or the card game *Might and Magic*.

One of the characteristic features of games is that they can imitate complex systems in a simple way, emphasizing the most important aspects (Redpath et al. 2018: 420). In the past decades, academic environment began to appreciate their potential as purposeful tools for transferring knowledge, skills and experimental field (eg. Mayer et al. 2014: 502; Girard et al. 2013: 208). Change in the perception by broadening the purely entertaining purpose of games created a new concept – serious games, designed primarily to achieve certain objectives.

Serious gaming is widely deployed for learning (Aldrich 2003; Speelman et al. 2019: 33), experimentation (Marsh 2011: 62) and explorative research (Geurts et al. 2007: 536; Peters et al. 1998: 6). However, some say that serious games should first and foremost aim at solving existing problems (Gouveia 2015: 147). This term is related to impact games which are designed to put an impact on certain individuals and achieve expected behavior. Indeed, the game environment enables manipulating experimental factors which improve learning outcomes and engage participants in the process.

Gaming for Learning

Serious games are rooted in the idea of game-based learning – more effective acquirement of new ideas and skills through appropriate use of games. Researchers underline its superiority over traditional forms of learning due to intrinsic motivation of players, authenticity of experience, self-reliance and experiential learning which are stimulated by game mechanisms. Such

mechanisms include simple rules, challenging goals, interactions, fictional setting, progressive learning levels and efficient feedback system (Perrotta et al. 2013: 5). Recent researches show effective contribution of serious gaming to teaching and knowledge transfer (see among many: Kapp 2012: 75–104; Peters et al. 1998: 8; Johnson et al. 2017: 120; Garris et al. 2002: 441).

Appropriate game design is crucial for effective learning. It has to consider learning outcomes, storytelling in the game, gameplay itself with rules and user experience (Winn 2009: 1012). To achieve its goals, design should consider characteristics of players and expected results. Participants who experience comparable conditions to those in real life may experiment with decision-making and explore possible outcomes. As metaphors and reflections are transferable into real life decisions, serious games are believed to be a fruitful tool for transformative change and social learning.

What is characteristic for the learning process in serious games, participants learn by doing. Effectiveness of learning has threefold fundamentals: normative, relational and cognitive (Connolly et al. 2012: 661). Cognitive aspect assumes gaining new knowledge or revising existing information while playing; relational aspect refers to broadened understanding of other actors and their perspectives, while the normative one implies changing point of view and shift in values. Learning process is also stimulated through creating strong user experience. It involves emotions and values, triggers interactions with others and finally, provides safe conditions for self-reflection. Values are transmitted through the plot, model of the game which encourages expected behavior, motivation system rewarding desired attitudes or evaluation of the game (eg. *SuperBetter*, fighting mental problems; see *SuperBetter* 2012), indicating important aspects of the gameplay and user's decisions (Gugerell and Zuidema 2017). Emotions are triggered by the form of transferring values through a serious game. For instance, shock caused by the outcome of the game (eg. *My Cotton Picking Life*, question of child labor and welfare; see *My Cotton Picking Life* 2012) or narration and plot (eg. *Darfur Is Dying*, the story of refugees trying to get water; see *Darfur Is Dying* 2007).

Interactions are more characteristic for analogue serious games, expressed through indirect or direct collaboration and competition, however, online games give numerous opportunities for virtual interactions, as well. Notwithstanding, not all serious games have an interactive design. The extent (or lack) of interacting with other participants and the game depend on established objectives. In terms of self-reflection, participants may take part in formal, evaluation activity, for instance a session with a facilitator or a survey. On the other hand, it may be informal, with automatic feedback provided during the gameplay or at the end of it.

Inclusion: A Challenge for Current Times

At a first glance, inclusion partially overlap with serious games: game design may be inclusive as well as promoting inclusiveness may be one of the game's objectives. Nonetheless, the relation of those two concepts remains unambiguous, mostly due to multiple applications and interpretations of those terms.

Inclusion is deeply rooted in human rights and immanent human dignity. Its origins date back to 1900, when opponents of segregation began to raise their voices against excluding children with special educational needs from the education system. Systematic fight for the process of integration resulted in disabled children being able to participate in classes (Hossain 2012: 5–8). Meanwhile, the term began to resonate far and wide, breaking into new discourses, for instance female labor rights or rights of minorities. Finally, the term gained considerable popularity with increase of interest in sustainable development goals, where it relates to education, economic growth, cities, innovation, societies and institutions.

From this perspective it is visible that current understanding of inclusion is rather a revival of the concept, with new broadened meanings than the previous term. Although the essence of inclusion, meaning including minorities, underrepresented groups and individuals is still prevailing, the current scope is much wider. For instance, nowadays inclusion does not refer only to those who suffer from exclusion (Felder 2018: 56–70). On the contrary, in numerous contexts it admits advantages deriving from diversity which is built on inclusion of new actors. Therefore, inclusion becomes a desired phenomenon in education, business, innovation or leadership. It turns out that inclusion improves creativity, embeds democratic values, enhances innovativeness and leads to synergic outcomes in various spheres (Pansera and Owen 2018: 28–31). This understanding of inclusion constitutes a crucial aspect of the responsible innovation process.

Inclusion became a concept-umbrella for different groups and environments, sharing the same characteristic: taking into consideration underrepresented communities or individuals. Inclusive business, inclusive innovation or inclusive management are only a few examples. While inclusion is a phenomenon associated with including someone or something, inclusiveness represents a value reflecting equal rights to participate and appreciation for the attitude of including others. Therefore, to some extent, inclusion and inclusiveness may be applied interchangeably.

