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Real needs of virtual reality developers: experiences from research work within a gamedev company

Paweł Strojny*
Faculty of Management and Social Communication, Jagiellonian University
Simpro sp. z o.o.
0000–0002–6016–044X

ABSTRACT

Aim
The aim of this article is to present challenges and benefits of cooperation between psychologists and game developers.

Thesis
The consequence of the rapid increase in the popularity of computer games is the increased demand for psychological services. In addition to counteracting the negative effects of gaming and basic research on the consequences of gaming, the next field that uses psychological competencies is game design – both entertaining and serious.

Conclusion
The author briefly introduces the game industry. Then he reports on his observations resulting from five years of experience in managing the research department of one of the game companies. Factors encouraging industry representatives to establish cooperation with psychologists-researchers are listed. The most important benefits of a psychologist

* Paweł Strojny, Institute of Applied Psychology, Faculty of Management and Social Communication of the Jagiellonian University, ul. prof. St. Łojasiewicza 4, 30–348 Krakow. The work is co-financed by the National Centre for Research and Development under the grant "Bio-adaptable simulator for critical infrastructure operators" (POIR.01.01.01–00–1131/17–00) received under the Intelligent Development Operational Program (Sub-measure 1.1.1. – industrial research and works development projects implemented by enterprises). I would like to thank all employees of the company for supporting the research team and members of the R&D team for their commitment to the ideals of science. In particular, I would like to thank Agnieszka Litworowska for her help in increasing the compatibility of research and development teams and Agnieszka Strojny for her priceless substantive and organizational support in all activities.

undertaking applied research in the field of games are presented with examples of finished R&D projects. Particular attention has been paid to the issue of innovation – the primary goal of research and development, sometimes unduly marginalized in the case of basic research. Three issues hampering effective cooperation were also highlighted, as well as remedial measures applied in practice. The presented facts can help to make an initial assessment of the rationale behind the search for opportunities for research collaboration in this field and lead to more general reflections on the responsibility of researchers to improve the functioning of societies.

Keywords: computer games, gamedev, society, applied research, R&D.

Et Vigny, plus secret,
Comme en sa tour d'ivoire, avant midi rentrai.

Charles Augustin Sainte-Beuvet

Imagine that you are a respondent in the survey; you have to answer the question "In what areas can the psychologist's competencies be useful?". Computer games are not the first to come to mind for most of us. This is due, in part, to the belief that this is a niche entertainment for a small group of people, and in part to the bad reputation that games have gained over the past three decades. When prompted by the interviewer, you will finally admit that a psychologist can also be useful in this area. Perhaps referring to the activities related to gaming disorder therapy, recently included in the ICD-11 by the WHO (WHO, 2020). This article was created to present the role of psychologists in another area – game design, including serious games. I focused on three areas that determine the success of cooperation between a psychologist-researcher and business entities from the gaming industry: identification of needs, specific benefits for such cooperation, and the conditions necessary for its success.

WHAT THE GAMEDEV IS AND WHY SHOULD IT HIRE PSYCHOLOGISTS?

The beginnings of the industry focused on the production of computer games (game development, gamedev) date back to the mid-twentieth century. There is no doubt, however, that it has grown enormously in the last two decades. It took several decades for gamedev to get from delivering simple hobby-created programs for a moment of fun to becoming real competition for entertainment fields such as movies and music. It was not a wasted time, in 2020 revenues from this branch of business are valued at USD 180 billion, the limit of USD 200 billion is to exceed in 2023 (Wijman, 2020). Game studios deliver their products to almost every corner of the world, to over 3 billion people. For comparison, the global film industry in 2019 (before the COVID-19 pandemic) brought in revenues of USD 100 billion, and all major sports leagues in the world – USD 75 billion (Witkowski, 2021). In 2020, gamedev generated more profits than these two

entertainment industries combined. In this global market, Polish entities are doing unexpectedly well, including the most famous CD Projekt (e.g. the Wiedźmin series, Cyberpunk 2020), whose capitalization as of May 2021 amounted to PLN 17 billion. New studios are being established in Poland, and more companies are listed on the Stock Exchange (currently 39 such companies are listed on the Polish Stock Exchange). Gamedev needs hands to work. But why would they be psychologists and research psychologists in particular?

