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Perspective-Taking in Virtual Reality for Military Personnel: An Overview of Approaches to Virtual Social Training

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Perspective Taking and Its Cognitive Aspects

"To be able to act properly, e.g. to help another person – you need first to notice that this person requires aid, and this aid needs to be interpreted as the knowledge that you do not want to be in the same position yourself. It means that a person puts himself in the same situation. From the understanding of this position, this person can infer how to act in accordance with the situation and do so".[1] With these words, Gutzwiller-Helfenfinger explains what perspective taking and integration of perspective stands for.

To enunciate a definition, perspective taking (PT) can be understood as "assumption of a point of view from which something is presented or

[1] Eveline Gutzwiller-Helfenfinger, "Förderung der sozialen Perspektivenübernahmefähigkeit bei Jugendlichen", in: Eveline Gutzwiller-Helfenfinger, *Moralische Entwicklung und Erziehung in Kindheit und Adoleszenz* (Hogrefe, 2010).

assessed and is traceable only in those aspects which correspond with the said point of view".[2] In this case, assuming a given perspective gives us access to particular ways of perceiving it, while occluding others. The term *perspective,* when used in reference to taking a stance in relation to the assessment of a given state of affairs, can also be defined as a type of *view* towards a definite importance of things[3] Perner's proposal of a broad definition of perspective, states that it is a "method of how something can be represented".[4]

The analysis of philosophical and psychological conceptions of perspective-taking done by Białek,[5] leads him to infer that "cognition is inherently perspective-ridden, each representation happens from some form of perspective, and because of that, only some aspects of the represented object are represented, and that means representation is always 'representation as'". Perner also states that you cannot represent while not representing something in a particular way, because every usage of that medium happens from a perspective itself.[6]

The mental construct of perspective taking has a complex, multifaceted character. Its genesis is defined by developmental processes and in the later stages of life by the motivational component.[7] According to that, one can enumerate social, linguistic, cognitive, and affective contexts of perspective taking.

The point of origin for PT is the social aspect of the human mind[8] Here, PT is expressed through nonverbal behaviours triggered in response to the reactions of others.[9] Taking in social perspective is defined as a process, during which the observer not only registers his/her own thoughts, feelings, motivations of other persons, or even groups

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[2] Carl Graumann, "Explicit and Implicit Perspectivity", in: Carl Graumann, *Perspective and Perspectivation in Discourse*, (Amsterdam: John Benjamins Publishing Company, 2002), 25–40.

[3] Josef Perner, Sandra Stummer, Manuel Sprung, Martin Doherty, "Theory of mind Finds Its Piagetian Perspective: Why Alternative Naming Comes With Understanding Belief" (Cognitive Development 17, 2002), 1451–1472.

[4] Josef Perner, Johannes Brandl, Alan Granham, "What is Perspective Problem? Developmental Issues in Belief Ascription an Dual Identity" (Facta Philosophica 5, 2003), 355–378.

[5] Ann E. Bigelow, Kevin Dugas, "Relations Among Preschool Children's Understanding of Visual Perspective Taking, False Belief and Lying" (Journal of Cognition and Development, 9, 4, 2007), 411–433.

[6] Perner, Brandl, Granham, "What is Perspective Problem?", 355–378.

[7] Ibidem.

[8] Rafał Ohme, "Podprogowe informacje mimiczne" (Warszawa: Wydawnictwo Instytutu Psychologii PAN i Szkoły Wyższej Psychologii Społecznej, 2003).

[9] Nalini Ambady, Robert Rosenthal, "Half a minute: Predicting teacher evaluations from thin slices of nonverbal behaviour and physical attractiveness", *Journal of Personality and Social Psychology* 6 (2013): 431–441.

of people, but also recognises the distinctness of their points of view and makes an effort to understand how others perceive a given situation.[10] This particular ability is paramount to understanding others' beliefs, desires, or motives of actions,[11] and a prediction of behaviour that is based on the knowledge of others' beliefs. PT allows one to understand that the beliefs and desires of another person can be dissimilar to one's own.