In this light, it might seem confusing why promoting inclusion is still important if it is that beneficial. Inclusion, an *act of making a part of*, requires compromises, either from including part or from the included. Those who commit an act of including have to make an effort in order to create an appropriate environment for inclusion at an organizational, cultural and normative level (Chataway et al. 2013: 1–10). Meanwhile, those who are being rendered "a part of" have to negotiate, respond and adapt to available conditions. Each of those compromises requires dialogue and mutual understanding, which tends to be

time and energy-consuming. Sometimes, analysis of profit and loss does not encourage actors to act inclusively. Then, in democratic context, it is a space for an intervention to promote inclusion (Cozzens and Sutz 2012: 33; Foster and Heeks 2013: 110–119).

Inclusion: The perspective of Responsible Innovation

Considering arising societal, environmental and governance-related concerns, inclusive innovation governance poses a significant challenge. In democratic context, governing innovations in a responsible manner is a complex task, particularly due to conflicting values of various actors (van de Poel 2015: 89–93; van den Hoven 2013). Yet, the ambiguous concept of responsibility evokes questions – firstly, how to distinguish between causally and morally responsible actors under the dilemma of many hands (van de Poel et al. 2012: 50–55), secondly, whether forward-looking and backward-looking responsibility should be executed at the same level (Doorn 2012: 68–71), and finally, how to convince the society to share responsibility under democratic circumstances.

The concept of responsible (research and) innovation was established by European Union to deal with implications of those dilemmas. It emphasized the need for addressing societal challenges with innovative, potentially disruptive, solutions and design inclusive, sustainable innovations in compliance with social values (Owen and Pansera 2019: 26–38). In consequentialist terms, responsible innovators are expected to anticipate and address both negative and positive implications, sharing the responsibility with societal actors (Von Schomberg 2013; Lubberink et al. 2017).

For embedding the theoretical approach in *de facto* innovations, aligning innovation outcomes with social expectations and sharing the responsibility with broader society, inclusion is critical (Owen et al. 2012; Guston 2014: 218–225; Stilgoe et al. 2013: 1571–1572; Koops 2015). It is expressed by democratic governance of innovation (Lubberink et al. 2017: 22; Macnaghten et al. 2014), participatory design (van der Velden and Mörtberg 2014: 2–5; Björgvinsson et al. 2010), social dialogue (Stilgoe et al. 2013: 1572), engaging stakeholders into risk assessment (Owen and Pansera 2019: 34–38) or involving them into innovation process through conceptual and technological investigation of value-sensitive design (van den Hoven 2017: 68–71). It is often expressed through cross-sectoral trainings, partnerships and collaboration on information sharing (Felt et al. 2007: 732–735; Owen et al. 2013: 35–43; Stilgoe et al. 2013: 1571–1572). However, this knowledge is not apparent for practitioners.

In a perfect world, inclusive innovators collaborate with entities representing other sectors as well as expand partnerships into other industries. Partnerships are performed on different levels within the innovation process, based on mutual trust; thus, partners take advantage on implicit and explicit benefits, including creating scenarios of innovation outcomes, infrastructure outsourcing, monitoring

of the process and active participation in the innovation process (Lubberink et al. 2017). The aim of this article is to prove that serious gaming provides appropriate means to enhance inclusion in the responsible innovation process.

Methodology

Taking under consideration characteristics of serious games and their positive impact on normative, relational and cognitive level of learning, it is assumed that it is transferable to the responsible innovation field. To find evidence that designing a serious game is an approach reasonable for enhancing inclusion in this context, the literature on the intersection between serious games, inclusion and responsible innovation was investigated. The aim of the review was to fill the research gap on existing articles on the subject, in what areas of innovation process games are applied and what the characteristics of inclusion enhancement are. As the notion of responsible innovation and serious gaming are rarely associated with each other, literature with responsibility attributed to the innovation process was researched as well. Literature review was based on the JSTOR database as it contained the biggest number of sources for "serious games" domain among recognized academic databases (Scopus, Web of Science, PubMed, IEEE).

For the purpose of the research, a staged review process was conducted. It consisted of an initial review of abstracts and an in-depth review (Torraco 2005: 361). The research process was divided into three stages: creating a database with relevant keywords, verifying accuracy of the articles – selection of titles relevant for the research, classification and choice of illustrative case studies for full-text screening. The articles were searched in JSTOR database, considering dates between 2009 and 2020, as the discussion around responsible, deliberative governing of radical or disruptive innovation emerged then. It contained keywords: responsible innovation, inclusion and serious games (serious gaming) searched in titles, abstracts and articles. Boolean operator (AND) was applied while searching for phrases.

The criteria for exclusion were:

– biased context of the keyword (eg. war described as a [serious] game, game-changing technologies, application of game theory);
– game as a metaphor (eg. serious game-changing innovations);
– "innovation" as a subject to the game instead of an object (innovation in a game process);
– random combination of keywords;
– non-English language.

The initial phase revealed 2,706 searches. It was manually verified according to relevance to the subject (title or abstract). The outcome of the research was 199 potentially relevant articles. Then 28 articles where serious gaming and innovation processes were only mentioned or did not contribute to the research

question were excluded (context of keyword use or abstract). At this stage analysis of disciplines was conducted. Disciplines were grouped according to journal type, keywords and abstract. Also, articles were divided into case studies and theoretical articles. The outcome of the thematic analysis (Table 1) was 10 groups: 1) business and management, 2) social sciences, 3) education, 4) STEM (science, technology, engineering, mathematics), 5) environment, 6) policy and governance, 7) military, 8) urban, and 9) medicine. Besides, there was an additional group representing 10) theoretical articles. If an article covered more than one area, the classification was based firstly on keyword and secondly on research question(s).

