Review Article

Developing a ludic framework for counteracting interventions for dementia: A narrative and analytic review

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ABSTRACT

As the field of medicine tries to tap into various facets of gamification, the potential of video games and gaming-based interventions has become a hotbed of interesting activity in the Dementia circles of medical research. This paper, exploratory in nature is a bid to find common grounds for the fields of neurosciences, psychology, and psychiatry with the sub-field of ludology in a hope to find unique insights from the benefits of interdisciplinary research and extrapolating findings from gaming addiction.

From the perspective of game studies, the paper will draw from elements of concepts like flow, immersion and engagement in a bid to understand the various tools that can be of use if people ailing from neurocognitive disorders were to engage in gaming activity. This paper will lay the framework that will enable the beginning of a matching gaming exercises based on cognitive deficits and psychological profiling of clients diagnosed with neurocognitive disorders and advance the fields of neurosciences and psychology. By combining the findings from existing studies and original work this paper will propose both a means to study the possible effects of gaming-based interventions and suggest ways to streamline and optimize the use of gamification in patient care.

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1. Introduction

Gamification is today's buzzword, being used in a variety of scenarios across fields of expertise in a bid to find interesting newer solutions for existing problems. The adoption of gamification and its principles can be gauged from ride platforms like Uber to payment approaches like Google's Gpay and Phone Pe. In an era where the most fascinating work for academia is in the blurring boundaries of established disciplines, it is only natural that the fields of psychology, psychiatry, cognitive science, and game studies come together to view the problems faced by people suffering from neurocognitive disorders.

While research exploring the intersection between the above-mentioned fields has become incredibly popular in the last decade with the Sea Hero Quest experiment being the watershed moment.[1,2] Earlier research has indicated that gaming-based interventions have shown positive signs with patients suffering from dementia and Alzheimer's related disorders as patients have shown improvement over time with several gaming platforms.[3–5] Studies have also looked at concepts like "exergaming" where gaming related activities have been viewed as a form of exercise for the mind and have consequently shown some cognitive improvement overtime with patients as they experienced fun and engagement.[6]

Other studies have also looked at the use of innovations like virtual reality, and the use of motion-based technology

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to help setup and run gaming technology groups for people suffering with dementia and related disorders.[4–8] In a clearly burgeoning area of work, this paper proposes to look at how elements from game studies can be used in order to build counteracting gaming-based interventions. Secondly, the paper also discusses in detail the process of developing a suitable game with the said elements and suggests the creation of a framework that will easily allow for building of future games.

2. Channeling Flow, Immersion & Engagement

To credit the Sea Hero Quest exercise and its focus on cognitive elements of spatial navigation abilities, for the first time the supposed gold standard of memory loss to detect dementia has been now replaced by a method that is more reliable. By replacing the general complaint of memory loss to one's specific loss of the spatial skills of navigation can be called a gigantic step forward in detecting dementia.[2] By making the act of navigating in a virtual environment on a tiny touch-based screen a trivial pursuit the experiment was able to collect data from one of the largest samples in mental health history.

Looking at the success of the exercise it is important to consider the various elements that make gaming 'fun' in the first place. This paper draws broadly from three core concepts from game studies namely, Engagement, Immersion & Flow.

Immersion: Immersion is one of the most prominent elements that is immediately considered with regards to video games. Owing to the bedrock of work with regards to gaming and violence and the addictive abilities of video games as a medium, immersion is often construed in a negative light. Simply put, immersion is a state that players experience when they blur the boundaries of the offline worlds with their online counterparts. A phenomenon that is as likely to happen in worlds of fantasy as video games immersion is key to the use of gaming for building the counteractive intervention.

Engagement: A concept suggested by Gordon Calleja in order to replace the more abstract immersion; Calleja has developed a six-point frame in order to study players' engagement with games.[9] By unpacking the video game as a medium into six distinct elements (tactical, performative, affected, shared, narrative and spatial) he then analyses immersion across each of these elements. Calleja points out that when a player is playing, he/she wouldn't necessarily be able to distinguish between the six elements and would experience the involvement as a unified cognitive sensation.[9]

Flow: The concept of immersion is best illustrated by most Ludologists using Csikszentmihalyi's concept of flow. Key to the experience of flow and the Zen state is Csikszentmihalyi's understanding of the term where he understands the state of being in flow as a heightened experience that he compares to the athletes in the zone, mystics' ecstasy and artists' aesthetic rapture and refers to the full involvement of flow as the "excellence in life." Instances where people experience the Zen state are labeled by him as moments of intense living that are dispersed against the dull background of everyday life.[10]

