

RESURRECTION OF EVOLUTIONARY PSYCHOLOGY IN GAMING: HOW CAN OLD PRINCIPLES CONTRIBUTE A NEW DOMAIN

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Abstract: The multidisciplinary character of game studies enables the implementation of knowledge from various study fields, and so explores games in different terms. However, not all approaches have so far gained sufficient attention. This study introduces the meaning of evolutionary psychology as well as points out its significance and certain neglect in relation to present digital games research. The exploratory study aims to contribute to the creation of a theoretical framework for the research of digital games from the perspective of evolutionary psychology. Partial goals include summarization, characteristics, and applications within the gaming discourse illustrating far-reaching ways in which evolutionary theory could potentially advance digital games research and hence enrich the game studies in general.

Keywords: digital games, evolution, evolutionary psychology, game studies, gender differences, supernormal stimuli.

1 Introduction

Game studies, a more general term including the academic study of digital games and related phenomena are defined as an interdisciplinary or multidisciplinary field of study that interconnects knowledge from computer science, anthropology, sociology, philosophy, art, literature, media, and communication studies with theory based on traditional game concepts and game design. [1,2] Considering the defining aspect of digital games is the interaction of players, the implementation of knowledge from psychology is also notably important in the study and research of games. However, several areas of psychology have been rather neglected, which should change in order to extend comprehensive knowledge and opportunities for their research. One of such approaches is *evolutionary psychology*.

Evolutionary psychology is a psychological approach applying principles from the field of evolutionary biology particularly from a widely – known theory of natural selection proposed by Charles Darwin in 1859 [3] to the research of human brain and behaviour. Evolution conveys means by which organisms are changing over time and so is changing its understanding. Theories of evolution preceding the one of Charles Darwin were described before, e.g., Jean Baptiste Lamarck's or George Léopold Chrétien Frédéric Dagobert Cuvier's and also afterwards, such as William D. Hamilton's. [4] A simplified explanation of Darwin's theory addresses accidental inherited changes within the competition of survival and reproduction. Changes in organisms that aid survival and reproduction continue, while those who limit survival and reproduction disappear. [5] The core principles of Darwin's theory of natural selection include: variation, inheritance (evolutionary theory focuses only on inherited variations) and differential reproductive success meaning possessing variants that increase or decrease chances of survival and reproduction. [5] Except from, the theory of natural selection Darwin later proposed the theory of sexual selection so "there are two general evolutionary processes that create adaptations: natural selection and sexual selection". [6 p4] While natural selection pays attention to adaptations as a result of successful survival, sexual selection focuses on adaptations as a result of successful mating and could manifest either as intrasexual competition or intersexual competition. Meanwhile, variation and selection act as opposing mechanisms – mutations and recombinations increase genetic variation, natural selection decreases it. [7]

Darwin's work considers not only physical characteristics but also behaviour. Thus, as stated for example by Buss [6] limiting evolutionary psychology to mating and sex differences is

insufficient since it has a potential to shed light onto all sorts of human behaviour including social interactions, language, morality, learning, motivation or emotions – all topics heavily in the focal point of the psychology of digital games as well. In terms of the topics conveyed by evolutionary psychology we can distinguish four universal and innate Darwinian modules that emerged as a reaction to specific survival problems: reproductive module including issues of attractiveness, courtship, partner selection, survival module including for example competition, selection of shelter and living environment or feeding habits, kin selection module regarding the order and relations of siblings and reciprocation module including social aspects such as gift-giving behaviour and means of fostering relationships. [8]

2 Applications of evolutionary psychology in digital games

Evolutionary psychology is being mostly overlooked by the domain of digital games. Currently, with the gaming practice turning more and more towards the insights from the psychology, this topic surely has a potential to grow. It can benefit designers (e.g., subjects of competition, evolutionary background of emotion, attention or preferences), researchers (e.g., gender specific insights) and gamers themselves (e.g., the topic of gaming addiction and signalling). With the majority of the research in social sciences focusing on so called proximal causes with standard social science model ignoring innate differences and favouring social learning [6], evolutionary psychology turns to ultimate causes of individual behaviour. Proximate causes are trying to inform us how an effect works and ultimate causes ask why it even exists. In the context of digital games this distinction projects into the debate of play as a *cultural artefact*¹ vs. play as a *biologically rooted phenomenon*.² It is essential to note that these two approaches doesn't have to exclude one another, but they together can and even should explain nuances of human behaviour. Evolutionary psychology aims to fill in the gaps within applied psychology research (with psychology as a discipline fairly fractured between various approaches and schools of knowledge) with the ambition to be unifying and more universal.