Table 1

Numbers of articles and disciplines

No.	Thematic area	Number of articles
1.	business and management	43
2.	social sciences	27
3.	education	26
4.	STEM	19
5.	environment	17
6.	policy and governance	11
7.	military	7
8.	urban	6
9.	medicine	4
10	theoretical	11

Source: own study.

Next stage aimed to choose articles providing knowledge on application of serious games within the (responsible) innovation process and exclude articles addressing gamification (applying game elements in the real life). The inclusion criteria were:

– relevant research question (referring to the influence of a game on a dimension derived from inclusion, eg. stakeholders' engagement, participatory design, democratic governance);
– embeddedness or reference to innovation and responsibility in the research;
– discipline related to radical or disruptive innovations.

After the second, detailed review of abstracts and content, 17 articles were selected for full-screening (Figure 1). Analysed articles represented quantitative or qualitative studies on application of games for non-entertaining purposes within the innovation process or supporting it.

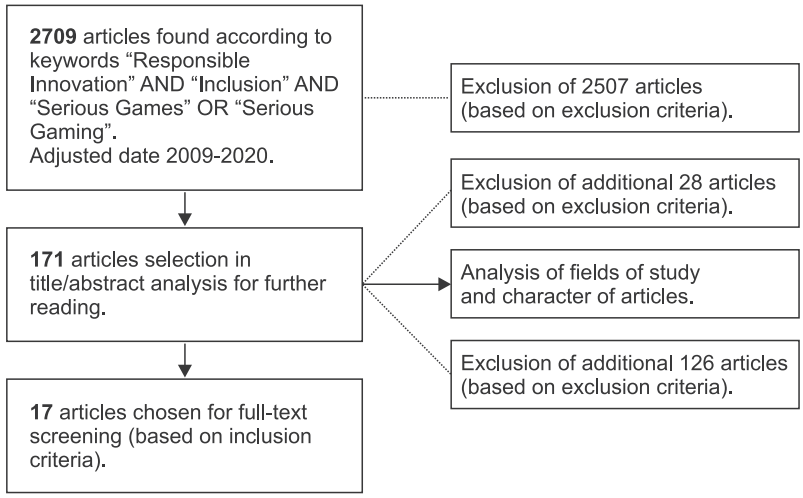

Figure 1. Staged review process of literature review and amount of excluded articles
Source: own study.

Discussion

Initial analysis of studies on the intersection between innovation, inclusion and serious games revealed 9 thematic groups: 1) business and management, 2) education, 3) environment, 4) medicine, 5) military, 6) social sciences, 7) STEM (science, technology, engineering, mathematics), 8) policy and governance, 9) urban. Each group was characterised by different participants, field of study, understanding of inclusion as well as applying it.

Business and management was characterised by focus on employees and managers, mostly in multinational enterprises. Games were applied to cognitive level: for transferring skills or presenting business processes. For instance, to present value streams, encourage market knowledge diffusion, empower employees or examine innovations. Games were mostly contributing to business and managerial objectives, eventually promoting responsible practices. In this case, games were online and offline simulations, analogue games played during workshops and gamified platforms. Cooperation was an important aspect of particular plays.

In **Education** emphasis was put on innovative learning processes and game literacy among teachers and students. It addressed a wide group of subjects, including long-life learning, inclusive education, creative performance, psychology or experience-based learning. However, the main focus was on educational advantages of applying games and adjustment of game conditions to expected outcomes and participants' needs. Here, games tackled normative and relational level, promoting inclusive collaboration between underprivileged, disabled or minorities.

Environmental games contributed to two main themes: sustainable transition (energy, water, farming, transportation) and innovation within environmental-related fields (conservation of nature, power grids, agroecology). The first group was characterised either by transfer of skills necessary for sustainable transition or effective collaboration during the process. The second group was focused on knowledge transfer (understanding, deliberating and boosting innovative solutions). In these cases, inclusion was important from a pragmatic point of view. Also, games covered all three levels: relational, cognitive and normative. Moreover, awareness and behavioral change were distinguished.

Medicine – in this case, games related to simulation training of innovative technologies with one exception on evaluation of the impact of public health preparedness to emergency situations. Participants were medical staff, familiar with specific vocabulary and conditions of simulations. Thus, trainings were merely cognitive, in order to strengthen certain skills.

Military articles were oriented toward hard skills (eg. maritime competence, strategy) and simulating crisis situations (war, tough weather conditions). Like medicine, it was designed for experienced individuals as a supportive means. However, in this case inclusion was mentioned for scenario planning and effective training.

Social sciences was the most distinct group. In this case, inclusion was underlined as a competence transferred through gaming among members of groups and communities to achieve certain objective (eg. resilience or citizen engagement). Although participants represented various groups (villagers, families, indigenous people, citizens, multi-actor systems), games often contributed to similar goals – making people cooperate to create social innovation. Here, games were innovation-oriented, taking inclusion for a means to achieve this goal.

STEM (science, technology, engineering, mathematics) articles were especially interesting as they overlap with the main field of responsible innovation. STEM innovations are potentially disruptive, hence, require a deliberative approach. In this case, games were applied for better understanding of the process, promotion of participatory science and development of possible scenarios for innovation outcomes (eg. autonomous vehicles, human-machine interaction). Despite diversity in terms of innovations and disciplines, games had similar objectives (promoting participation or engagement and broadening knowledge of an innovation). Comprehensive representation of complex problems was underlined as a significant advantage of games in this case. Role-play games and game-based workshops often took advantage of simplified models of problems.