There are two main reasons. Firstly, computer games are a psychological phenomenon, secondly – stakeholders of companies from the gaming industry formulate expectations, the fulfillment of which requires research, often including psychological studies. The role of psychology in games is indirectly mentioned by the definition of "good game", attributed to Sid Meier (Civilization), the undisputed authority for successive generations of game developers. He argues that a good game is a "series of meaningful choices" (Rollings and Morris 2000, p. 38). Contrary to appearances, games have ceased to be reducible to efficient controller operation, now they engage cognitively and evoke emotions. The decisions made in the game are to lead to the satisfaction of needs (eg Ryan, Rigby, Przybylski, 2006). Like other fields of entertainment, they are a means of inducing desired states in the user. Contrary to some, more "traditional" entertainment – their methods of influence are non-invasive, which makes them even more closely related to psychology. Moreover, gamedev is a branch of business in which significant resources are involved. Productions should bring profits, which is why managers try to make decisions based on evidence. Since one aspect of a game's success is its effectiveness in meeting the psychological needs of players, it needs to be monitored, and no one can do it better than a professional, in this case, a psychologist. There is no difference here between games and other branches of mass entertainment such as Facebook (e.g. van Dam and De Velden, 2015) or Netflix (e.g. de Vries, 2020), as consumers, we absorb the work of not (only) artists but craftsmen who follow a carefully designed plan.

However, the above observation should not lead to over-generalization. The needs fulfilled by games are not only primitive and hedonistic, and "desired states" do not come down to "intoxication", of which we would call the gaming equivalent "immersion" (Jennet et al., 2008). Even among purely entertainment titles there is considerable diversity, but at this point, I would like to draw attention to the field of serious games, in which I also include professional simulators for this paper. Serious games are defined as "games used for training, advertising, simulation or education designed for use on personal computers and consoles" (Susi, Johannesson, & Backlund, 2007). Thus, they can be both products adapting existing entertainment titles to other purposes (e.g. the *VBS3* system, which is an extension of the *Arma* series military entertainment games for training purposes) or created from scratch as tools to meet precisely defined goals. Entities interested in games of this type (e.g. military, large enterprises) are usually more aware than individual consumers of entertainment games, often presenting detailed expectations, also in psychological terms. In addition, they mobilize developers, demanding from them objective verification of the effects of their work – in the form of research reports, and sometimes even publications in

the scientific journals. Moreover, institutions supporting projects in this industry require the use of the scientific method (which is confirmed by my experience with two of them: the Polish National Centre for Research and Development and the Swiss National Science Foundation). And this is the second factor that may contribute to the readiness to employ psychologists-researchers in the gamedev industry – the need to objectively verify the quality of developers' work. To sum up, two of the reasons why game developers decide to seek cooperation with psychologists-researchers are of particular importance. On the one hand, the fact that games are a product created to meet psychological needs, and on the other hand, the need to verify the goals of stakeholders.

The context for collecting the data and experiences

This article aims to present information about research cooperation between psychologists and gamedev on specific examples. Therefore, it should be noted at this point that the presented facts are unique and may depend on the context. Therefore, below I present information that may help in interpreting them, also in combination with third-party reports. The experiences that I am trying to include in this article come largely from projects focused on serious games, with particular emphasis on professional simulators. The research work on which this article is based was carried out in 2016–2021 as part of the Research & Development Department (R&D) of two related companies *Nano Games* and *Simpro* (*Simpro*, from "professional simulators", was spun off from Nano Games, which operates mainly in the entertainment games market). My contract started on June 1, 2016, and ends on September 30, 2021. The department was formally established in 2016, when the company received the first funding for the research project from the funds of the National Centre for Research and Development ("Widespread disaster simulator: research and preparation for implementation"; POIR.01.01.01–00.0042/16). Being the author of the application, I naturally became the head of the department. In the following years, my department carried out research work under subsequent external grants ("Bio-adaptable training simulator for critical infrastructure operators" – POIR.01.01.01–00–1131/17–00; "Controlling an autonomous drone using goggles (or monocular) – DOB-BIO9/26/04/2018; "Marshaller VR Simulator" – Krakow Technology Park) and numerous works financed exclusively from the company's funds. The R&D department employed from four to seven full-time employees (including a significant proportion of Ph.D. researchers), specialists employed under contracts, and interns also joined the team. The research problems to be solved forced interdisciplinarity – the team members included psychologists, cognitive scientists, computer scientists, and physicists. In the context of a company with a total of around forty employees, this was a significant department. The R&D team played an important role in establishing cooperation with European entities (e.g. the Fraunhofer Institute in Dresden) and national entities (e.g. the Research and Development Centre for Fire Protection in Józefów). Intensive research work, documented by publications in the scientific journals, was an element of the company's strategy,

