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BrainHex: A neurobiological gamer typology survey ☆

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ABSTRACT

This paper briefly presents a player satisfaction model called BrainHex, which was based on insights from neurobiological findings as well as the results from earlier demographic game design models (DGD1 and DGD2). The model presents seven different archetypes of players: Seeker, Survivor, Daredevil, Mastermind, Conqueror, Socialiser, and Achiever. We explain how each of these player archetypes relates to older player typologies (such as Myers-Briggs), and how each archetype characterizes a specific playing style. We conducted a survey among more than 50,000 players using the BrainHex model as a personality type motivator to gather and compare demographic data to the different BrainHex archetypes. We discuss some results from this survey with a focus on psychometric orientation of respondents, to establish relationships between personality types and BrainHex archetypes.

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1. Introduction

Many different personalities play games for a myriad of different reasons. When digital games were first developed, they tended to focus on a single principle of play catering to just one specific play style, often dictated by the hardware limitations of the time (e.g., *Pong* and related games were constrained by limitations in display technology). More recently, digital games make use of multiple game mechanics, often structured over many levels, thus extending appeal to players expressing many different kinds of playing preferences. The same is true for many areas of life, where we guide our personal interests according to our taste (e.g., music, movies, cooking), but in most of these instances there is currently no reason to suspect a deeper explanatory level beyond aesthetic and personal taste. This is not the case in the context of games, where the existing research in emotions of play and player satisfaction modeling already reveal experiential distinctions that connect to neurobiological systems [1]. The reasons players have for choosing their games will involve an element of aesthetic choice, but optimal experiences in play show demonstrable patterns that can be investigated empirically using both qualitative and quantitative methods.

Exploring the gaming preferences of diverse players offers significant advantages for the development of games that cater to different demographic players groups. Such insight can be valuable for creating games with a more personalized experience, and may also benefit artistically motivated games by establishing a conventional framework of game design to be subverted, deconstructed or otherwise manipulated in the pursuit of artistic goals. In the field of player satisfaction modeling, typologies of playing preferences can provide a theoretical basis for more technical modeling approaches. At first glance, the idea of a typology based around personality factors (including those reflecting stylistic gameplay preferences) depends on psychological types. However, since psychological types have been understood as rigid categories of personality, a more promising way of developing a gamer typology would be found within psychological trait theory, which would allow a more flexible way categorizing players. Trait theory is concerned with the study of personality as measured in behavior patterns, emotions, and cognitive preferences. While trait-focused approaches are often bottom-up (i.e., synthesizing different personality features into traits and types), psychometric evaluations could provide a top-down view of gamer typology that can then look for common traits connecting the potential gamer types (i.e., breaking down psychometric compositions into type-relevant traits).

BrainHex is such a top-down approach, taking the inspiration for its archetypes from neurobiological research, previous typology

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approaches, discussions of patterns of play, and the literature on game emotions. In the following, we will discuss the literature providing the fundament for the BrainHex work, before introducing the seven BrainHex archetypes and their specific traits. We will then present a demographic survey of psychometric types in the context of the BrainHex archetypes and analyze the different correlations and preferences.

2. Related work

There are several streams of related work that have contributed to building the BrainHex model. First, we will discuss psychological typology as a forerunner to playing preference typologies and certain recent neurobiological findings tied to the experience of play. Then, we will briefly discuss Caillois' different elemental patterns of play [2], and Malone's theory of motivating instruction [3] and Lazzaro's four fun keys of play [4]. Finally, we will discuss previous models of player motivation from Yee [5] and Bartle [6].

2.1. Psychological typology

The Myers-Briggs Type Indicator (MBTI) is the most widely used psychological typology, which is based upon a set of four axes, each assessing two opposite psychological types. Although originally believed to represent discrete bimodal types, Bess and Harvey [7] challenged this assumption. However, McCrae and Costa [8] showed that each MBTI axis can be seen as a measure of a particular psychological trait rather than a discrete type. While, the "Big Five" another prevailing psychometric instrument in research [9], is based on trait theory, the MBTI is still widely used in many practical contexts, and data on MBTI type results is consequently easy to gather.

MBTI had been used for an early player satisfaction model entitled DGD1 [10], which in turn lead to the development of a revised model entitled DGD2, the direct forerunner of the BrainHex model presented in this paper. As part of the questionnaire data analyzed in this paper, respondents were asked to provide their MBTI type (if known), providing a convenient opportunity for comparison between this psychological typology and the playing preference typology of the BrainHex model.

2.2. Caillois' patterns of play

The oldest typology for play was offered by Caillois [2], who described four different forms of playful behavior, which can also serve as play style patterns. Caillois chose words from different languages to describe his concepts, hoping to get as close to the original concept as possible.

- *Agon* is the Greek word for contest and was used to describe games of challenge, meaning games that involve a direct conflict or competition.
- *Alea* is the Latin word for dice and describes games of chance and randomness.
- *Mimicry*, similar to the biological term, is used to describe play as someone or something else, which includes role-playing, play acting and dress-up.
- *Ilinx* is the greek word for whirlpool or vertigo (i.e., sudden shock). This is used to describe games with a visceral impact.