Policy and governance was focused on triggering innovation through effective policy-making. Participants were mostly citizens and urban policy-makers. Innovation process was perceived as an output of policy-making. Games are a tool to facilitate this process and improve deliberation on innovation. Collaborative innovation was especially supported by this kind of game.

Moreover, a few examples contributed to transferring procedural knowledge for policy-makers.

Urban games were addressed mostly to citizens and covered sustainable development within urban boundaries. One interesting article contributed to promoting urban innovativeness through gaming. Also, gaming was pointed to be useful for transition into a smart city. The main difference between urban and policy and governance studies was the object of gamified discussion: policy-making (eg. open discussion governance platforms) or collaboration versus innovations on built environment or sustainable urban solutions.

As explained before, the literature regarding serious games for inclusion is present in the scholarly environment, though the concept seems to be emergent for the innovation process. Among most common notions, inclusion with regard to the innovation process is unsurprisingly reinforced through serious gaming in business and management, education and social sciences. Nonetheless, for applying serious game for responsible innovation, examples form STEM, environmental and urban studies seem relevant.

To broaden the understanding of inclusion within digital games, additional two considerable reports published by European Commission on empowerment and inclusion in digital games were investigated (Kahne et al. 2008: 30–32). Reports underlined "[…] societal participation in social inclusion" and "[…] engaging in some collective effort to improve or protect the social and physical environment" as core elements of inclusion. These aspects significantly overlap with the definition of inclusion embedded in responsible innovation framework. Also, there was a new concept introduced: e-inclusion meaning socio-economic process of engagement and participation through information and communication technologies (ICT). In this case individuals are included through modern technologies, what positively contributes to social inclusion.

Among digital games for empowerment and inclusion, Stewart (et al. 2013: 30) indicated support for disadvantaged individuals, promoting health and well-being and improving civic participation as the most critical issues. The third aspect is especially interesting from the perspective of inclusion. Civic participation is supported by games reinforcing participatory communities and spatial planning (*Community PlanIt* [2013], *Enercities* [2011] for environmental awareness or Block by Block program adapting *Minecraft* mechanism). The report distinguishes also activism and games for change which stimulate social action and collaboration, aiming first and foremost at behavioral change or raising awareness which is crucial for inclusive innovation process (Bleumers et al. 2012: 98).

Considering impact on civic inclusive behavior of adolescents, Kahne (et al. 2008) revealed positive correlation between playing games and participatory attitudes. Nevertheless, the research did not cover the question of whether civically active people are more willing to play or the game itself has contributed to the change. On the other hand, research by Neys (et al. 2012) conducted on impact on inclusive behavior of participants playing *Poverty Is Not a Game* revealed positive change in civic attitudes after the gameplay. For instance,

players admitted that during three months afterwards, they talked about the game, encouraged others to play and discussed it with people non-familiar with the subject. Proyer (et al. 2017) agreed that board and digital games make a positive contribution to inclusion among players after the gameplay. Authors put emphasis on narrative-Socratic dialogue, though, and facilitation during all the process as success factors.

Serious games facilitate business skills acquisition and knowledge transfer (Speelman et al. 2019: 32). In the innovation management context, serious games are most commonly deployed as a learning tool (Bellotti et al. 2014: 357; Merkuryev et al. 2009: 289; Newbery et al. 2016: 740). Rodela (et al. 2019: 2) points that serious games are effective means for dialogue between stakeholders which in real life may be threatened by unequal knowledge, incomparable level of education or power distance. From this perspective, serious games may serve as innovative tools for strengthening inclusiveness among innovators and embedding inclusion into the innovation process. Moreover, Speelman (et al. 2019: 32–35) presents several successful games, aiming at including stakeholders in business processes, especially representatives of the "bottom of the pyramid."

In-depth analysis of articles revealed that in general, the literature on inclusion, business and innovation process is scarce. Rather, there are components of reinforcing inclusion through gaming, for instance cross sectoral collaboration (Teutschbein and Blicharska 2020: 2–12; Jean et al. 2018), partnerships (Romero et al. 2015), stakeholders' engagement (Mochizuki 2016; Lalicic and Weber-Sabil, 2019) or deliberation (Mochizuki et al. 2018). Further analysis of the reports and 17 chosen articles revealed two distinct perspectives for enhancing inclusion through and within games.

Inclusion as a goal, where inclusion or its elements were objectives for games itself. For instance deliberation or collaboration between disadvantaged citizens, minorities, representatives of different groups of interests. It was typical for education, social sciences and partially for policy and governance and STEM. In this group objectives related either to raising awareness of inclusive behaviors/attitudes or intending to achieve behavioral change. Inclusion was enhanced in order to promote democratic values in various disciplines. However, participants represented distinct groups.

Inclusion as a means for effective innovation management or contribution to the innovation process. For instance, participatory planning, developing scenarios for innovations, evaluating outcomes of innovation processes. In this case, inclusion was often accepted on a normative level and assumed to be necessary in order to achieve goals of the game. In this group there were professionals who needed to acquire skills, knowledge or exchange information. Also, in this case the range of subjects was very broad, often referring to sustainability, policy-making or resource management. Inclusion was a means for simulation games, where collaboration between partners was a core aspect. Interestingly, it covered urban innovation initiatives as well as STEM deliberative processes.

