Chapter 15

Empirical Game Aesthetics

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15.1 WHAT ARE GAME AESTHETICS?

For much of the history of game studies, questions of aesthetics have either been downplayed or are entirely absent from the discourse, and when they have been addressed there has been no consistent deployment of the term. As Niedenthal reports, "game aesthetics" has been taken to refer to the sensory content of a game (how it looks or sounds), has been used to connect games to other art forms as a means of generalization, or it has been used to refer to aspects of the game experience (emotions, pleasures) [1]. In fact, this uncertainty as how the term *game aesthetics* should be used is mirrored by uncertainty about aesthetics as a field *even by its practitioners.* In an address to the American Society of Aesthetics, the philosopher of art Kendall Walton is forced to conclude that there is no "Grand Basic Question" in aesthetics, and the field (like philosophy of science) is more constituted by its borders than by some central theme [2].

That aesthetics is an "untidy" field is not surprising, since the domain of art is far from uniform. Dance, theater, film, painting, and sculpture are all very different media that invite different approaches in aesthetic theory, just as stars, polypeptides, bacteria, and clouds all invite different approaches in the relevant theoretical and empirical research areas. The absence of unity in any academic discipline need not be a weakness but is reflective of the multitude of methods available for investigation. The problem in the case of game aesthetics has been a certain lack of interest in executing those investigations, coupled with debilitating problems produced by disagreements over the use of the term *game* itself—conflicts that deeply mirror parallel disagreements over the term *art*, as argued in "Implicit Game Aesthetics" [3].

Rather than attempting to resolve the boundary disputes over games by asserting ever more diverse definitions of game, the program proposed by "Implicit Game Aesthetics" is to recognize that definitions of the term game are constitutive of

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aesthetic value judgments and thus to view the possible definitions as reifying those judgements. In so doing, the apparently insurmountable task of establishing a robust framework for understanding what constitutes a game becomes supplanted by the recognition that the entire domain of artefacts of play was already subdivided according to aesthetic criteria. By not adequately investigating game aesthetics, the resolution of the quixotic quest for a definitive definition of game always remained out of reach.

However, perhaps it is premature to argue that aesthetic investigations have not taken place, since a great deal of work has been conducted on *player satisfaction modeling*. Player satisfaction is a term synonymous with "fun" that simultaneously reframes the concept as a potential measurable quantity or quality [4]. However, as has been repeatedly shown in the author's work [5–9] as well as the work of Nicole Lazzaro [10, 11] and others, understanding how to satisfy players is to study the *differences* in people's enjoyment of play. Although this connection has emerged only slowly through this research, it is now abundantly clear that player satisfaction modeling is a form of game aesthetics—specifically, *empirical* game aesthetics—and as such contributes significantly to our understanding of games as artefacts and phenomena.

In the context of well-founded commercial game development, game design can be understood as a set of processes that aim at player satisfaction through the implementation of certain specifiable systems and to view that process as requiring a model of the diversity of play preferences—what can be termed *play styles*—in order for player satisfaction to be plausibly attainable. This position was forcibly argued by Bateman and Boon in the early 2000s [5] and ran contrary to the prevailing trend in game design to view the game design process as inherently driven by intuitions and thus somehow mysteriously immune from empirical investigation. The development of these ideas has led to a contextualization of player preferences in play within the framework of contemporary neurobiology [12] and linked the resulting patterns back to one of the earliest studies of play, that presented in Roger Caillois' 1958 book *Les Jeux et Les Hommes* [13]. A persuasive argument demonstrates that Caillois' observations accurately characterize the expression of discrete neurobiological mechanisms related to play, despite being formulated in the absence of any such biological foundation [6, 14].