which resulted in a relatively large autonomy in the field of research and was an important distinguishing feature of Nano Games and Simpro compared to other representatives of the Polish gamedev. As can be seen, some features of the work environment may make it difficult to draw generalized conclusions about the industry. On the other hand, some conclusions from my experience may be more universal – for example, go beyond the gaming industry.

BENEFITS OF THE COLLABORATION BETWEEN PSYCHOLOGIST AND GAMEDEV

In this part, I will present three selected benefits that I experienced during my five-year collaboration with gamedev. Two of them seem obvious; *supporting the process of formulating research problems* and *facilitating cooperation with entities outside the psychologist's default interests*. However, the most important benefit is *the encouragement of real innovation*. Thus, the real impact of research on the socio-economic environment.

Cooperation with gamedev helps to identify and select research problems

In research work, we often come to the point where it is necessary to decide to give up some promising research directions (we less often encounter a situation where an idea is missing, although cooperation with the industry can also help here). We make these decisions based on the limited premises available to us, sometimes regretting it after a few years. Meanwhile, having a close relationship with people strongly involved in the broadly understood "market", the researcher has the opportunity to consult his or her ideas with people representing a different point of view. An example of including the business environment in the process of formulating a research problem can be the subject of an implementation doctorate from R&D team member Natalia Dużymańska-Misiarczyk ("The influence of agents on the effectiveness of virtual training"). Some developers of serious games have for several years included computer-controlled characters in the role of tutors in their products. However, they do it in a way characteristic of entrepreneurs – quickly and intuitively. The effects of these activities can be beneficial, although sometimes only from the marketing perspective – facilitating not so much teaching as selling a given product. The issue of the possible role of computer agents in the process of facilitating the transfer of competencies during training in virtual environments is therefore an example of activities that in practice are ahead of scientific research. However, after a period of admiration for the novelty, market representatives begin to ask questions that require reliable research. The participation of team representatives in the industry conference on VR training (World Crans-Montana XR Forum; Strojny, 2019), during which an interesting discussion of aviation industry representatives on the validity of using an educational bot in VR training (Langsteiner, 2019) took place, became

one of the direct inspirations not only to undertake research on this subject but also influenced the shape of the currently implemented research program. In this case, research is a response to a problem identified in the community of practitioners, the solution of which requires research (Can AI-controlled bots replace a real teacher or his avatar? What conditions must be met for this to happen?). If we assume that science should contribute to the improvement of the functioning of societies, this process can be perceived as an illustration of how to respond to the research problem verbalized outside the university.

Cooperation with gamedev is favorable to establishing relationships with entities outside the default circle of interests of the psychologist-researcher