Conclusion

The aim of this article was to argue for serious games as effective means for enhancing inclusion within the responsible innovation process, based on theory and systematic literature review of the intersection between serious gaming, innovation process with notion of responsibility and inclusion.

Because of facilitated learning (knowledge and skill transfer), serious games are promising for that purpose. Evidence from literature, especially STEM, urban and environmental studies reveal interesting outcomes in terms of reinforcing elements of inclusion (participatory design, collaborative innovation, co-creation). As literature on responsible innovation is scarce, it is recommended to establish inclusion as a goal for games accompanying possibly disruptive innovation processes. Research reveals effectiveness of role-play games and game-based workshops. Inclusion as a means within a game is advised to be applied among more mature communities and participants, who already adopted inclusion to their normative system. In this case, simulations are promising, to focus on a specific solution under inclusive, gamified circumstances.

However, defining elements of inclusion is crucial for goal establishment. Also, it has to be considered whether inclusion will be achieved at normative, relational and cognitive levels. Precise definition of inclusion (or its elements) and choice of the expected outcome will drive the design of the game. This discussion also addresses responsible innovation. Although serious gaming may contribute to creating a more effective responsible innovation process, the understanding of inclusion and expected outcomes has to be concise.

References

Aldrich, Clark. 2003. *Simulations and the Future of Learning: An Innovative (and Perhaps Revolutionary) Approach to e-Learning*. San Francisco: Pfeiffer.

Bellotti, Francesco; Berta, Riccardo; De Gloria, Alessandro; Lavagnino, Elisa; Antonaci, Alessandra; Dagnino, Francesca; Ott, Michela; Romero, Margarida; Usart, Mireia; and Mayer, Igor. 2014. Serious Games and the Development of an Entrepreneurial Mindset in Higher Education Engineering Students. *Entertainment Computing*, 5 (4), pp. 357–366.

Björgvinsson, Erling; Ehn, Pelle; and Hillgren, Per-Anders. 2010. Participatory Design and "Democratizing Innovation." In: Bødker, Keld; Bratteteig, Tone; Loi, Daria; and Robertson, Toni (eds.). *PDC 2010. Participation: The Challenge. Proceedings of the Eleventh Conference on Participatory Design*. Sydney, November, 29 – December, 3. New York: Association for Computing Machinery, pp. 41–50.

Bleumers, Lizzy; All, Anissa; Mariën, Ilse; Schurmans, Dana; Van Looy, Jan; Jacobs, An; Willaert, Koen; and de Grove, Frederik. 2012. *State of Play of Digital Games for Empowerment and Inclusion: A Review of the Literature and Empirical Cases*. Luxembourg: Publications Office of the European Union.

Connolly, Thomas M.; Boyle, Elizabeth A.; MacArthur, Ewan; Hainey, Thomas; and Boyle, James M. 2012. A Systematic Literature Review of Empirical Evidence on Computer Games and Serious Games. *Computers and Education*, 59 (2), pp. 661–686.

Doorn, Neelke. 2012. Responsibility Ascriptions in Technology Development and Engineering: Three Perspectives. *Science and Engineering Ethics*, 18 (1), pp. 69–90.