Caillois also classified games along an activity dimension ranging from structured *ludus* (i.e., a rule-based activity) to unstructured *paida* (i.e., spontaneous activity). Bateman [11] has connected these patterns to underlying neurobiological mechanisms (and dubbed Caillois' approach 'Patterns of Play'), suggesting that Caillois' system presents an observational typology reflecting genuine emotional and neurological distinctions, but constructed before the necessary research existed to draw the relevant implications.

2.3. Malone's theory of motivating instruction

A popular theory among game designers is Malone's theory of intrinsically motivating instruction [3], which identifies three rudimentary categories of fun in computer games: *challenge*, *fantasy*, and *curiosity*. Challenge depends on goals with uncertain outcomes, achieved for example by variable difficulty level, multiple level goals, hidden information, and randomness. Fantasy distinguishes between extrinsic and intrinsic fantasies. The first depend only softly on the player skill. Malone uses the game *Hangman* as an example where spelling and vocabulary are the skills that are only weakly related to the fantasy of drawing person on the gallows. The latter (intrinsic fantasies) are intimately related to player skill. Here Malone uses *Darts* as an example game, where the positions of the arrows on the number lines (the fantasy) are strongly related to estimating fractions (the skill). Curiosity is split into sensory and cognitive parts. Sensory curiosity can be triggered by audio and visual effects of a game and cognitive curiosity can be aroused by making players believe their knowledge structures are incomplete or inconsistent.

Malone's category of challenge relates directly to Caillois' agon, and his fantasy to Caillois' mimicry, but his recognition of the role of curiosity in play was ground-breaking.

2.4. The Four Fun Keys

Lazzaro's research is focused around the development and improvement of a set of emotional patterns observed in hundreds of player studies [4]. The results suggested four distinct patterns of response, which she termed the Four Fun Keys.

Hard fun is related to achieving a goal when playing (Caillois' agon, Malone's challenge). This is a type of fun related to challenge of mastery of a certain skill needed to reach a goal. Hard fun can lead to frustration but then eventually *fiero* (described by Ekman [12] as "triumph over adversity") when the challenge is mastered. The level of challenge is related to the concept of *flow* where an optimal balance has to be struck between skills and challenges as the player progresses through a level. However, hard fun also requires alternating the nature of challenge to allow players to form new strategies.

Easy fun is related to explorative play and curiosity fostered for example by aesthetic experiences, ambiguity, incompleteness, attention to detail and role-play (Caillois' mimicry, Malone's fantasy and curiosity). Whereas hard fun is concerned with goal-oriented challenges, easy fun maintains the player's attention; that attention may still be structured by goal states, but the player is experientially engaged by content rather than the pursuit of outcomes.

Serious fun describes the visceral impact of play (similar to Caillois' ilinx). Players feel excitement or relief by playing because their thoughts and feelings from the real world are suspended and they can engage in the rich experience of the game world. This kind of fun almost has a therapeutic nature to it as it concerns the escapist nature of playing.

People fun comes from the competitive or collaborative experiences in multiplayer games. When playing with other people, players feel amusement, *Schadenfreude* (i.e., pleasure in other's misfortune), and *Naches* (i.e., vicarious pleasure through the achievement of someone one has mentored). The social component of play is complex, but inherently enjoyable in a manner distinct from the other three keys.

2.5. Bartle's player types

Bartle [6] described an informal, qualitative model of four player types (*Killers*, *Achievers*, *Socializers*, and *Explorers*) constituting the participants in the early online synthetic worlds known as MUDs, and offering the first player typology, as such.

Achievers are players that consider the gathering of points their main motivation for playing. They actively seek treasures and values that the game provides. *Explorers* are more interested to figure out how the game world works and like to tinker with game mechanics, possibly trying to expose potential exploits. They engage in discovery and mapping of the game system, structure or topological world. *Socialisers* are more interested in the social interactions that the game facilitates than the game mechanics itself. They want to get to know the other players, understand their motivations and form relationships with them. *Killers* are very competitive players, interested in imposing themselves onto others and in many cases are motivated to pursue the misery of others if caused by their behavior.

Bartle's types do not map directly onto the other models discussed above, despite some parallels. Socialisers may be broadly construed to correspond to Lazzaro's People Fun, and Killers pick up the theme of schadenfreude in People Fun and combine it with elements of Lazzaro's Hard Fun (plus Caillois' agon and Malone's challenge). The distinction Bartle has drawn in respect of the Killer type straddles multiple aspects of the other models.

2.6. Yee's MMORPG user motivations

Yee [5] recognized that since Bartle's test is constructed on comparisons between specific scenarios, bias can occur as a result of these pairings: if the same questions appeared in different pairs, a different result might be gained by the same individual.