Within communication and linguistic domains, PT remains an important component. It may partain to the perspectivity of language itself, because with its use we can express it, directly referring to the very same object.[12] In case of cognition, PT is often connected with visual perception that allows us to reason that there is a reliable to comprehend how another person perceives a given object in our line of sight.[13] In general terms, giving an overview of PT, we can also use cognitive flexibility, that remains a part of executive functions.[14] Cognitive flexibility is understood here as the ability to switch between different points of view, keep track of variety of aspects of a given situation, and understand the simultaneousintegration of various points of view that are focused on an object,[15],[16],[17] – which is the paramount quality of PT.

In the affective domain PT enables understanding of the feelings and experiences of others. What is important to note here, is that PT in itself is not entirely required to acquire basic affective competencies – e.g. expression detection. It is, however, required to comprehend why a certain person feels this particular way at a given time and in given circumstances, especially when our own experiences differ vastly in the same set of conditions from the person perceived.

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[10] Hunter Gehlbach, Maureen Brinkworth, Ming-Te Wang, "The social perspective taking process: What motivates individuals to take another's perspective?", *Teachers Collage Record* 114 (2012): 197–225.

[11] Perner, Brandl, Granham, "What is Perspective Problem?": 355–378.

[12] Eve Clark, "Conceptual Perspective and Lexical Choice in Acquisition", *Cognition* 64 (1997): 1–37.

[13] John Flavell, "Perspective on Perspective Taking", in: John Flavell, *Piaget's Theory. Prospects and Possibilities* (Hillsdale, NJ: Lawrence Erlbaum, 1992), 107–140.

[14] Raphael Greenberg, Jesus Maldonado, Sam Droege, M.V. McDonald, "Tidal Marshes: A Global Perspective on the Evolution and Conservation of Their Terrestrial Vertebrates", *BioScience* 56 (2006), 675–685.

[15] Akira Miyake, Naomi P. Friedman, Michael J. Emerson, Alexander H. Witzki, Amy Howerter, Tor D. Wager, "The Unity and Diversity of Executive Function and Their Contributions to Complex "Frontal Lobe" Tasks: A Latent Variable Analysis" (Cognitive Psychology, 41, 2000), 49–100.

[16] Sophie Jacques, Philip Zelazo, "The Flexibility Item Selection Task (FIST): A Measure of Executive Function in Preschoolers" (Developmental Neuropsychology, 20(3), 2001), 573–591.

[17] Jacques Sophie, Zelazo Philip, "Language and Development of Cognitive Flexibility: Implications for Theory of Mind", in: *Why Language Matters for Theory of Mind* (Oxford: Oxford University Press, 2005), 144–162.

Virtual Reality and Research on Cognition

Ever since VR headsets reached their first official commercial release, the number of ways in which we can test and probe the virtual domain has drastically increased. Chat and IRC rooms have taken a back seat, while telepresence media have risen to the top. One cannot deny that immersive virtual environments[18] are a versatile tool as well as an entertainment medium that still has not shown its full potential.[19] Nowadays, even a cell phone can provide some semblance of VR immersion by having an appropriate headset inserted, or even a paper box with lenses.

The growing availability of this medium, the frequency of its use, as well as its simplicity, could have an effect on the way we perceive the world, and in the long term, it could also "attune" human cognition to this new medium. If that is the case, then the virtual world requires careful examination. In this case, research on cognition, communication, and expression in virtual reality has found its niche, and the notion of immersive *virtual environment technology as a methodological tool for social psychology*[20] brings the promise of studying virtual interaction, medium reception, and social cognition with even greater detail than its real world counterpart. This affinity for more in-depth analysis stems from the ability to completely control every event contained in the simulation. Users can freely change their virtual bodies, place avatars, or just change the whole world with a single click. Such manipulation creates never before seen ways of exploring social cognition that might provide a deeper sense of understanding of the intricacies of the human mind.