Duke, Richard D. 1974. *Gaming: The Future's Language*. New York: Sage Publications.
Felder, Franziska. 2018. The Value of Inclusion. *Journal of Philosophy of Education*, 52 (1), pp. 54–70.
Felt, Ulrike; Igelsböck, Judith; Schikowitz, Andrea; and Völker, Thomas. 2015. Transdisciplinary Sustainability Research in Practice: Between Imaginaries of Collective Experimentation and Entrenched Academic Value Orders. *Science, Technology, and Human Values*, 41 (4), pp. 732–761.
Foster, Christopher; and Heeks, Richard. 2013. Analyzing Policy for Inclusive Innovation: The Mobile Sector and Base-of-the-Pyramid Markets in Kenya. *Innovation and Development*, 3 (1), pp. 103–119.
Garris, Rosemary; Ahlers, Robert; and Driskell, James E. 2002. Games, Motivation, and Learning: A Research and Practice Model. *Simulation and Gaming*, 33 (4), pp. 441–467.
Geurts, Jac; Duke, Richard; and Vermeulen, Patrick. 2007. Policy Gaming for Strategy and Change. *Long Range Planning*, 40 (6), pp. 535–558.
Girard, C.; Ecalle, Jean; and Magnan, Annie. 2013. Serious Games as New Educational Tools: How Effective Are They? A Meta-Analysis of Recent Studies. *Journal of Computer Assisted Learning*, 29 (3), pp. 207–219.
Gugerell, Katharina; and Zuidema, Christian. 2017. Gaming for the Energy Transition. Experimenting and Learning in Co-Designing a Serious Game Prototype. *Journal of Cleaner Production*, 169, pp. 105–116.
Guston, David H. 2014. Understanding 'Anticipatory Governance'. *Social Studies of Science*, 44 (2), pp. 218–242.
Hossain, Mokter. 2012. An Overview of Inclusive Education in the United States. In: Aitken, Joan E.; Fairley, Joy P.; and Carlson, Judith K. (eds.). *Communication Technology for Students in Special Education and Gifted Programs*. Hershey, PA: IGI Global, pp. 1–25.
Jean, Steven; Medema, Wietske; Adamowski, Jan F.; Chew, Cheng Zi; Delaney, Patrick; and Wals, Arjen. 2018. Serious Games as a Catalyst for Boundary Crossing, Collaboration and Knowledge Co-Creation in a Watershed Governance Context. *Journal of Environmental Management*, 223, pp. 1010–1022.
Johnson, Cheryl I.; Bailey, Shannon K.; and Van Buskirk, Wendi L. 2017. Designing Effective Feedback Messages in Serious Games and Simulations: A Research Review. In: Wouters, Pieter; and van Oostendorp, Herre (eds.). *Instructional Techniques to Facilitate Learning and Motivation of Serious Games*. Cham: Springer International Publishing, pp. 119–140.
Kapp, Karl M. 2012. *The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education*. San Francisco, CA: Pfeiffer.
Koops, Bert-Jaap. 2015. Introduction. In: van den Hoven, Jeroen; Oosterlaken, Ilse; Koops, Bert-Jaap; and Romijn, Henny. *Responsible Innovation 2: Concepts, Approaches and Applications*. Dordrecht: Springer, pp. 1–15.
Lalicic, Lidija; and Weber-Sabil, Jessika. 2019. Stakeholder Engagement in Sustainable Tourism Planning through Serious Gaming. *Tourism Geographies*, 23 (3), pp. 1–21.
Lubberink, Rob; Blok, Vincent; Van Ophem, Johan; and Omta, Onno. 2017. Lessons for Responsible Innovation in the Business Context: A Systematic Literature Review of Responsible, Social and Sustainable Innovation Practices. *Sustainability*, 9 (5), pp. 3–22.
Macnaghten, Phil; Owen, Richard; Stilgoe, Jack; Wynne, Brian; Azevedo, Adalberto; De Campo, André L.; Chilvers, Jason; Dagnino, Renato; et al. 2014. Responsible Innovation across Borders: Tensions, Paradoxes and Possibilities. *Journal of Responsible Innovation*, 1 (2), pp. 191–199.
Marsh, Tim. 2011. Serious Games Continuum: Between Games for Purpose and Experiential Environments for Purpose. *Entertainment Computing*, 2 (2), pp. 61–68.
Mayer, Igor; Bekebrede, Geertje; Harteveld, Casper; Warmelink, Harald; Zhou, Qigi; van Ruijven, Theo; Lo, Julia; Kortmann, Rens; and Wenzler, Ivo. 2014. The Research and Evaluation of Serious Games: Toward a Comprehensive Methodology. *British Journal of Educational Technology*, 45 (3), pp. 502–527.
McGonigal, Jane. 2011. *Reality Is Broken: Why Games Make Us Better and How They Can Change the World*. New York: The Pinguin Press.
Merkuryev, Yuri; Merkuryeva, Galina; Bikovska, Jana; Hatem, Jonas; and Desmet, Bram. 2009. Business Simulation Game for Teaching Multi-Echelon Supply Chain Management. *International Journal of Simulation and Process Modelling*, 5 (4), pp. 289–299.

Mochizuki, Junko. 2016. Review of Serious Gaming Applications in Humanitarian Operations and Disaster Risk Management: State-of-the-Art and Future Directions for Research. In: *7th International Conference on Integrated Disaster Risk Management Disasters and Development: Towards a Risk Aware Society, October 1–3, Isfahan, Islamic Republic of Iran*, pp. 169–170.

Mochizuki, Junko; Magnuszewski, Piotr; and Linnerooth-Bayer, Joanne. 2018. Games for Aiding Stakeholder Deliberation on Nexus Policy Issues. In: Hülsmann, Stephan; and Ardakanian, Reza (eds.). *Managing Water, Soil and Waste Resources to Achieve Sustainable Development Goals: Monitoring and Implementation of Integrated Resources Management*. Cham: Springer International Publishing, pp. 93–124.

Newbery, Robert; Lean, Jonathan; and Moizer, Jonathan. 2016. Evaluating the Impact of Serious Games: The Effect of Gaming on Entrepreneurial Intent. *Information Technology and People*, 29 (4), pp. 733–749.

Owen, Richard; Macnaghten, Phil; and Stilgoe, Jack. 2012. Responsible Research and Innovation: From Science in Society to Science for Society, with Society. *Science and Public Policy*, 39 (6), pp. 751–760.

Owen, Richard; and Pansera, Mario. 2019. Responsible Innovation and Responsible Research and Innovation. In: Simon, Dagmar; Kuhlmann, Stefan; Stamm, Julia; and Canzler, Weert (eds.). *Handbook on Science and Public Policy*. Cheltenham: Edward Elgar Publishing, pp. 26–48.

Owen, Richard; Stilgoe, Jack; Macnaghten, Phil; Gorman, Mike; Fisher, Erik; Guston, Dave; and Bessant, John. 2013. A Framework for Responsible Innovation. In: Owen, Richard; Bessant, John; and Heintz, Maggy (eds.). *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society*. London: John Wiley, pp. 27–50.

Pansera, Mario; and Owen, Richard. 2018. Framing Inclusive Innovation within the Discourse of Development: Insights from Case Studies in India. *Research Policy*, 47 (1), pp. 23–34.

Perrotta, Carlo; Featherstone, Gill; Aston, Helen; and Houghton, Emily. 2013. *Game-Based Learning: Latest Evidence and Future Directions*. Slough: National Foundation for Educational Research.

Peters, Vincent; Vissers, Geert; and Heyne, Gerton. 1998. The Validity of Games. *Simulation and Gaming*, 29 (1), pp. 1–9.