Yee analyzed specifically why MMORPGs are appealing and a factor analysis of his 40-item questionnaire revealed five user motivations for playing: *Achievement*, *Relationship*, *Immersion*, *Escapism*, and *Manipulation*. Achievement measures the desire to become powerful in the context of the virtual environment through achieving goals and amassing powerful items. This is very similar to Bartle's idea of an Achiever. Relationship measures the desire of users to interact with one another and how willing they are to form meaningful relationships that allow a degree of real-life problem disclosure. This is very much in line with Bartle's Socialisers. Immersion measures how much users enjoy being in a fantasy world, the role-play of being someone else and the narrative that evolves from it. Escapism measures how players are using the virtual world to avoid escape from real-life obligations. Manipulation measures how much a player wants to objectify other users and manipulate them for personal gain and satisfaction. This relates to Bartle's idea of the Killer. Yee's results brought into doubt the validity of Bartle's Explorer type, since it did not appear to be validated in Yee's study, but it is not clear whether this is a deficiency of Bartle's model or of Yee's.

Yee's contributions are most valuable for having built quantitative measures on Bartle's originally qualitative foundations, and for recognising the importance of Escapism to the play of digital games. Other perspectives on play have tended to combine this with what Yee terms Immersion; Yee's results demonstrated that the desire to escape from the demands of everyday life was not directly connected to the enjoyment gained from entering the fictional worlds of digital games. This is of limited relevance to a general player typology, but is especially relevant to research into digital game addiction, as it suggests those who become psychologically dependent upon certain kinds of online play are motivated by factors *extrinsic* to the game itself.

A common limitation between Bartle and Yee's approaches is the specific focus on massively multiplayer games, which creates a significant disconnect between wider models of play, such as those offered by Caillois and Lazzaro. Bartle and Yee's work remains an important part of the history of player typology, but a comprehensive model of play necessarily requires a wider perspective.

2.7. The first demographic game design model (DGD1)

Five years after Bartle's model, Bateman was considering the idea that the Myers-Briggs typology could possibly provide a psychometric basis for player types. This prompted the development of the first Demographic Game Design model, known as DGD1 [10]. This was not a true player typology but an adaptation of Myers-Briggs typology to games, and thus an investigation of how the patterns within this inventory applied to playing games.

Bateman and Boon [10] presented findings based upon a set of four play styles supported by the data, with awareness that the derivation of these styles was limited not only by the use of Myers-Briggs typology on the one hand, but also by the methods of statistical analysis used, which had required considerable manipulation to become tractable. These four play styles: *Conqueror*, *Manager*, *Wanderer* and *Participant*, were also investigated in a series of case studies that provided some qualitative support for the results. These play styles did not appear to relate significantly with Bartle types.

The key finding of this study was that rather than the informal terms 'hardcore' and 'casual' relating to a specific style of play—as was hypothesized—players who assessed themselves as 'hardcore' or 'casual' were represented in *all* of the four clusters of play styles. In other words, 'hardcore' and 'casual' did not appear to be terms reflecting a specific play preference but rather a trait dimension that differentiated a different aspect of player behavior, one apparently corresponding to the Myers-Briggs dimension of 'Intuitive' (i.e., preference for abstract thinking).

This result suggested that the principle difference between 'hardcore' and 'casual' players was not—as believed prior to the research—the willingness to persevere in the pursuit of victory (this became the basis for the Conqueror play style), but rather a greater capacity for imaginative play. This openness to imagination (called 'Openness' in FFM) seems to be a characteristic of those who play digital games as a hobby. Rather than calling such players 'hardcore' it might be more appropriate to term them *gamer hobbyists* (i.e. players who play many different games).

These hobbyists can be contrasted to the mass market of players (the 'casual' market) who may well play games—and indeed may play regularly— but do not play anywhere near the range and diversity of titles that hobbyists engage with. The tendency to play a greater diversity of games (as observed in case studies) also leads to a greater comprehension of the general trends, patterns, implicit rules and other elements in the background of understanding for digital games. For this reason, it is reasonable to refer to such players as having superior *game literacy,* and later studies (particularly DGD2) explore this point explicitly.

2.8. The second demographic game design model (DGD2)

Following up the findings of DGD1, a second survey revealed a number of interesting patterns [14]. In respect of gender, it was discovered that women consistently assigned lower scores than men when describing their game playing competences, the importance of emotions to their play, and their enjoyment of various patterns of play. For example, female respondents consistently rated their gaming skills lower than male players. This does not necessarily mean female players are not as skilled as their male

counterparts, but rather that female players possibly underrate themselves, or (alternatively) that male players overrate themselves, when compared to the other gender.

Whereas DGD1 had been based on Myers-Briggs typology, DGD2 made more use of the related model of Temperament Theory, which is based on four basic type patterns, each of which relates to a skill set – Logistical, Tactical, Strategic and Diplomatic. A bug in the data gathering program means that data on Diplomatic skills was lost, but the data for the other three skill sets broadly validated the other three skill sets as viable patterns. However, factor analysis identified only *two* components – loading basic game literacy with Tactical skills, and Strategic with Logistical skills (as had also happened in DGD1, although this had been assumed to be an artifact of the methodology used). Re-examination of the questions suggest that not enough care was taken to distinguish the skill set patterns from one another, but in terms of future research this overlap provided an opportunity. The connection between basic game literacy and Tactical skills all involved questions assessing the respondent's capabilities in respect of controlling (or understanding how to control) avatars, vehicles etc. in the fictional worlds of games. This component could perhaps be characterized as competence with real-time controls, and may be a candidate for a trait dimension in future models.