Flow amongst players while interacting with games is more common in contrast to "normal" or routine activities of the everyday, the interaction with(in) a game requires the player to engage at multiple levels and enter a state where his/her skills are completely involved in overcoming a challenge while adhering to the rules. Csikszentmihalyi also points out that the person seeks constant moments of flow by either mastering new skills or increasing the difficulty of the challenge.[10] It is important to note that in theory, this heightened flow/Zen state is such that once people experience it, they will always strive to experience the intensity and exhilaration repeatedly.[10]

While the three concepts seem promising it is very important to note that contrary to popular belief, the proverbial Zen state or the feeling of complete immersion in games is never a constant. Like in the conceptualization of Csikszentmihalyi's heightened state, in gaming too the moments of complete immersion are at best fleeting.[11]

Thus, the need to build a framework that takes engagement into consideration by allowing for elements of flow and immersion to be generously interspersed is key for this exercise to allow for the players to experience the flow state as frequently as possible.

The challenge here however is two pronged, by trying to introduce a gaming intervention in a generation of people who haven't experienced gaming as a leisure time activity and may also be less than inclined towards the usage of technological platforms. However, for an intervention like this to truly work there is a need for participants who look at games first as an interesting activity, then gravitate towards looking at it as a habit, begin to engage with it as a practice and eventually begin to think of it as a ritual.[12,13]

The need for understanding users' interactions in the context of the everyday is of paramount importance and it is also important for the suggested methodology to work as the study needs to look at both what games do to people in the conventional fashion but also more importantly look at what users do to the games.[12]

3. Need for designing newer interventions

With the increase in average life span, the prevalence of chronic diseases are on the rise.[14] This includes cognitive impairment as a sequelae to dementia, traumatic brain injury, autoimmune diseases etc. The barriers to traditional cognitive training (which include paper and pencil exercises) and rehabilitation for neurocognitive disorders

include increasing cost of health care, declining caregiver support, non-availability of trained occupational therapists, requirement of labor-intensive therapy, accessibility to therapy, and difficulties in transportation; especially for the disabled.[14–16] These barriers hold validity for both the developed and developing world.[17] This constantly growing unmet health needs can only be addressed with the aid of efficient and effective use of technology widely available through portable electronic devices such as smart mobile phones, tablets and laptops with integration of World Wide Web. This technology can be utilized for assessment, therapeutic management, and monitoring of progress.[18] Some studies have reported conflicting results.[19] However, recent systematic reviews showed that gaming interventions hold promise in cognitive training.[20] This necessitates further enhancement of the existing gaming interventions in order to improve delivery of care.

3.1. Lacunae In the Existing Gaming Interventions and Need to Build Specific Games

Games designed for cognitive training are few and have several limitations.[21] Most of them focus on single cognitive domains such as working memory, attention and concentration, for example, Sea Hero Quest focuses which focuses on spatial navigation alone.[22] Also, Games utilized in traditional occupational therapy settings continue to focus on theoretical constructs rather than functional recovery.[23] This results in inability to tailor therapy to the felt needs of the clients. This dissatisfaction is often seen as poor compliance to therapy and large attrition rates in gaming studies. The existing traditional assessment (Addenbrooke's Cognitive Examination II, Minnesota Cognitive Acuity Screen, Mini Mental State Exam, Frontal Assessment Battery) and games also do not consider the phenomenological and user-experience of the client resulting in games being considered too mundane, uninteresting, stressful, long and painful.[24] Also, several available games focus of single trained tasks with limited transferability to unpracticed tasks,[25] or focus on minor gains which in reality cannot be frequently reinforced, generalized or magnified.[26] For example, single finger tapping can be utilized as the most important operating function during play and can be reinforcement, but, in real life setting, single finger movement has limited function. Therefore, the current gaming industry focusing on cognitive retraining needs to involve neurologists, geriatric medicine, mental health professionals, occupational and physiotherapists; apart from graphic designers, in order to improve user-experience , adherence and functional recovery.[27]

4. Building the Game

For a ludic based intervention to work the following factors are necessary to be considered for the resultant game to work:

1. An enjoyable and fluid interface that is easy to understand and internalize.
2. Game that is conceptually simple and visually appealing,
3. Encourages longer sessions of play,
4. Incentivizes repeated sessions of play, and
5. Rewards longer periods of engagement.