It is highly unlikely there is a psychologist-researcher who doesn't cooperate with others. However, the question "who are these 'others'?" is legitimate. Are they 'other psychologists', 'other scientists', or finally 'other people'? I am not prejudging whether any of these answers are better, but my experience shows that the wider and more diverse group of people involved in cooperation on a given project, the more effective it has a chance to turn out. Even assuming that, it is often difficult to expand this circle of potential partners. While we know researchers who deal with issues similar to ours, and thanks to the openness of the environment, we can contact even the most outstanding of them at any time, it is much more difficult to contact representatives of other fields of science – not to mention officials, entrepreneurs or politicians. So we are sometimes left to ourselves with our ideas and knowledge, passively waiting for some of them to show initiative and establish contact with us. However, the situation may change by establishing cooperation with at least one entity from the business environment, with particular emphasis on gamedev. Why with special attention for that? It seems that representatives of the gaming industry have certain characteristics that predispose them to be valuable partners for a psychologist. The two most important ones are the fact that gamedev is a young industry, therefore many of its representatives are young people, open to interdisciplinary cooperation, who value psychology as a field complementing more technical aspects of their activities, at least. An example is the invitation to give a lecture at one of the largest industry conferences in Central Europe, The speech was entirely devoted to the methodology of psychological research in the context of games, a relatively sophisticated matter (Digital Dragons, Strojny, 2018). It met a competent reception, initiated a substantive discussion, and resulted in the subsequent publication of the interview on the prestigious industry portal gamesindustry.biz (Taylor, 2018). All in a situation where, to my knowledge, there was no psychologist other than me in the room. As can be observed, the community not only wants to gain access to knowledge in the field of psychology but is also ready for it. The second factor is the internal willingness of the community to cooperate and share knowledge, which is unprecedented in other industries. It manifests itself at every level – specialists from various companies cooperate, as well as entire organizations – including potentially competing companies. In this atmosphere of cooperation,

the psychologist has the opportunity to establish valuable contacts both with other representatives of the industry and to go beyond the gamedev itself. As a result, my team had the opportunity to cooperate, among others, with representatives of the Border Guard in creating software for controlling a drone or the State Fire Service to create a simulator for training officers in VR. Such contacts also resulted in several invitations to industry conferences or tasks funded by investment funds, carried out at the university. Some of these relationships still contribute to broadening the possibilities for partnerships.

Collaboration with gamedev forces the researcher to replace creativity with innovation

Creativity is highly appreciated in the academic community. Undoubtedly, the creativity of university graduates and researchers is a trait that can determine success. However, is it enough alone? Nęcka defines creativity as a manifestation of behavior consisting in the production of new and valuable products (Nęcka, 2012). This definition makes a clear condition – it is not enough to be new for something to be creative. It must also have value. Are the original costumes of the students during the university festival creative then? The answer to this question may not be obvious. The perspective of management sciences comes here, supplementing the concept of "creativity" with the other – "innovation". Innovation is "the emanation of creativity". It manifests itself in new technologies, organizational processes, and finally products (Drozdowski et al., 2010). Only the assumption that creativity is not a final goal. That it is rather a necessary step to the emergence of innovation, which in turn is to improve the functioning of societies, allows for understanding the functioning of markets outside universities. This is confirmed, among others, by Levitt in his work entitled "Creativity Is Not Enough" (2002). What academics find through systematic research is intuitively understandable to entrepreneurs. They will always ask the uncomfortable question "what's the value of your idea for me?". Moreover, they will rarely be content with an answer that would be sufficient for discussing the results in the "practical applications" section of a research article. They will drill down because they know that their investment must be for them either a gain or a loss. It is also not without significance that the vast majority of them dispose mostly of private rather than public funds.

The dissonance between the attitudes of researchers who are driven by knowledge and entrepreneurs who are driven by profit may turn out to be valuable. It may happen when both sides undertake cooperation resulting from a real need. Importantly, they should not give up their aspirations. A researcher driven by curiosity, equipped with the knowledge and a scientific method, plays the role of the main supplier of ideas, and the "selfish" entrepreneur has a twofold role – he or she pre-selects ideas based on his or her knowledge of the market (see the previous paragraph) and facilitates the transformation of ideas into ready-made technologies, processes or products. Even the most brilliant idea or discovery will not affect reality if it is not offered in a useful form. It is this role, unattractive from the researcher's perspective, that an entrepreneur can play. An example of the phenomenon