The results of DGD2 also suggested an interesting distinction between players preferring multiplayer and those preferring single player. According to the data analysis, multiplayer gamers tend to be challenge-oriented, and willing to be aroused to anger presumably since this enhances their eventual reward in *fiero* (and possibly *Schadenfreude*) when they attain victory. They are not only enjoying *fiero*, they are also enjoying the social element of multiplayer games such as the sense of belonging to a team, feelings of envy and gratitude, and the feeling of *Naches* – the satisfaction of seeing someone you taught to play perform well. They also rated themselves much higher in terms of tactical skills which is not surprising given that the most popular multiplayer digital games all depend upon tactical skills (first person shooters and racing games, for instance).

Conversely, single player gamers (statistically speaking) show greater interest in having control over the space of their play. This is one way to interpret their lower interest in random elements – these add variety to play, but they also mean the player has less direct control over outcomes. Their higher interest in sandbox play might also be interpreted as an increased interest in having complete control over the play space.

Social preferences for play have not usually been considered particularly significant, but this data identifies distinctive patterns. It seems that the emotional reward of fiero may be more attractive when it is earned against (or with the assistance of) human players—beating a single player game might be less satisfying because it was not a person that was overcome. For the 36% of gamers in this survey for whom multiplayer competitive play is appealing, playing together is doubly rewarding: not only do they get the emotional benefits of social play, but the taste of victory appears to be all the more sweet when it is won from a human opponent.

One final result from the analysis of the DGD2 data concerns obsessive tendencies. Respondents who self-identified as 'hardcore' showed higher mean response to the obsessive tendencies question. In fact, it appeared as if the higher someone rated their game abilities, the more likely they were to report obsessive tendencies. No similar pattern was shown for gender, preference for multiplayer versus solo play, or any other significant factor. The results of the surveys and studies up to this point became the inspiration for a new player satisfaction model, BrainHex. The new survey and model moved explicitly towards an examination of play from the perspective of hypothetical neurobiological factors, and away from using pre-existing psychometric models such as Myers-Briggs and Temperament Theory. While the use of these models has proven useful in establishing a framework for player typology, we are approaching the point whereby it will necessarily become more valuable to establish typologies on play-specific foundations.

3. The BrainHex model

Based on the reviewed research, BrainHex intends to provide a typology of playing preferences motivated by combining existing findings from player research with neurobiological insights into the presumed underlying mechanisms (see Bateman and Nacke [1] for a review of this research). BrainHex is, however, an interim model – it is hypothetical in nature, and exists primarily to further the investigation of possible traits that could be used for the construction of a more robust future model. It serves to provide a first top-down step towards a new player typology. Each category within BrainHex should be understood not as a psychometric type, *per se*, but as an archetype intended to typify a particular player experience, which can thus be understood as a qualitative presentation of an underlying implicit trait framework, with the descriptions combining hypothetical expressions of neurobiological research with observational case studies of players. The paragraphs that follow describe the seven types within BrainHex, and how they connect to the neurobiological mechanisms discussed above.

3.1. Seeker

Following research by Biederman and Vessel [13], the archetypal Seeker is motivated by interest mechanism, which relates to the part of their brain processing sensory information (i.e., the sensory cortices) and the memory association area (i.e., hippocampus). Encountering richly interpretable patterns produces endormorphin, which in turn triggers the pleasure center [1]. The Seeker type is curious about the game world and enjoys moments of wonder, preferring play in the manner of Lazzaro's Easy Fun. It can be partially related to Caillois' mimicry and Yee's immersion, and strongly connected to Malone's curiosity

3.2. Survivor

While terror is a strong negative experience, certain people enjoy the intensity of the associated experience, at least within the context of fictional activities such as horror movies and games. The neurotransmitter related to this type is epinephrine, the chemical underpinning of excitement, which enhances the effects of dopamine (triggered when rewards are received). The state of arousal associated with epinephrine becomes that of terror as a result of the action of the fear center, which becomes hyperactive when a situation is assessed as frightening (based on prior experience, and certain instinctive aversions). It is not yet clear whether the enjoyment of fear should be assessed in terms of the intensity of the experience of terror itself, or in terms of the relief felt afterwards. If the latter case were validated, the Survivor archetype could be related to Lazzaro's serious fun, but in either case it can be seen as a special case of Caillois' ilinx, which purposefully courts controlled experiences of panic

3.3. Daredevil

This play style is all about the thrill of the chase, the excitement of risk taking and generally playing on the edge. Game activities such as negotiating dizzying platforms or rushing around at high speeds while still in control typify the implied play preference. The behavior related to this type is focused around thrill seeking,

excitement and risk taking, and thus epinephrine, which was already mentioned, can be seen as a reward enhancer. As with the Survivor archetype, the Daredevil archetype relates to Lazzaro's Serious Fun and Caillois' ilinx, the distinction being the degree of fear experienced: in the case of the Survivor, a player subjectively enjoys feeling terrorized, albeit in a fictional context, whereas the Daredevil archetype seeks excitement solely as a positive experience.