With these as overarching principles for the building of the game, the game can be further personalized based on demographic data, and diagnosis. Trained medical personnel can enlist the deficits hierarchy wise with focus on major domain affected. Reinforcements are identified, adjusted based on performance and to meet 'eu-stress' difficulty. A story line with integrated specific assessment through mini games can serve as gamification of the medical intervention. Mean scores are derived and compared to other players and synced to server. Caregivers can be trained to monitor this exercise.

4.1. Matching game elements with specific traits of dementia

The following table summarizes the cognitive deficits in different domains and alongside lists the remediation strategies required to address them, games currently available and their key elements.

5. Challenges and Limitations

Several challenges can be anticipated at multiple fronts due to disability and other medical comorbidities. 'Game pain' as a factor for non-compliance is difficult to address. User experience must be considered which is influenced by cultural and ethnic factors. The game will also be expected to provide psychological support, improve quality of life, and improve self-esteem.

This article also makes a few assumptions that game related to ability deficit can be learnt and can be generalized to other areas. It also does not consider the probable harms of gaming as therapy such as impact of the patient failing the game or addiction, given that game is intended to be immersive and engaging.

6. Conclusions

There is rise in global prevalence of cognitive disorders. Technology can serve as an efficient, and cost-effective method to bridge this growing health gap. Gaming interventions are promising but limited. Few consider user-experience, tailored exercises, and functional rehabilitation.

Table 1:

Deficits	Remediation strategies	Games available	Key Game Elements
1. Learning and memory. i. Short term memory: Forgetting recent events,- conversations, dates, repetitive questions,- iii. Long term memory:- misplacing objects and valuables. Forgetting personal past memory and highly learnt material.	Recall strategies: Mnemonics, cueing (vanishing and forward), chunking, method of loci, spaced retrieval, sematic trainin.	Big Brain Academy, Memory Card Flip.	Games that evoke memories, focus on personal histories & milestones. Games that look to build sequential memory through use of chronological and linear tasks.
2. Language i. Aphasia: Word finding, names of family members, reduced fluency of productive speech, word substitutions and mispronouncing. 3.Perceptual Motor Ability (is one phrase).	Face-Name recall, Number recall, story recall, object recall, word-pairs/associations, Letter fluency test.	Big Brain Academy, Mindmate, Scrabble, Hangman, Spellathon, Crosswords, Unscramble.	Games that build word associations. Use of clues with increasing complexity. Allowing for rebuilding and reassociation of words with contexts. Games that focus on location and motor-based cognition skills.
i. Visual perception: Navigational difficulties in dark. ii. Visuoconstruction: Navigational difficulties in familiar environments. iii. Apraxia: Initially, difficulty with previously familiar tools and skills, later ADL (dressing, bathing, feeding). iv. Agnosia: Difficulty in recognizing familiar faces, objects and one's own reflection.	Procedural memory training: prompting & fading, action-based encoding, chaining,.	Sea Quest, Wii sport, Dots, Temple Run.	Allow for development of pattern recognition. A process that gravitates from recognition and development of simple patterns to more complex ones.
5. Complex attention. i. Easily distracted. ii. Trouble with new information (is one phrase) (please adjust numbers). iii. Thinking takes longer.	Fluency training- Direct instruction, precision teaching, names and numbers.	Wii sport, Quiz based games, Strategy based games, Polytopia, Age of Empires.	Games that provide players with a safe environment to make challenging and risky decisions. Games that allow for collection, processing and data analysis in conjunction with decision making. To work towards a processual reduction in the time required to make complex decisions.
6. Executive function i. Disturbances in planning, organizing, sequencing and abstracting. ii. Performing complex tasks or solving such as finances or medication.	Object location pairing, correct placement, modelling.	Lumosity, Wii sport, Diner/Recipe based games, Resource based games, Tycoon genre.	Games that encourage incorporation of strategy and allow for players' building of sequential and diverse thought processes. Game environments that encourage cogent thought, resource handling and multitasking.
7. Social cognition i. Ability to recognize other emotions and mental state. ii. Change in behavior and personality.	Identify cues and emotions in others.	Life is Strange, Witcher, Firewatch, Mass Effect, Dragon Age.	Games which involve human emotion. Incorporate elements of dialogue and decision making. Special focus on elements that help contextualize and understand thus fostering shades of sympathy and empathy.

Exploiting findings from gaming addiction and concepts from gaming may be of use.

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None.

8. Conflict of Interest

None.

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