described above may be the process of carrying out research as part of one of the projects aimed at creating software adapting the course of training in VR to the psychophysiological condition of the trainee (POIR.01.01.01–00–1131/17–00). In the beginning, the research was to lead to equipping the already owned VR trainer with a module that will have two features: the capability to control the involvement of the trainee in real-time using physiological measures and the capability to optimize involvement by dynamic modification of the training course. In other words, it was an attempt to implement the idea of dynamic game difficulty balancing (Hunicke and Chapman, 2004) into serious games; the simulator was supposed to control the amount of effort put into the task on an ongoing basis and modify it accordingly if a decrease in involvement was detected. One of the features of innovation was to resign from manipulating difficulty in favor of exposure to social stimuli, which should mobilize the trainee to greater effort by the activation of cognitive schemas. We managed to produce the components (Argasiński et al., 2019; Czarnek et al., 2020; Czarnek et al., 2021; Lipp et al., 2021), however, there were difficulties with system integration – the interpretation of psychophysiological signals in real-time and reliable influencing involvement through social stimuli. As a result, work on the module was suspended. However, thanks to the continuous involvement of representatives of the company's departments other than R&D, they were not wasted. Work is currently underway to being implemented in several areas – training of "soft skills" (social incentives in staff training, measurement of teaching progress), human resource management (measurement of baseline competencies using physiological data), and military (control and regulation of the level of excitation in critical situations). The combination of high market competencies with the motivation to multiply profit, natural for entrepreneurs, prevented the waste of researchers' creativity and caused their discoveries, less spectacular than expected, to be successfully used in innovative products and services.

As can be seen, cooperation of psychologists and gamedev motivated by common interests can bring benefits to the researchers in three ways:

– by influencing the formulation and selection of research problems,
– by promoting cooperation with a broad socio-economic environment,
– by supporting the generation of innovations.

However, deciding on such cooperation, one should be aware of the need to compromise in certain areas.

THE NECESSITY FOR A COMPROMISE

As part of my cooperation with the gaming industry, I came across numerous situations in which the parties had to find a compromise. They can be categorized into three categories: lack of well-identified common goals, incompatibility of modes of operation, and conflict of interest. In my case, the above-mentioned compromises sometimes required large concessions on the part of researchers, sometimes on the part of the entrepreneur. In this section, I will indicate the essence of the problems and the ways that allowed me to overcome them.

The first area that may doom research collaboration is failure to realize its meaningfulness. In my short career, I have met with numerous unsuccessful attempts to establish cooperation. These may result from an insufficient mutual respect of both parties, which indispensably makes the sense of cooperation questionable. It is just as common to treat researchers as detached from reality and easy to manipulate dreamers, as is the perception of entrepreneurs as profit-hungry dodgers. Unfortunately, both stereotypes have some basis in reality. If the new relationship seems to be built on such foundations, it is often better to quit cooperation and look for another opportunity. However, insufficient awareness of the sense of cooperation may also occur when both sides respect the partner. This is often due to the scarcity of such contacts. Simply put, the researcher does not know exactly what the entrepreneur expects from the cooperation; which may be surprising the entrepreneur often expects brutally simple things – for example, he or she wants to increase the sale of a game thanks to cooperation with psychologists. On the other hand, entrepreneurs are also not always able to understand that a researcher is not entirely interested in material profits, and what motivates him or her is gaining access to an unlimited number of respondents. I could use the examples of 'job creation' and 'gaining new knowledge' here, but I have deliberately used examples of pragmatic benefits as these are often left unspoken at the beginning of the collaboration. Before starting cooperation, it is worth making sure that both parties identify the motivations and a common field of action.

Another category of problems requiring a compromise is the incompatibility of modes of operation, sometimes trivial ones. Among them, we can mention different working time habits (one of the parties may expect contact on weekends when the other does not want it – surprisingly, in my case, the party working on weekends was me), different understandings of the meaning of hierarchy (the academic community is more liberal in this respect than the companies I have dealt with) or differences in project management methods. The last can serve as an example of the adjustment that the researchers made. When I started managing the commercial R&D department, I had a specific idea of research project management. I did not realize, however, the enormity of my ignorance in this field; I used to consider "project method" as a synonym for "waterfall model", I prepared Gantt charts and distributed tasks. However, it quickly turned out that research projects can also be carried out differently than building a house, using a different methodology. Other methods have two features necessary to optimize the conduct of a research project – allowing plan flexibility and tolerating uncertainty. Under the influence of colleagues from other departments, I consciously decided to change a project management methodology, the agile methodology was chosen. This decision was followed by other decisions – about the selection of appropriate software, communication methods, and verification of the effects of subsequent stages. The effects of this experience are wide – since then, even graduate students under my supervision work with the help of modern software and a properly selected method.