Nevertheless, the aforementioned long-term impact on cognition is still an unknown. Despite that, there is a plethora of studies that take into account the discovery of …} discovering the effects of exposure to virtual reality. One of such discoveries is the proteus effect.[21] In short, one can define it as a change in the behaviour of the VR user which depends on the form of the assumed avatar form. By manipulating a single physical trait of an avatar one can alter some dispositions, diminish or

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[18] Jim Blascovich, Jack Loomis, Andrew Beall, Kirsten Swinth, Lorlene Hoyt, Jeremy Bailenson, "Immersive virtual environment technology as a methodological tool for social psychology", *Psychological Inquiry* 13, 2 (2002): 103–124.

[19] Y. A. G. V. Boas, "Overview of virtual reality technologies", in: *Proceedings of Interactive Multimedia Conference* (Association for Computing Machinery, 2013).

[20] Blascovich, Loomis, Beall, Swinth, Hoyt, Bailenson, "Immersive virtual environment technology as a methodological tool for social psychology": 103–124.

[21] Nick Yee, Jeremy Bailenson, "The Proteus effect: The effect of transformed self-representation on behaviour" *Human Communication Research* 33, 3 (2007): 271–290.

strengthen cognitive bias,[22] enhance empathy or prosocial behaviour.[23] Continued research on these effects has led to the creation of various forms of virtual therapy[24] that can be used as a supplement to specific treatment. It can help reduce symptoms, but can also provide the means to quantify patients' progress. Alongside this, a new venue of treatment aid is also being tested – virtual analgesia.[25]

Owing to extensive aural and visual stimuli substitution while using a VR headset, the user experiences deeper immersion in the newfound experience, which in turn subtracts the nontrivial portion of his/her attention from the registered pain sensation. This results in a non-invasive way of modulating pain e.g. while undergoing chemotherapy.[26] So far, the therapeutic effects of these technologies are still being tested and scrutinized, yet they present a viable option as a secondary source of pain relief. This is especially important in case of phantom pain due to loss of a limb.[27] As the patient becomes less susceptible to the medication by developing resistance, alternative sources of relief are gaining importance. That is why VR training with simulated limbs can be a great tool for long-term treatment and care.

VR Exposure Therapy for Prevention and Intervention for Psychological Trauma

Finally, another type of virtual reality exposure therapy relates to the treatment of posttraumatic stress disorder (PTSD), especially in cases of a combat-related variety. Because of the proteus effect and its characteristics – fast feedback and traceable change in behaviour even after a single session – such technology can provide relief to veterans or even

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[22] Tabitha C. Peck, Sofia Seinfeld, Salvatore M. Aglioti, Mel Slater, "Putting yourself in the skin of a black avatar reduces implicit racial bias", *Consciousness and Cognition* 22, 3 (2013): 779–787.

[23] Robin S. Rosenberg, Shawnee L. Baughman, Jeremy N. Bailenson, "Virtual superheroes: Using superpowers in virtual reality to encourage prosocial behaviour", *PloS one* 8, 1 (2013): e55003.

[24] Thomas Parsons, Albert Rizzo, "Affective outcomes of virtual reality exposure therapy for anxiety and specific phobias: A meta-analysis", *Journal of behaviour therapy and experimental psychiatry* 39, 3 (2008): 250–261.

[25] E. A. Mayer, C. B. Saper, "Pain modulation: expectation, opioid analgesia and virtual pain", *The Biological Basis for Mind Body Interactions* 122 (2000): 245.

[26] Susan Schneider, Linda Hood, "Virtual reality: a distraction intervention for chemotherapy", in: *Oncology nursing forum*, National Center for Biotechnology Information, NIH Public Access, 34, 1 (2007): 39.

[27] Elisabetta Ambron, Alexander Miller, Katherine Kuchenbecker, Julie Buxbaum, Branch Coslett, "Immersive low-cost virtual reality treatment for phantom limb pain: Evidence from two cases", *Frontiers in neurology* 9 (2018): 67.

to military personnel serving on active duty.[28] Additionally, harsh conditions within a theatre of war might make it impossible to provide extensive long-term treatment of PTSD, as psychological supervision can also be limited because of a variety of reasons (mission parameters, requisition, conditions in the theatre of operations etc.). Employment of VR technologies can overcome that with their portability and ease of use. This could lead to an increase in the mental stability of combat veterans who may start showing early stages of PTSD.