Taking into account the richness and strong theoretical background of the presented areas, in the following sections, the paper introduces a condensed general overview of the applications and potential of evolutionary psychology in gaming in an effort to raise general awareness of this topic and, where appropriate, also its consideration in relation to further research.

2.1 The nature of gaming itself

The process of evolution produces either adaptations, by-products of adaptation or random effects/noise. [4] There exist an ongoing debate whether video games as a cultural product are grounded in certain adaptive process (digital games as an adaptation bringing certain advantage) or whether they just might serve as a by-product. Huskey et al. [12] elaborate on two types of play considered as adaptations: rough-and-tumble play originally defined as a physical form of mammalian play including chasing and fighting and pretend play.

According to Mendenhall et al. [13] we might have evolved the capacity to play as a mean of addressing specific evolutionarily relevant problems. They furthermore outline a perspective that gaming helps us acquire "artificial" fitness in virtual world (e.g., sports or shooting abilities) instead of the real fitness in the real world and suggest that some might argue that video game playing not offering real fitness benefits is therefore maladaptive. [13] On the other side, there is the notion of the Training for the

¹ Huizinga [9] defines a game as a phenomenon older than culture, in which the culture is born. According to Durkin [10], a game is a cultural artefact that can be studied regardless of medium.

² Žbirková [11] says that man encounters a game at all ages and stages of development, but its content, forms, and tasks change with age.

unexpected hypothesis. Described predominantly in relation to animal behaviour, Training for the unexpected hypothesis focuses on one particular function of play – to rehearse behaviour. A safe context of play (which we can easily apply to playing digital games) provides an opportunity to experiment with a behaviour in a safe environment leading to novel and possibly adaptive responses. [14]

Niko Tinbergen – a Nobel Prize laureate in Biology – used dummies to elicit (nurturing, mating or fighting) responses in animals and found out that some of the dummies elicit even stronger responses than those occurring naturally. [15] He coined the term supernormal stimuli for “*exaggerated, often artificial or simulated versions of natural stimuli, for which evolved responses exist, thereby provoking naturalistic or even stronger reactions by the recipient*”. [16 p55] Supernormal stimuli (in popular culture for example junk food or pornography) are often preferred to natural ones (because they activate reward pathways in our brains more in comparison to stimuli for which these systems were originally intended) [17] making them prone to excessive consumption and a precursor of an addiction. A thorough work regarding the evolutionary roots of addiction is presented by Van Staaden et al. [18], nonetheless, links specifically to gaming addiction are not so far sufficiently examined in academia. In the context of digital games a supernormal stimulus can be any feature that is more “hyper” in pretty much any sense of the term: more attention grabbing, in forms of exaggerated visual features – cutest, sexiest, more horrifying, in a form of an exaggerated sense of progression in game or a variety of similar exaggerated features at once described in Naomi Alderman’s [19] article about *Candy Crush Saga* (King, 2012). The promotion of digital games often utilizes particularly exaggerated female shapes (through partially exposed décolletages, revealing clothing, etc.) as marketing appeals, e.g., ads for game series *Dead or Alive* (Team Ninja, 1996-2019). Currently, this strategy is also applied to mobile games, but while in the game *Kiss of War* (tap4fun, 2019), luscious women from ads are also a part of the game, many other games use sexuality just within so-called *fake-ads* or *fake-gameplay-ads*, i.e., the gameplay itself is completely different from the game’s ads. [20]

2.2 Games as a learning tool about evolution

Additionally, evolution in relation to digital games can act not only as a theoretical or research base, but also as a main topic in a narrative. This notion can occur in either entertainment or serious game titles. Perhaps the best known depiction of evolutionary content in digital games is a game *Spore* (Maxis, 2008) as a single player evolution simulation game (where a player takes care of a being from a single cell stage up to an intergalactic life form) sparked a debate about the accuracy of this playable version of evolution process and its pros and cons as a potential learning tool. *Spore* is considered an interesting learning tool facilitating the overall interest in the topic of evolution [21] while at the same time is being criticized for scientific misconceptions regarding evolution: need-based causality, operating on individuals rather than populations, lacking randomness and variation of evolution, not being able to observe genetic variability over time or within a particular specimen, reinforcing a notion that evolution is caused by an external force (the player), changing body parts or behaviour in order to meet in game goals forgetting functions are the result of random mutations and natural selection, abrupt transition from creature stage into human-like form or giving the process of evolution a clear goal it naturally does not have.