An example of a concession by a company could be the issue of a conflict of interest. There is no room for the researcher's interpretation of the rules in this case. For example, the APA requirements are very clear – all possible reasons

for a conflict of interest should be disclosed when reporting study results (APA, 2020). However, a researcher employed by a commercial company must take into account its interests – for example, the fact that some findings are to be patented or commercialized differently, and therefore their content cannot be disclosed prematurely. Some research conclusions may also help or harm the company's image – for example, demonstrating the didactic (in)effectiveness of the software being developed. To minimize the influence of conflicting interests on my and my team members' decisions, I adopted two principles. Firstly, I avoided making the amount of remuneration directly dependent on the company's financial performance, for example, taking up shares in an enterprise. Secondly, and this required greater flexibility from the company, we adopted the principle that we divided the research projects into two categories: those aimed at the publication of results and internal tests. The former was to end with publication (which is also favored by regulations of financing institutions – awarding bonuses or directly requiring publication of results or data). The second not only was not supposed to be published but even could not – to avoid the temptation to select data post factum as "worth publishing" and "embarrassing" ones. Thanks to such an agreement, it was clear from the very first day of work on given research that the entrepreneur would not hinder publishing its results. On the other hand, the interests of the company – the research funding institution – were secured by the possibility of transferring research considered "risky" to an internal category. As I mentioned earlier, my employer's strategy was to build the image of an innovative company by publishing research results. Therefore, in practice the ratio of scientific research was overwhelming. Another issue worth mentioning is the suspicion on the part of the editors of some journals to which manuscripts with affiliation with a commercial enterprise were sent. Sometimes this required additional explanations, but never once did the editors reject the proposed text for ethical reasons.

In conclusion, both the researcher and the entrepreneur differ in many respects. Sometimes the differences are so large that attempts to increase compatibility may be pointless – in such a situation it is necessary to end such a poorly prognostic relationship as soon as possible. However, in many cases it is possible to reconcile the motivations, beliefs, and goals of both parties – this usually takes time and a willingness to make concessions. The above-mentioned issues that required a compromise happened to me while managing the R&D team. The solutions we applied may not be optimal or universal, however, I am presenting them here to show that, assuming a real willingness to collaborate in research, the problems may be solved. More than once, they can also be a source of new competencies for us (e.g. in management).

SUMMARY

This article aimed to familiarize the reader with the nature of work in the R&D department of a commercial gamedev company. Assuming that people completely

focused on basic research in the academic structure would consider this idea as a curiosity, I decided to address it mainly to people facing a decision to choose a career path. That is why I shared my experiences and reflections without trying to systematize them in the context of existing theories from management sciences or psychology – with the full awareness that this approach will limit its impact on these fields of science. However, that was not my ambition. Rather, it was to encourage those with research potential to consider a third option – between 'staying at university' and 'working in a corporation' – to conduct applied research in commercial enterprises. I believe that gamedev is the optimal environment for psychologists who would like to go on this path. Hopefully, I was able to demonstrate that the potential benefits are worth the risk.

All the above-mentioned facts and conclusions can be seen in the context of the "ivory tower" metaphor of Sainte-Beuve, who used this phrase to point out to his colleague his excessive distancing from social issues. As researchers, we are sometimes forced to go to this place of retreat to avoid the influence of current factors on our work. But this tower is comfortable, and the fact that we are separated from the world's problems by a noble material may cause us to fall into a trap and stay in it for too long. Staying in this metaphor, close cooperation with business entities, in my case gamedev, can be a stimulus that will help us – researchers – to keep the balance between the two environments.

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