The efficacy of VR exposure therapy given to military personnel requires the specific examination of factors that need to be taken into account in both prevention and post-trauma treatment. The mental competencies of the members of this occupational group, and the overall social relations developed and maintained during training and duty are factors that have an effect on the mental fitness[29] of an individual who comes into contact with a traumatic event while performing actions on foreign soil. VR training and therapy could be a way of helping with both recovery and the development of the said fitness.

Cultural Learning, Perspective Taking, and Its VR Implementation for Military Personnel

We would like to propose an assembly of venues of discussion that show viable VR application in conjunction with the employment of perspective taking and cultural learning in a military-relevant context. Immersive technologies provide us with highly customizable environments for soldiers that are in their initial stages of training and preparation for deployment, while providing various scenarios where the users can train and develop their social competencies through virtual stress inoculation training[30] and techniques meant to increase cognitive flexibility.

According to an article by Prasolova-Førland et al. "Training Cultural Awareness in Military Operations in a Virtual Afghan Village: A Methodology for Scenario Development"[31] there is a visible tendency to use state-of-the-art technologies in the case of the development of PT

[28] Robert N. McLay, Kenneth Graap, James Spira, Karen Perlman, Scott Johnston, Barbara O. Rothbaum, JoAnn Difede et al., "Development and testing of virtual reality exposure therapy for post-traumatic stress disorder in active duty service members who served in Iraq and Afghanistan", *Military Medicine* 177, 6 (2012): 635–642.

[29] Michael Pickering, *Soldier Mental Fitness Psychological Construct Development* (Cheney: Eastern Washington University, 2016).

[30] Brenda Wiederhold, Mark Wiederhold, "Virtual reality as a tool in early interventions" (San Diego, CA: Virtual Reality Medical Center, R&T Organization, 2006).

[31] Ekaterina Prasolova-Førland, Mikhail Fominykh, Ramin Darisiro, Anders I. Mørch, "Training cultural awareness in military operations in a virtual afghan vil-

among military. Authors take note of the lack of research on the employment of gamified simulations and the design of educational scenarios in a military context, especially concerning cultural consciousness. This project aims to create a simulation based on the game Second Life that would take form of cultural consciousness training among military personnel in preparation for active duty overseas. The research on various aspects of 3D worlds was performed on representatives of the Norwegian Armed Forces emphasizing probable scenarios during operations on foreign soil. The results presented state:

- scripts employed in the game could not only teach various cultural patterns, but also discover appropriate responses for given social contexts within given geographical location;
- formalization roles and the difficulties that are adjusted to military rank help in the better preparation of the unit prior to deployment through higher stress and social resilience;
- it is a cost-effective way to expose individuals to a given ethnicity or targeted social group in order to develop PT.

Despite the positive aspects mentioned above, the authors see some shortcomings in this method, and if they were to be mitigated, it could possibly drastically improve its efficacy. The problems concern limited nonverbal communication and incomplete editing of tactical tasks. Taking all of this into account, the results show that virtual training cannot be a substitute for real world exposure to cultural consciousness training and tactical drills. However, when confronted with the traditional perspectives on learning, virtual worlds are a reliable way of enhancing the development of interaction that in the end are translated into real-world applications.

Similar conclusions can be found in the work of Logan-Terry and Damari in "Key culture-general interactional skills for military personnel"[32] (2015). It is based on the premise that US Army soldiers have to communicate both with the enemy forces and with allies in the theatres of war where combined multinational forces are utilized. They state that it is better to provide a training that is *culture-general*[33] because it prepares military personnel to succeed wherever they are deployed. While they base their work on previous research in this area, the authors decided to further develop interaction skills in the cross-cultural domain in response to the specific needs of the armed forces. The article enumerates 3 main groups of skills and competencies that can aid military

lage: a methodology for scenario development", in: *2013 46th Hawaii International Conference on System Sciences* (IEEE, 2013), 903–912.