3.4. Mastermind

A fiendish puzzle that defies solution or a problem that requires strategy to overcome is the essence of fun to this archetype. Players who fit this archetype enjoy solving puzzles and devising strategies, as well as focusing on making the most efficient decisions. Whenever players face puzzles or must devise strategies, the decision center of the brain and the close relationship between this and the pleasure center ensures that making good decisions is inherently rewarding. The Mastermind archetype is close to Bartle's Explorer and Yee's manipulation motivation, as well as being more loosely connected with Caillois' ludus and Lazzaro's Hard Fun (which incorporates puzzle solving as a source of fiero).

3.5. Conqueror

Some players aren't satisfied with winning easily—they want to struggle against adversity. Players fitting the Conqueror archetype enjoy defeating impossibly difficult foes, struggling until they achieve victory, and beating other players. They behave forcefully, channeling their anger to achieve victory and thus experience fiero. When mammals face difficult situations, their body produces epinephrine (adrenalin) and norepinephrine, the former producing arousal and excitement and the latter being associated with anger and combative tendencies. Anger serves to motivate opposition and hence to encourage persistence in the face of challenge, and testosterone may also have an important role in this behavior (irrespective of gender). The Conqueror archetype relates directly to Lazzaro's Hard Fun, Caillois' agon, and Malone's challenge, as well as weakly relating to Bartle's Killer. The name is derived from the DGD1 model, which first associated pursuit of fiero with playing preferences [10].

3.6. Socialiser

People are a primary source of enjoyment for players fitting a Socialiser archetype—they like talking to them, they like helping them, they like hanging around with people they trust. Players whose preference for play fits this pattern tend to be trusting, and they get angry at those who abuse their trust. This behavior connects to the social center, and which is the principal neural source of oxytocin, a neurotransmitter demonstrated to have a connection with trust. The name of this archetype pays tribute to Bartle's Socialisers, verified by Yee's relationship motivation and the style of play is related to Lazzaro's People Fun.

3.7. Achiever

While a Conqueror can be seen as challenge-oriented, the Achiever archetype is more explicitly goal-oriented, motivated by long-term achievements. This distinction can be subtle, but it is nonetheless important: preference for Achiever-style play is rooted in 'ticking boxes', while preference for Conqueror-style play is rooted in defeating challenges. The satisfaction felt on attaining goals is underpinned by dopamine (and hence the pleasure center) but in the case of the Achiever archetype play should be understood as being ultimately obsessive in its focus. Achievers therefore prefer games amenable to ultimate completion, especially digital RPGs, whose self-adjusting difficulties ensure completion as a result of perseverance.

While the pleasure center is certainly related to this playing preference, the decision center likely plays a role: subjective reports from players tending towards Achievement-style play show a fixation on reaching certain goals compulsively. Players who fit the Achiever archetype will collect and complete everything they can find—no "grind" is too arduous for such a player! In their pursuit of the satisfaction of a completed task, Achiever-style play should be understood as being ultimately obsessive in its focus. The games players fitting this description choose to play tend to be those amenable to ultimate completion, especially computer role-playing games, whose self-adjusting difficulties ensure eventual completion as a result of perseverance (as opposed to challenge-oriented games such as fighting games, for which victory may require specific degrees of skill – such games attract players fitting the Conqueror archetype).

The name of this archetype pays tribute to Bartle's Achiever, verified by Yee's achievement and advancement motivations, and none of the other models discussed in this paper directly express this playing preference to any degree.

4. Demographic player type survey

Predating this study were two demographic studies, discussed before as DGD1 and DGD2 [10,14], which identified play styles from Myers-Briggs typology in conjunction with a series of questions concerning playing preferences. Following case studies supported the qualitative validity of the suggested four types: *Conqueror*, *Manager*, *Wanderer* and *Participant*, which correspond broadly to Conqueror, Mastermind, Seeker and Socialiser of the BrainHex archetypes.

In moving forward, a decision was taken to attempt to significantly increase the number of respondents in the hope of providing a more reliable data set for statistical analysis and data mining. With this goal in mind, the BrainHex study (launched in August 2009) was branded as a game personality survey that would compute the individual player types based on a few questions (similar to a psychometric type survey). It was not expected that the BrainHex types reported in the results would be objectively verified by the results, but rather that the data gathered would be open to a variety of analyses capable of yielding possible elements of a future trait theory.

4.1. Methods

The survey was launched through the website www.brainhex.com and a custom PHP script was developed to gather demographic and playing preference data alongside computing the preferential order of the BrainHex 'classes' (i.e., archetypes) and anonymous survey respondent identification. The survey was split into several parts. The first part collected demographic information such as year of birth, gender, geographical territory of respondent, typical playing frequency, self-assessment as casual or hardcore gamer, working in or outside the game industry, single and multiplayer preferences, attitude toward digital game stories, three favorite games, and attitudes towards pets. Finally, those participants who knew their Myers-Briggs-Type (a personality type test) could select it from a drop-down menu.