Proyer, Michelle; Schmölz, Alexander; Kremsner, Gertraud; Karpouzis, Kostas; Yannakakis, Georgios; Handle-Pfeiffer, Daniel; Möhlen, Lisa-Katharina; and Koulouris, Pavlos. 2017. Doing Social Inclusion: Aiming to Conquer Crisis through Game-Based Dialogues and Games. In: Pivec, Maja; and Gründler, Josef (eds.). *Proceedings of the 11th European Conference on Game-Based Learning*. Reading, UK: Academic Conferences and Publishing International Limited, pp. 554–561.

Redpath, Steve M.; Keane, Aidan; Andrén, Henrik; Baynham-Herd, Zac; Bunnefeld, Nils; Duthie, Alexander B.; Frank, Jens; Garcia, Claude A.; Månsson, Johan; Nilsson, Lovisa; Pollard, Chris; Rakotonarivo, O. Sarobidy; Salk, Carl; and Travers, Henry. 2018. Games as Tools to Address Conservation Conflicts. *Trends in Ecology and Evolution*, 33 (6), pp. 415–426.

Ritterfeld, Ute; Cody, Michael; and Vorderer, Peter (eds.). 2009. *Serious Games: Mechanisms and Effects*. New York: Routledge.

Rodela, Romina; Ligtenberg, Arend; and Bosma, Roel H. 2019. Conceptualizing Serious Games as a Learning-Based Intervention in the Context of Natural Resources and Environmental Governance. *Water*, 11 (2), pp. 1–15.

Romero, Margarida; Usart, Mireia; and Ott, Michela. 2015. Can Serious Games Contribute to Developing and Sustaining 21st-Century Skills? *Games and Culture: A Journal of Interactive Media*, 10 (2), pp. 148–177.

Speelman, Erika; Rodela, Romina; Doddema, Mandy; Ligtenberg, Arend; and Mangnus, Ellen. 2019. Serious Gaming as a Tool to Facilitate Inclusive Business: A Review of Untapped Potential. *Current Opinion in Environmental Sustainability*, 41, pp. 31–37.

Stewart, James; Bleumers, Lizzy; Van Looy, Jan; Mariën, Ilse; All, Anissa; Schurmans, Dana; Willaert, Koen; De Grove, Frederik; Jacobs, An; and Misuraca, Gianluca. 2013. *The Potential of Digital Games for Empowerment and Social Inclusion of Groups at Risk of Social and Economic Exclusion: Evidence and Opportunity for Policy*. Luxembourg: Publications of European Commission.

Stilgoe, Jack; Owen, Richard; and Macnaghten, Phil. 2013. Developing a Framework for Responsible Innovation. *Research Policy*, 42 (9), pp. 1568–1580.

Torraco, Richard J. 2005. Writing Integrative Literature Reviews: Guidelines and Examples. *Human Resource Development Review*, 4 (3), pp. 356–367.

van den Hoven, Jeroen. 2013. Value Sensitive Design and Responsible Innovation. In: Owen, Richard; Bessant, John; and Heintz, Maggy (eds.). *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society*. London: John Wiley, pp. 75–83.

van den Hoven, Jeroen. 2017. Ethics for the Digital Age: Where Are the Moral Specs? Value Sensitive Design and Responsible Innovation. In: Werthner, Hannes; and van Harmelen, Frank (eds.). *Informatics in the Future: Proceedings of the 11th European Computer Science Summit (ECSS 2015), Vienna, October 2015*. Cham: Springer, pp. 65–76.

van de Poel, Ibo. 2015. Conflicting Values in Design for Values. In: van den Hoven, Jeroen; Vermaas, Pieter E.; and van de Poel, Ibo (eds.). *Handbook of Ethics, Values, and Technological Design: Sources, Theory, Values and Application Domains*. Dordrecht: Springer, pp. 89–116.

van de Poel, Ibo; Fahlquist, Jessica; Doorn, Neelke; Zwart, Sjoerd; and Royakkers, Lambèr. 2012. The Problem of Many Hands: Climate Change as an Example. *Science and Engineering Ethics*, 18 (1), pp. 49–67.

van der Velden, Maja; and Mörtberg, Christina. 2014. Participatory Design and Design for Values. In: van den Hoven, Jeroen; Vermaas, Pieter E.; and van de Poel, Ibo (eds.). *Handbook of Ethics, Values, and Technological Design: Sources, Theory, Values and Application Domains*. Dordrecht: Springer, pp. 1–22.

Von Schomberg, René. 2013. A Vision for Responsible Research and Innovation. In: Owen, Richard; Bessant, John; and Heintz, Maggy (eds.). *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society*. London: John Wiley, pp. 51–74.

Winn, Brian M. 2009. The Design, Play, and Experience Framework. In: Ferdig, Richard E. (ed.). *Handbook of Research on Effective Electronic Gaming in Education*. Vol. 3. Hershey – New York: IGI Global, pp. 1010–1024.

Wittgenstein, Ludwig. 1953. *Philosophical Investigations*. Malden: Blackwell.

Internet Sources

Chataway, Joanna; Hanlin, Rebecca; and Kaplinsky, Raphie. 2013. *Inclusive Innovation: An Architecture for Policy Development*. [Online]. Innovation, Knowledge, Development. Accessed from: http://www.open.ac.uk/ikd/sites/www.open.ac.uk.ikd/files/files/working-papers/ikd-working-paper-65.pdf [7.10.2020].

Cozzens, Susan; and Sutz, Judith. 2012. *Innovation in Informal Settings: A Research Agenda*. [Online]. International Development Research Centre. Accessed from: https://www.idrc.ca/sites/default/files/sp/Documents%20EN/iid-framework-july-29.pdf [7.10.2020].