Hereby we can observe the everlasting and so far unsolved discussion within the field of digital games about the “fun” (in order to motivate and engage) versus educational goals. Other games relevant to this topic are *Defender: Natural Selection* (National Geographic, 2021) targeted at a more narrowly defined audience of grades 5-8 students created primarily for educational purpose and board-game based strategy game *Evolution* (North Star Games, 2019). Assessing each title’s accuracy in terms of evolutionary psychology would require an absolute knowledge of each of these games and game’s commitment to scientific rigor

is certainly a subject of opinion based on whether the game is marketed as entertainment or edutainment one. In our point of view each game has the ability to serve as a learning tool. And each and every existing tool has its limitations therefore using such game in educational setting requires additional explanations and guidance (from a lecturer) including the confutation of potential inaccuracies. All in all, even after many years of interest digital games are still challenged by the lack of general guidelines for educational purposes, general character of resources concerning game-based learning, a vague link between particular game mechanics and educational purposes and limited transfer of training hypothesis suggesting the unknown adaptability of skills acquired in digital games to real-life setting.

2.3 Gender aspects and physical attractiveness

Evolutionary psychology pays a great deal of attention to gender differences because it believes men and women are facing different adaptive problems leading to the implementation of different adaptive strategies. [22] Evolutionary psychology approach is a fruitful addition to research adopting *Social cognitive theory of Gender differentiation*. Typically, academic literature supports the notion of gender differences in gaming. Male gamers prefer achievement-oriented, competitive, aggressive and warfare games to a greater extent than female gamers. [13,23,24] Men also manifest more positive attitudes towards first person shooter games and real-time strategy games. Women evaluate party games, life simulators, and platformers more positively. [13] Market research company Quantic Foundry has been mapping gamer motivation in a large-scale study since 2014. In their research report female gamers’ primary motivations are more often Design, Fantasy, Story, Completion and male gamers are more likely to be driven by Competition, Destruction, Challenge, Excitement, and Strategy. Yee [25] from Quantic Foundry calls attention to the moderating role of age in this context – e.g., gender difference in competition tends to disappear with age. With the everlasting inflow of new game titles, gender research within digital games is a topic that will never be outworn. Since gender is quite a strong predeterminant in gaming, we should count for it as a moderating variable also in cases when our research is focused on other topics than gender itself. With the areas of gender differences in gaming motivation and genre preferences covered in academia at least to some extent, we find it interesting to change the direction of research interest towards gender differences regarding game mechanics and objectives with the acknowledgement of its evolutionary appeal.

As mentioned in the introduction, the key part of the theory of natural selection is reproduction. According to Li et al. [26] the function of attraction is to “*direct one’s attention and energy towards pursuing, mating with, and retaining individuals who display traits that contribute to greater survival and reproductive success*”. Individual can experience two types of benefits from his/her mate’s physical attractiveness, both important from evolutionary perspective: direct benefits for the perceiver of such attractiveness and indirect benefits for perceiver’s offsprings. [27] The purpose of the attractiveness signals is to enhance mating success by attracting mates or intimidating rivals. [28] We try to assess reproductive value of potential partners and then compete for high quality mates and signal our own reproductive value, all at the same time. In digital environment it is an imperative to know the evolution-based principles of attraction perception from the point of avatar design, both for developers trying to address certain audience and players trying to impress other players or reflect their own personality within their avatars. According to the research of Rusňáková [29] during the avatar creation process the vast majority of players take into account and apply mainstream beauty standards (attractive, strong, young, with an athletic body, etc.) at least to some extent. The choice of appearance reflects their desires for a better and more enjoyable life, and most of them at least once created an avatar that represented an idealized version of their physical appearance.