The second part of the survey presented participants with several statements that were connected to the different BrainHex player archetypes from early pilot testing. Each player type had three statements (e.g., Seeker: "Looking around just to enjoy the scenery.") that needed to be rated on an arbitrary scale with the

Fig. 1. MBTI Extraversion and Introversion groups broken down by BrainHex primary type.

answers "I love it!" (1), "I like it." (0.5), "It's okay." (0), "I dislike it." (-1), and "I hate it!" (-2).

The third part of the survey then presented seven strong identifying statements for each BrainHex archetype that would need to be rated on a scale from 1 (worst) to 7 (best) in order of preference, where each rating could only be applied once per statement. The statements were:

- Seeker: "A moment of jaw-dropping wonder or beauty."
- Survivor: "A moment of heart-stopping fear while escaping."
- Daredevil: "A moment of breathtaking speed or vertigo."
- Mastermind: "The moment when the solution to a difficult puzzle clicks in your mind."
- Conqueror: "A moment of hard-fought victory."
- Socialiser: "A moment when you feel an intense sense of unity with another player."
- Achiever: "A moment of completeness that you have strived for."

The script would then compute the sum of the three statements and the ratings to compute the BrainHex 'class', which would be directly presented to the participant. Both highest scoring and second highest scoring type were combined to create main type, subtype combinations. The most-preferred archetype is referred to in this paper as the *primary class*, which should be understood as the best fit archetype for any given respondent, based on their responses.

4.2. Participant demographics

At the time of analysis, the survey had been taken by 50,423 participants. The gender split between respondents was not equal as this variable is hard to control for in an open field survey (88.6% males). The survey language was English, and it seems that the survey was most appealing to a North American audience (49.8% of respondents). The survey was also popular in Western Europe and the UK (27.9%), followed by Eastern Europe or Russia (8.2%), Australasia (4.3%), and South and Central America (4.3%). Only very few respondents came from Asia (2.1%) and other territories. The majority of the respondents played very regularly, most of them every day (66.2%) or at least every week (24.4%).

When ask to self-identify themselves as a 'hardcore', 'casual', or 'midcore' gamer, most respondents answered they thought of themselves as 'midcore' gamers (58.9%), followed by 'hardcore' gamers (23.5%), and 'casual' gamers (14.7%). While most people preferred some form of multiplayer gaming (16.7% multiplayer in same location, 20.1% multiplayer over the internet, 8.6% clan play, 13.1% MMORPGs), about a third of participants engaged primarily in single-player games alone (36.3%). Most people were also in agreement that stories either help them enjoy games (53.8%) or are important to their enjoyment of games (37.5%).

5. First results

These results will primarily be concerned with analyzing psychometric type responses to the questionnaire, based on MBTI preferences. While a rich amount of data was gathered with the BrainHex questionnaire, the results reported in this paper will solely focus on this aspect, with future papers addressing other aspects of the results. In this respect, these first results can be considered a follow up to the original DGD1 study, which had these types as its sole focus. It is hoped that future analysis will serve the intended goals of the study to investigate options for a trait theory of play.

5.1. Psychometric types and player types results

Most respondents fell into the INT categories, meaning more respondents seemed to be part of an introverted psychometric type. For the analysis of psychotypes and their distribution within each of the player classes, we excluded all answers without an MBTI type. This resulted in 11,526 responses for the following analyses. The dataset limited only to the people who answered the psychometric type question was individually split 4 times for each dimension to conduct separate analyses.

When divided between Extraversion and Introversion as Fig. 1 shows, all player types have more players showing a preference for Introversion. A chi square test showed differences for Achiever ($\chi^2 = 344.20$, $p < .001$), Conqueror ($\chi^2 = 618.17$, $p < .001$), Daredevil ($\chi^2 = 117.60$, $p < .001$), Mastermind ($\chi^2 = 1087.20$, $p < .001$), Seeker ($\chi^2 = 883.20$, $p < .001$), Socialiser ($\chi^2 = 125.33$, $p < .001$), and Survivor ($\chi^2 = 240.17$, $p < .001$).