Gouveia, Patricia. 2015. Serious Gaming: How Gamers Are Solving Real World Problems. In: Bidarra, José; Eça, Teresa T.; Tavares, Míriam; Leote, Rosangella; Pimentel, Lucia; Carvalho, Elizabeth; and Figueiredo, Maura (eds.). *ARTECH 2015. Proceedings of the Seventh International Conference on Digital Arts. Óbidos, Portugal – March 19–20*, pp. 147–156. [Online]. Academia. Accessed from: https://www.academia.edu/11651087/_Serious_gaming_how_gamers_are_solving_real_world_problems [7.10.2020].

Kahne, Joseph; Middaugh, Ellen; and Evans, Chris. 2008. *The Civic Potential of Video Games*. [Online]. Civic Engagement Research Group at Mills College. Accessed from: http://www.civicsurvey.org/White_paper_link_text.pdf [7.10.2020].

Neys, Joyce L.D.; Van Looy, Jan; De Grove, Frederik; and Jansz, Jeroen. 2012. *Poverty Is Not a Game: Behavioral Changes and Long-Term Effects after Playing PING*. Etmaal Conference, Leuven, Belgium. [Online]. Accessed from: https://core.ac.uk/download/pdf/55868142.pdf [7.10.2020].

Teutschbein, Claudia; and Blicharska, Malgorzata. 2020. *Sweden Cross-Sectoral Collaboration*. [Online]. SIM4NEXUS. Accessed from: https://www.sim4nexus.eu/page.php?wert=Casestudies&id=Sweden [7.10.2020].

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Community PlanIt. 2013. [Online]. Web Archive. Accessed from: https://web.archive.org/web/20170216080419/https://www.communityplanit.org/how-to-play/ [10.09.2020].

Darfur Is Dying. 2007. [Online]. Games for Change. Accessed from: https://pl.y8.com/games/darfur_is_dying [10.09.2020].

Enercities. 2011. [Online]. Paladin Studios. Accessed from: https://paladinstudios.com/enercities/ [10.09.2020].

My Cotton Picking Life. 2012. [Online]. Game The News. Accessed from: http://gamethenews.net/index.php/my-cotton-picking-life/ [10.09.2020].

Poverty Is Not a Game. 2010. [Online]. Poverty Is Not A Game. Accessed from: http://www.grin.be/blog/?p=38 [10.09.2020].

SuperBetter. 2012. [Online]. SuperBetter. Accessed from: https://www.superbetter.com/ [10.09.2020].

Summary

This paper presents a theoretical consideration of the use of serious games to enhance inclusiveness in the process of creating so-called responsible innovation. The literature regarding the impact of serious games on inclusion with its possible implications for a responsible innovation process is explored. The article sheds light on the concept of serious gaming, including its aims, core elements and the learning process. It tackles inclusion within different contexts and its origins, linking it to gaming. The responsible innovation concept is explained from this perspective, with attention paid to inclusion. Next, a systematic literature review is presented, focusing on recent sources from the JSTOR database. It is followed by selected cases of games enhancing inclusion. The article summarizes the outcomes of the review and compares them with the theoretical assumptions. In the conclusion, the topic of using serious games as a promising method to improve the level of inclusiveness in the process of creating responsible innovations is addressed. It was also noted that, from the point of view of the creators of responsible innovations, particularly interesting areas are studies devoted to urban and environmental issues, as well as articles on natural sciences, technology, engineering and mathematics.

Wzmacnianie inkluzywności w procesie tworzenia odpowiedzialnych innowacji poprzez poważne gry

Streszczenie

W artykule przedstawiono teoretyczne rozważania nad wykorzystaniem poważnych gier (ang. *serious games*) w celu wzmocnienia inkluzywności w procesie tworzenia tak zwanych odpowiedzialnych innowacji. Dokonano przeglądu literatury z zakresu wpływu poważnych gier na inkluzywność, łącznie z jego możliwymi implikacjami. Przybliżono koncepcję poważnych gier, uwzględniając ich cele, główne elementy, a także wymiar edukacyjny. Inkluzywność ukazano w różnych kontekstach, biorąc pod uwagę jej początki, a także związek z poważnymi grami. Koncepcję tworzenia odpowiedzialnych innowacji wyjaśniono z perspektywy edukacyjnej, zwracając uwagę na zagadnienie inkluzywności. Następnie, na podstawie analizy aktualnych zasobów bazy danych JSTOR (Journal Storage database), przedstawiono systematyczny przegląd opracowań na temat gier

zakładających odpowiedzialność uczestników, wykorzystywanych w procesie tworzenia innowacji. Uzupełniono go wybranymi przykładami gier wzmacniających inkluzywność. Podsumowano wyniki przeglądu i porównano je z teoretycznymi założeniami. Na koniec odniesiono się do tematu zastosowania poważnych gier jako obiecującej metody poprawienia poziomu inkluzywności w procesie tworzenia odpowiedzialnych innowacji. W wyniku zaprezentowanego badania wykazano, że inkluzywność jest zarówno celem poważnych gier tworzonych z myślą z kreowaniu innowacji, jak i środkiem do osiągnięcia innego celu, związanego z odpowiedzialnością. Zauważono także, że z punktu widzenia twórców odpowiedzialnych innowacji szczególnie interesującymi obszarami są opracowania poświęcone problematyce urbanistycznej i środowiskowej oraz artykuły na temat nauk przyrodniczych, technologii, inżynierii czy matematyki.