Overall, as attractive are perceived biological indicators of health and fertility (evolutionary psychologists refer in this context to the concept of reproductive value) such as youth, healthy hair

and teeth, clear skin, pink cheeks, clear eyes and average and symmetrical facial characteristics. Nonetheless, Perret et al. [28 p417] adds that “*exceptionally attractive faces deviate from the average, and averaging the highly attractive faces produces a composite that is more attractive than the average of the entire population*”. Reproductive value of women is judged mainly based on physical attractiveness and is more dependent on age (women are considered the most attractive at an age of their highest reproductive value so it is reasonable that they oftentimes employ beauty means by which they lower their perceived age). [28] Another attractiveness indicator is waist-to-hip ratio whereby the ratio perceived as the most attractive for women across cultures is approximately 0,7 [3,30], according to Barber [28] the range perceived as attractive lies between 0.67-0.80 for women and around 0.85-0.95 for men. According to Beck et al. and Gitter et al. [28] both sexes perceive “hourglass shape” as desired for women. More than that, slim waist is also an indicator of youth because older women and men tend to gain fat around the abdomen. [28] Interestingly, the ratio itself is independent from the weight a person has. A character heavily criticized for the inaccurate and distorted representation of female body (waist-to-hip-ratio) was *Lara Croft*. [31] Wells and Nicholls [32] analysed relationships between weight, size and body compositions in real and fantasy women. They calculated that Lara Croft had presumably a Body Mass Index comparable to women with anorexia. However, the depiction of Lara Croft has changed throughout the years and particular versions of the game and we were not able to determine which version of Lara Wells and Nicholls analysed.

Moving towards male signs of attractiveness, the reproductive value of men is hardbound to social status and dominance. [6] Also in games, men prefer avatars that reflect these aspects. [13] Women also notice in men shoulder width or shoulder-waist ratio and upper-body strength that is from the evolutionary perspective interpreted as an adaptation for hunting or fighting, as well as other signs of physical strength (representing the ability to protect). [28] We should not omit psychological aspects of attractiveness such as agreeableness or intelligence that has served as an adaptive advantage for both sexes. [33]

In terms of facial attractiveness specifically, attractive are in general features signalling the absence of parasites, abnormalities or sickness, symmetry, averageness (resemblance of a face to the majority of other faces within a population linked to genetic diversity), secondary sexual characteristics/dimorphic shape cues (meaning feminine features in women and masculine features in men), skin color/texture related to good health a marginally also age, weight, eye and hair color, facial hair and makeup [27] The topic of the face attractiveness signals is linked to psychological effect called the Baby-Face bias or more in line with the language of evolutionary theory the perception of the neotenous bodily traits. As neotenous body traits are considered large eyes, tiny nose, large forehead, round cheeks, round face, tiny chin, indistinctive cheek bones, hairless skin, fair complexion and hair. [30] These features encourage nurturant responses and parents' engagement in caring and protecting their kin. In contrast, prominent cheekbones or large chin are perceived as mature and suggest social dominance and competence. In this respect we tend to perceive people and things with baby-faced features as owners of childish characteristics such as naivete, helplessness, honesty, innocence, incompetence. [30] In certain situation we can prosper from baby-face bias (for example, we could be perceived as more honest), in other it can be the opposite (e.g., manager with neotenous traits is perceived as less competent). In games, we can observe this exaggerated baby schema characters in the first (non-evolved) stages of *Pokémon*, several characters of *Super Mario* universe, and, especially, (not only) women in manga-style animation, like the *Final Fantasy* (Square Enix, 1987-2021) series.

Another research-worth application of baby-face bias and other phenomena linked to the perception of human attractiveness can be seen within the realm of so-called Proteus effect defined by Yee and Bailenson [34] as a behaviour that reflects our digital self-representation regardless of how that representation is

perceived by others. Therefore, our in-game behaviour will be in line with the adorable or fighter appearance of our avatar. Not only are we altering our avatar, but our avatar (especially its physical appearance) is shaping us to certain extent.

2.4 Signalling

Signalling theory represents a theoretical framework regarding communication between individuals based on the study of animal communication. The aim of signalling is to communicate an underlying quality – e.g., to impress a potential mate, demonstrate fitness, build alliances, gain reputation or intimidate rivals. Evolutionary signalling theory presume that signal is beneficial both to sender and receiver. [35] Signalling is in close relation to the concept of competition. Evolutionary biology pays attention to the competition between species or within a certain specimen. Competition ascends in relation to insufficiency or demand. [36] The more important the need for survival, the more protrusive the competition. [36] Signals may be honest or dishonest (deceptive).