[32] Aubrey Logan-Terry, Rebecca Damari, "Key culture-general interactional skills for military personnel", *Procedia Manufacturing* 3 (2015): 3990–3997.

[33] Ibidem, 3991.

personnel in successful communication with representatives of other cultures:[34] (1) Observing and adapting to unfamiliar norms, (2) building rapport, (3) recovering from trouble in interaction. Taking into account that interactivity is best suited for this type of learning, the authors proposed a set of scenarios that highlighted cultural differences and geographical specificity. In that regard they concluded:

- training in role acquisition on small and large scales can be done with minimal fiscal costs and logistical hurdles connected with the employment of contract role players;
- the effects of the training and developed social skills and competencies can be an important tool, no matter what the context, scene, or culture;
- scenarios teach ways of proper decision-making in stressful situations that are based on experiences acquired through life, allowing the perspective taking of *others* and the easier formulation of an appropriate action plan.

With this in mind, the authors infer that each cross-cultural interaction that we experience, even if it is in a training scenario, is connected with the solution of a problem in such a given context. The ability to assume the perspective of *other* allows us to adapt to unknown cultural norms, develop social relations, and finally, to solve the problem at hand.

To give an example of the virtual reality application of the aforementioned aspects of cognition, there is a virtual immersive system that incorporates cultural learning that is called VECTOR[35] – Virtual Environment Composable Training for Operational Readiness. This system is an interactive platform, based on the Lithtech Jupiter game engine that allows the creation of simulations with a plethora of avatars within various cultural and situational contexts. The user has a displayed HUD (head-up display) that shows mission parameters and status, further enhancing learning with incorporated procedures and methodology that can translate into different ways to complete given MOs (mission parameters). The authors recognize the need for cultural training in the armed forces, as modern combat roles often require engagement in OOTW (Operations Other Than War) where civilian activity is an important factor in such situations, e.g. contacting members of the culture of interest in order to acquire information or issue warnings. Initially the system was focused on Arabic culture. The overall purpose of the system is to increase the cultural sensitivity of soldiers, and not to instruct them on correct responses according to set of rules given beforehand. This devel-

[34] Ibidem.

[35] Charles Barba, John E. Deaton, Tom Santarelli, Bruce Knerr, Michael Singer, Jim Belanich, "Virtual environment composable training for operational readiness (VECTOR)" (Fort Washington, PA: Chi Systems Inc. 2006).

opment is personalized and virtual scenes provide enough flexibility to adjust and tailor each scenario to the needs of the specific soldier and his unit.

Stress Resilience in Virtual Environments – STRIVE system[36] – is a set of 30 combat scenarios, meant to provide better understanding of the situational context for a given simulated event, that focus on stress resilience. The authors of "Virtual reality goes to war: A brief review of the future of military behavioural healthcare" shows that there is an option to develop the system into an emotional assessment tool that will gauge the efficacy of emotional coping strategies both prior to VR exposure and after their developing new ones by the trainees. As a highlight of the system, the ability to measure the proposed allostatic load[37] of the user experiencing VR missions and experiences gives an opportunity to have better supervision over the processes that allow self-growth, not only in the case of combat-related soft skills, but of social skills in general.

Conclusions

Cultural sensitivity and perspective taking are important factors for the modern soldier. With centuries of evolution of warfare we finally possess tools that allow us to detect and diagnose the lack of social competencies that thwarts the potential of military personnel. To remedy this, immersive virtual reality enables the creation of detailed combat scenarios that emphasize various social competencies and make cultural sensitivity, PT, and stress resilience develop in a cost-effective, non-invasive way that can be administered in any confined space with enough room to move. The focus on the social domain for soldiers is important both from the perspective of mission objective and the people that risk their lives fulfilling these dangerous roles. By further enhancing their social growth they can improve themselves on a personal level and, for instance, in turn be better prepared for civilian life and the challenges that come with it. Moreover, VR-augmented social training provides both inoculation against and treatment of PTSD, allowing for early intervention and diagnosis. By using these technologies there is a possibility to save more people from the horrors of war and at the same time develop a new breed of soldier – better mentally equipped to deal with adversities while

[36] Albert Rizzo, Thomas D. Parsons, Belinda Lange, Patrick Kenny, John G. Buckwalter, Barbara Rothbaum, JoAnn Difede et al., "Virtual reality goes to war: A brief review of the future of military behavioural healthcare", *Journal of Clinical Psychology in Medical Settings* 18, 2 (2011): 176–187.