The same split was performed upon the Thinking–Feeling dimensions for each BrainHex primary class. As Fig. 2 shows, the results were not as homogenous as for the extraversion introversion dimension. Within the Seeker, Achiever, Socialiser, and
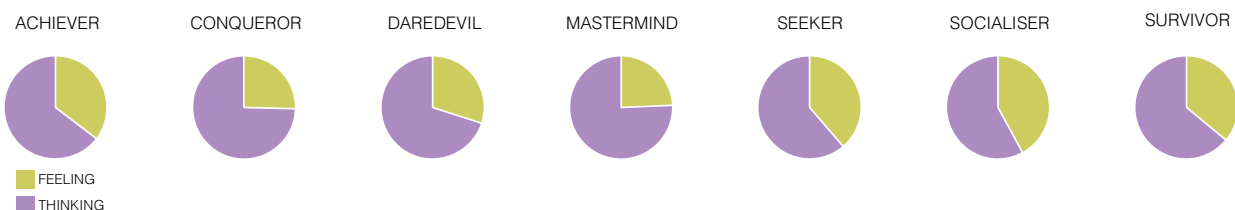

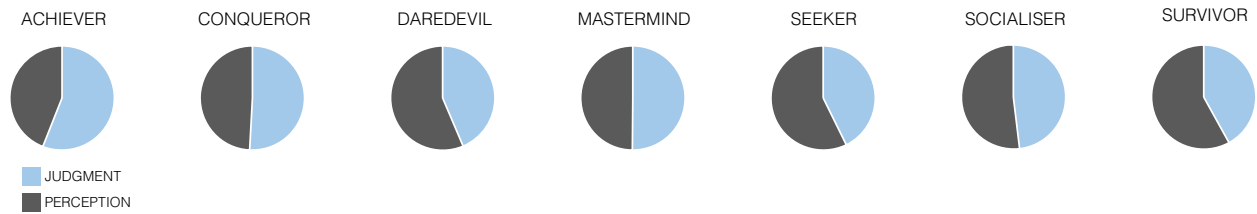**Fig. 2.** MBTI Feeling and Thinking groups broken down by BrainHex archetype.

Fig. 3. MBTI Judging and Perceiving groups broken down by BrainHex primary archetype.

Survivor class, there seemed to be a greater preference for Feeling than in the other primary classes. In general, all classes seem to be dominated by Thinking. This is supported by differences for Achiever ($\chi^2 = 95.72$, $p < .001$), Conqueror ($\chi^2 = 649.21$, $p < .001$), Daredevil ($\chi^2 = 90.24$, $p < .001$), Mastermind ($\chi^2 = 765.73$, $p < .001$), Seeker ($\chi^2 = 121.02$, $p < .001$), Socialiser ($\chi^2 = 28.72$, $p < .001$), and Survivor ($\chi^2 = 57.49$, $p < .001$).

Compared to the other dimensions, there is no clear dominating type in the Judging and Perceiving dimension (shown in Fig. 3). For Conquerors ($\chi^2 = 0.79$, $p = .38$), Masterminds ($\chi^2 = 0.01$, $p = .93$), and Socialisers ($\chi^2 = 1.42$, $p = .23$) both Judging and Perceiving preferences are equally represented without differences. Interestingly, the Achiever type is significantly dominated by Judging preferences ($\chi^2 = 15.98$, $p < .001$). Daredevils ($\chi^2 = 9.16$, $p = .002$), Seekers ($\chi^2 = 49.27$, $p < .001$), and Survivors ($\chi^2 = 18.73$, $p < .001$) are all more likely to show Perceiving preferences.

Finally, for the Intuitive and Sensing dimension, the split was more obvious across all BrainHex primary classes (see Fig. 4). This is supported by significant differences for Achiever ($\chi^2 = 248.03$, $p < .001$), Conqueror ($\chi^2 = 757.50$, $p < .001$), Daredevil ($\chi^2 = 171.99$, $p < .001$), Mastermind ($\chi^2 = 1310.27$, $p < .001$), Seeker ($\chi^2 = 1006.79$, $p < .001$), Socialiser ($\chi^2 = 374.56$, $p < .001$), and Survivor ($\chi^2 = 231.08$, $p < .001$).

6. Discussion

From those respondents knowing their Myers-Briggs type, there was a clear skew in the data towards preferences for *Introversion*, *Intuitive* and *Thinking*, which was also prevalent in each of the BrainHex primary classes in this subset of the data. The first of these findings – the greater incidence of Introversion preference – verifies the finding of the original DGD1 study, which connects an interest in digital games with a preference for Introversion. The high incidence of Intuitive preference may be a consequence of the branding of the survey, which appears to have attracted more gamer hobbyists than those in the wider market for games (81.4% of respondents considered themselves either midcore or hardcore by self-assessment).

In the context of the BrainHex archetypes, it is striking that Seeker, Survivor, Socialiser and Achiever should show a greater incidence of Feeling preference, compared to the other primary classes in the sample. The three archetypes that skew most heavily towards Thinking are concerned with intensity of the fight-and-flight response (Conqueror and Mastermind via fiero, Daredevil

via excitement). Conversely, Seeker, Survivor and Socialiser can be understood as *aesthetic* archetypes: Seeker concerns the aesthetics of wonder, Survivor the aesthetics of horror, and Socialiser the aesthetics of interpersonal relationships (i.e., drama and comedy). Achiever, while not being obviously aesthetic in its focus, is also notably disconnected from fight-and-flight play.

Thinking preference is usually associated with emotionally detached decision-making and Feeling with empathic decision-making; these results suggest an alternative interpretation of this measure in terms of preference for fight-or-flight play versus experiential play. This in turn suggests a possible play theory trait distinguishing between direct visceral rewards (i.e., fight-or-flight rewards) and more nuanced aesthetic preferences.