Simultaneously, competition, or *agon* [37], is one of the basic game principles that occur in modern games [28]. Various challenges related to competition are present in both singleplayer (comparison of high scores, online leaderboards, etc.) and multiplayer games (eSport, etc.), but whereas multiplayer games are primarily based on mutual player interactions, competition is more obvious here on several levels. [39] Massive multiplayer online games enable signalling of the player's status in various ways: symbolic (high level, rank in leaderboards, position in guild/clan, etc.), visual (customization of avatar appearance, skins, owning legendary items – weapons, armour, companion, etc.), in behaviour (dominance, superiority, etc.). For example, in multiplayer online battle arena *Fortnite Battle Royale* (Epic Games, 2017), currently one of the most popular digital games, more exclusive purchased skins of avatars reflect the more experienced level of the player, thus the basic appearance of an avatar indicates game rookies, “noobs”.

2.5 Evolutionary roots of preferences

Preferences as subjective evaluations of alternatives are crucial determinants of choice and decision-making process. They facilitate the design of particular alternatives and the prediction of the final decision. The knowledge about target group preferences is an imperative for the design of any kind of communication. The research of preferences is in general precarious for the reason of mostly implicit nature of preferences and their uncertain stability in time.

Evolutionary psychology deals with food preferences (food rich for calories being important for survival), colour preferences (solely in the context of blue usually being the favourite due to innate preferences for clear water and sky) and most important in our context the preferences of certain physical environment that established because certain environments are more suitable for survival and reproduction than others offering more resources, possibilities for a shelter, better weather conditions and less pathogens or predators. [13,40] Overall, from the point of evolutionary psychology we incline towards: natural scenery as compared to artificial environments, clear flowing water in comparison to still water, grassy scenery with scattered trees compared to a dry landscape without trees, mountains in the background in comparison to even terrain. We distinguish so-called savanna preference as a “*tendency to prefer savanna-like environments to other types of environments*”. [30 p212] According to Lynn et al. [5] this preference is stronger in case of younger individuals who are less influenced by experience. In games, an ecologically harsh environment may be sometimes utilized in order to create a compelling fear-inducing ambiance. [13]

In the context of digital games, the reflection of this principle is intricate due to the complexity of the game design process, but on the other hand, it provides more creative opportunities for further research. At first, concerning the aforementioned preferences of

the environment, the digital-gaming environment is artificial in every way, so it rather depends on its processing and the extent of the players' immersion during gameplay. The character of the digital-game environment and its subsequent perception by players is then strongly influenced by the overall visual style of the game (e.g., photorealism, caricaturism, abstractionism) and audiovisual elements of game environments like dimension, point of perception (perspective), visual outlook, and others. [41] In summary, preferences of the environment are primarily based on evolutionary psychology, but secondary affected by the nature of the game design. A separate category within the environmental preferences should probably be sand-box games, like *Garry's Mod* (Facepunch Studios, 2006) or *Minecraft* (Mojang Studios, 2011), allowing players to control the environment, create most of its aspects, or even create their own worlds.

However, it still applies that game progress or success is directly related to the knowledge and understanding of the game environment. It is oftentimes the essential condition for beating the game. According to Liboriussen [42], improving our chances of survival by knowing the environment in a particular game is not only a question of evolutionary past influencing landscape perception, but it holds a literal sense of survival within a game. An interesting example is the game *Control* (Remedy Entertainment, 2019). The game environment is represented by the interior of the Federal Bureau of Control building which is cross-dimensionally shape-shifted by the reality-corrupting entity. Throughout the game, the player restores the interior to its original state – from geometrically creative but dreadful to the boring, sterile, but (potentially) safer.

2.6 Evolutionary background of emotions

Emotions are represented either as an emotional value of a stimulus (e.g., fear-evoking) or as an emotional state of an individual. Emotions play a central role in information processing with its selectivity as well as decision-making process. From the evolutionary optics, distinct emotions established as a reaction to specific adaptation problems of our ancestors meaning that those who manifested particular emotion were having an advantage in terms of survival. Essentially, emotions serve a purpose of avoiding danger and direct organism towards prospect or reward. [43] Each emotion has its distinctive purpose and this notion applies also to emotions we tend to pinpoint as negative. The evolutionary purpose of fear is the activation of defence mechanisms and preparation for fight, flight or freeze. In psychology, there is an ongoing debate about the optimal level of evoked fear. Knowledge from evolutionary psychology supports the general idea that the level of evoked fear should be neither too low (will not provoke an adaptive reaction) nor too high (will be paralyzing). [3] Overall, stimuli associated with high fitness costs generate higher level of fear response and subsequently may lead to more significant changes in attitudes and/or behaviour. At the same time, fitness costs are moderated by gender, therefore reactions to fear will probably manifest gender differences and this notion is not always taken into the consideration. Evolutionary background of anger describes its purpose as a preparation for another plausible aggression, aid in defending ourselves, maintaining an advantage over rivals, building certain status, discouraging rivals from aggression or even discouraging partner from infidelity. [3] Function of grief is to shut away and regain strength or to call for help, the purpose of joy is to direct goal-oriented behaviour or motivate. [44]