[37] Bruce McEwen, Eliot Stellar, "Stress and the individual: mechanisms leading to disease", *Archives of Internal Medicine* 153, 18 (1993): 2093–2101.

serving in combat roles. Virtual reality can be considered a means to enhance social competencies while receiving military training.

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Summary

In this article, we have given an overview of exemplary empirical research on both the efficacy of perspective taking and the positive aspects of employment of virtual reality technologies in the context of military personnel training. The inclusion of awareness of mental states and subjective experiences expressed in accurately designed virtual scenarios can prepare soldiers for more effective and decisive operations prior to deployment on foreign soil, where they will have to come to terms with difficult decisions connected with cultural differences and plurality. First, we would like to present notions about perspective taking and what role VR maintains in relation to the development of aspects of cognition. Next, we approach the proposed ensemble of articles that state the extent of VR-PT efficacy: (1) the relevance of developing perspective taking in the military, (2) the effectiveness of VR in training. Although we did not find examples of the military perspective taking training in specifically immersive virtual environments, we do want to posit an idea that this kind of regime could bring a plethora of positive effects – e.g. accurate threat assessment in cross-cultural environments, positive nonverbal behaviour, increased outgroup helping behaviour, reduced/less dependency on stereotyping and possibly reduced conflict-inducing intergroup differences.

Keywords: cultural consciousness, perspective taking, virtual reality, military, social training

Streszczenie

Przyjmowanie perspektywy w rzeczywistości wirtualnej dla personelu wojskowego: przegląd podejść do wirtualnego treningu społecznego

W tym artykule dokonujemy przeglądu przykładnych badań empirycznych nad skutecznością przyjmowania perspektywy oraz pozytywnymi aspektami stosowania technologii wirtualnej rzeczywistości w kontekście treningu personelu wojskowego. Zawarcie znajomości stanów mentalnych oraz subiektywnych doświadczeń wyrażonych w precyzyjnie opracowanych wirtualnych scenariuszach może przygotować żołnierzy do bardziej efektywnego i zdecydowanego działania przed okresem rozmieszczenia misji na terenie innego państwa, gdzie będzie niezbędnym pogodzić się z trudnymi decyzjami powiązanymi z różnicami i mnogością kulturową. Po pierwsze, chcielibyśmy przedstawić pojęcie przyjmowania perspektywy oraz roli, jaką wirtualna rzeczywistość ma w relacji do rozwoju różnych aspektów poznania. Następnie odnosimy się do proponowanego zbioru artykułów, które określają zasięg skuteczności przyjmowania perspektywy w wirtualnej rzeczywistości poprzez: (1) istotność rozwijania przyjmowania perspektywy w wojsku, (2) skuteczność wirtualnej rzeczywistości w treningu. Mimo że nie znaleźliśmy przykładów wojskowego treningu przyjmowania perspektywy w immersyjnych środowiskach wirtualnych, chcielibyśmy przyjąć ideę, że tego rodzaju organizacja treningu może przynieść rozmaite pozytywne efekty, np.: precyzyjną identyfikacją zagrożenia w środowisku międzykulturowym, pozytywne zachowania niewerbalne, zwiększone nastawienie w pomocy wobec osób spoza grupy społecznej, zmniejszenie polegania na stereotypizacji oraz czynnikach mogących prowadzić do eskalacji konfliktów międzygrupowych.

Słowa kluczowe: świadomość kulturowa, przyjmowanie perspektywy, rzeczywistość wirtualna, wojskowość, trening społeczny