The results in terms of Judging versus Perceiving preference conform to what would be expected. This axis expressly distinguishes goal-orientation (Judging) from process-orientation (Perceiving)—as a result, it would be expected for Achiever to strongly relate to Judging preference, exactly as the data shows. Individuals preferring process-orientation (Perceiving preference) may well be interested in attaining goal states or in the quality of the eventual outcome, but are not as motivated as goal-oriented individuals to actually *complete* the process. Such people may indeed defer completion to continue to refine the process or improve its eventual output. The preference process-orientation in the context of the Daredevil, Survivor and Seeker primary classes is consistent with the definitions of these archetypes, since (along with the Socialiser) players fitting these patterns are less concerned with goals and more interested in the quality of their immediate experience.

Reviewing these findings and the support they provide for our *BrainHex* archetype model, we provide additional knowledge toward already existing player typologies rather invalidating other established player typologies. Our model supplements existing work with a more diverse array of player archetypes. Especially interesting for game designers might be the difference between the skill-oriented archetypes (such as Conqueror, Mastermind, and Daredevil) versus the aesthetic-oriented archetypes (Seeker, Survivor, Socialiser) or the goal-oriented Achiever archetype. Designers can have a vision of the archetypical player in mind when designing gameplay experiences or even alternate between catering to different player types in different maps or levels of their game.

For example, if a designer wanted to break down designing for a certain skill type down guided by player archetypes, they could
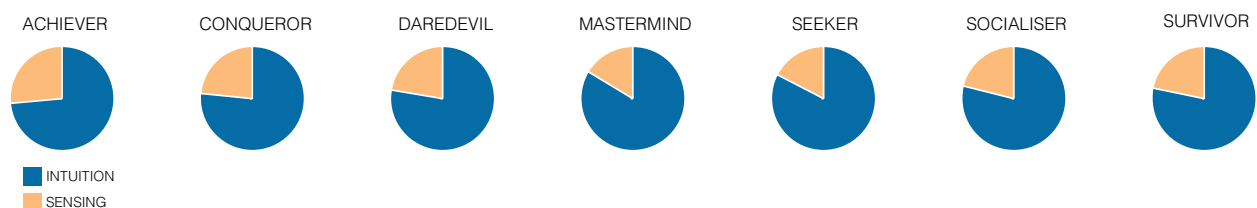

Fig. 4. MBTI Intuitive and Sensing groups broken down by BrainHex Class.

design difficult challenges that feature either motor and cognitive challenges (catering to Conquerors) or entirely cognitive puzzle challenges (for Masterminds), or they could provide a thrill-inducing environment without focusing on player skill first (along the lines of the Call of Duty: Modern Warfare single player campaigns), which would likely cater to Daredevils. On the other hand, a designer could put the aesthetic experience of gameplay first and focus on a wonder-inducing environment and narrative for Seekers, or horror-inducing aesthetics for Survivors. They could also focus on the experience of interpersonal relationships first and build the game around comedic or dramatic aspects of social interactions, which would entice Socialisers. Knowing how to weave elements of goal-completion and long-term achievements into games will cater more to our Achiever ambitions. Designers could use our *BrainHex* model to investigate archetype preferences in a player target group that they are considering for a game and then focus on designing for gameplay elements that these archetypes would find engaging. As our initial survey was given to gamers simply as a self-evaluation tool, many gamers could use it to evaluate their playing habits and detect changes in preference over time (since the same person might have different archetype preferences during different times and based on social and contextual factors in their life). Overall, we think that *BrainHex* helps designers, gamers and researchers to better understand motivations for playing games and behaviours exhibited during gameplay.

6.1. Conclusion and future work

The first results presented here are only the tip of the iceberg. A considerable volume of data remains to be examined, with any number of possible methods for its analysis still to be applied. In the context of comparison with its progenitor, the DGD1 survey, in terms of Myers-Briggs typological axis, the BrainHex data seems to verify the greater incidence of Introverted preference among gamer hobbyists.

However, a number of factors make it unwise to draw too strong a conclusion from these results, for instance, DGD1 actively typed respondents, while BrainHex asked respondents to provide their Myers-Briggs type *if known*. This might have produced inherent biases, depending on the distribution of knowledge of MBTI. The abundance of INFP and INTJ types in the results, despite these types only constituting 2-7% of the population, could be indicative of some kind of bias (in a sample of possibly mainly hardcore gamers) or a sampling error.

For identifying possible elements of a future trait theory of play, distortions in the sample are less relevant since any statistically significant pattern is evidence for a possible trait. Up to 4 traits are suggested by the results: (1) preference for visceral play (i.e., fight-or-flight rewards), (2) preference for aesthetic experience, (3) goal-orientation or obsessive play, and (4) preference for experiential play. It is also possible this is simply two traits: (A) preference for visceral versus aesthetic play, and (B) degree of goal-orientation. Further investigation is required to distinguish these scenarios from the four-trait alternative.

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