Fear-evoking elements belong to the most common design features in digital games as a result of the general preference of the horror genre across the entire pop-culture. Digital games have been implementing the horror genre since the very first titles. This genre is particularly suitable for minimalist game storytelling, presenting a familiar world with disturbing content and twisted topics to make it seem special. In addition to the practical benefits of this genre for game development, it enables manipulation of certain key emotions, like tension and fear, and pride. [45] Currently, elements of a horror genre are a secondary but important genre aspect of many games, including action games or blockbuster games with extensive storytelling, like

Control (Remedy Entertainment, 2019). According to Clement [46], in 2020, 24.5% of gamers worldwide preferred to play digital games, in which horror and survival genres dominated, e.g., *Resident Evil* series (Capcom, 1996-2021), one of the highest-grossing horror franchises.³

Aside from the general preference of fear-evoking genres, the same emotions can also be observed as ludic experiences, thus the result of the player's interaction with the game design. For example, the fear of losing or failing in reaching game goals is present in non-horror and even non-narrative games as well. [48] The same applies to violent digital games, which overall reach the same, if not greater, popularity as horror games. Needless to say that violence is not necessarily a game-required behaviour. Digital games like role-playing games with open-world provide options to act violently or not, or to use violence in situations that do not require it. [49] Further applications within the domain of digital games include design of facial emotional expressions of avatars [50], emotion regulation [51], frustration as an important determinant of game's individual evaluation [52] or evolutionary origin of empathy and emotional contagion [53] leading to further social contexts.

3 Conclusion

To properly understand gamers' behaviour, we should look at both ultimate and proximate explanations. So far, proximate explanations are dominant in related academic work and evolutionary psychology within the domain of digital games is in a phase when it generates more questions than it proposes answers. We have to remember, evolutionary psychology is not the sole explanation for phenomena of gaming, digital games are a cultural phenomenon subjected to very individual psychological effects, but its evolutionary background should not be overlooked because it has a potential to fill in the gaps of dominant research approaches within the field.

The presented exploratory study aimed to briefly introduce the general overview of the vast array of applications from the rich biologically informed field of evolutionary psychology into the design and research of digital games. At the beginning, we outlined opinions regarding the evolutionary background of gaming as an activity with the notion of supernormal stimuli within games. We proceeded to discuss games as a learning tool about evolution with particular examples, common inaccuracies about the process of evolution and broader discourse about the problematic areas of serious games design in general. Talking about evolutionary psychology, we had to pay attention to gender differences in preferences and motives and importantly for the design of avatars we focused a bit more on aspects of physical attractiveness. Later we very briefly outlined signalling theory and its relatedness to competition, evolutionary roots of preferences, especially those of the physical environment and we ended our efforts with evolutionary background of emotions and their adaptive meaning with the emphasis on fear-evoking elements.

The main limitation of the study was, understandably, an excessive range of selected topics, therefore we were not able to cover this comprehensive issue in-depth (e.g., the concept of costly signalling or dishonest signalling) and we even had to omit socially oriented topics such as gift giving or cooperation. Due to the negligence of the presented topic in academic literature, there exist many prospective areas for potential future research related to digital games discourse worth further insight: i.a. gaming environment preferences, dishonest signals in games, attention grabbing potential of supernormal stimuli in games, the evolutionary background of the preference for particular game mechanics differentiated by gender, perception of avatar attractiveness.

³ This does not include cross- and multi-genre games containing fear-evoking features and elements of the horror genre, but not to the extent to determine the genre of the game, e.g., *The Last of Us* (Naughty Dog, 2013). Therrien [47] mentions certain disagreements on the thematic elements defining the horror genre. Many famous digital games can be, therefore, associated with various versions of horror like the uncanny, marvelous, or fantastic.

We believe this study can contribute to the extension of the theoretical background of game studies and its research and inspire further interest in the topic. All of the aforementioned areas of evolutionary psychology have vast application potential also within the domain of marketing communication and with the promotion of digital games having its specifics, it would be interesting to later move this research focus towards that direction.

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