This body of research can be united theoretically under the banner of aesthetics by adapting Walton's influential make-believe theory of representation [15] to games of all kinds [14]. This philosophical project, explored in the book *Imaginary Games* and related papers [16, 17], has the inadvertent side effect of reconceptualizing research on play styles expressly as *aesthetic* research—with the benefit of bringing cross-disciplinary perspectives to bear on the problems of how people play and why people enjoy different game experiences. This not only creates new avenues for future empirical research (discussed later in this chapter) but also constitutes a robust defence of the claim that the medium of games qualifies as art, irrespective of the aesthetic or cultural value appropriate to individual titles. (That a medium is comprised of a great many poor-quality artworks has no bearing on whether that medium should be considered art.) This potentially provides digital games some protection

against censorship in countries like the United States, where artistic expression is afforded legislative protection.

This chapter traces the development of player satisfaction models as illustrative of both the methods available for empirical game aesthetics and the problems inherent to the approaches researchers pursued in this area. Particular attention is paid to the specific player satisfaction models that have been researched, namely:

- Richard Bartle's qualitative models of multiuser domain (MUD) and massively multiplayer online (MMO) players
- Nicholas Yee's research on MMO player motivations and its connections to Bartle's work
- Nicole Lazzaro's empirically derived *four fun keys* model of play styles and Ekman's *basic emotions* model that underpins it
- International Hobo's DGD1, DGD "1.5," DGD2, and BrainHex (DGD3) models

Additionally, by reviewing putative connections between neurobiology and play as summarized in "The Neurobiology of Play" [12], a sketch of avenues for future research in this field is provided. First, however, it may be prudent to emphasize the advantages of viewing this work as allied to the philosophical domain of aesthetics by contrasting two rival theories of game aesthetics, each of which emphasizes different aspects of the play experience.

15.2 REPRESENTATION VERSUS PERFORMANCE

The city of Manchester in the United Kingdom has inadvertently established itself at the center of theoretical game aesthetics research by virtue of the publication in 2011 of two entirely distinct approaches to the application of aesthetic theory to games and play. Graeme Kirkpatrick's *Aesthetic Theory and the Video Game* [18] builds on earlier papers and adapts a theory of form, as found in the work of Immanuel Kant and Theodor Adorno, to digital games viewed as a tightly specified, narrow domain. Conversely, *Imaginary Games*, which as already mentioned takes a theory of representation developed by Kendall Walton and expands it to games of all kinds, collects all aesthetic artefacts (including games) within one theoretical perspective, contextualizing their qualities in terms of prescriptions to imagine.

The two aesthetic theories can be characterized respectively as the *form theory* of digital games and the *prop theory of games*. One distinction is immediately obvious: Kirkpatrick's form theory follows a tradition in game studies of asserting the uniqueness of the digital game as a medium, whereas prop theory insists on the exact opposite—not only are digital games contiguous with other games, they are also contiguous with other imaginative activities (such as those crudely collected under the umbrella of art). As such, the two theories are not so much rivals as alternative tools, since each is better at emphasizing certain aspects of the digital game experience. Form theory, for instance, is an entirely hopeless choice for understanding digitally represented board games, whereas prop theory not only explicates the

experience of digital board games but also applies equally well to their physical progenitors.

Although Kirkpatrick develops many threads to his arguments in *Aesthetic Theory and the Video Game*, the core of what is termed here *form theory* is that the experience of digital game players is best understood by analogy to dance. Kirkpatrick's view builds on classical aesthetic theory in understanding different art forms as having an underlying *form*, which is different from its prima facie content *and aesthetically more relevant*. He views the locus of the experience of form in the digital game as lying in the player's interaction with the controller, stating: "To fully experience the form in a game we have to draw it out by playing well and we do this with our hands" [18, p. 100]. Kirkpatrick downplays the importance of representation in favor of performance, following his thesis that the aesthetic experience of digital game play occurs in the mastery of the specific actions the player implements with the interface device, even going as far as to remark (with reference to the presumed gender bias associated with dance as an art form) that "a generation of young men have grown up dancing with their hands" [18, p. 154].

By contrast, the prop theory of games is a direct adaptation of Walton's make-believe theory of representation. The term *prop theory* directly contrasts with *pretence theory*, which is the term used to refer to this theory when deployed to understand assertions and ontology. The basic thesis is that representative art can be understood as props that prescribe specific imaginings. Van Gogh's *Starry Night* prescribes we imagine that we are looking at a night sky, despite the fact that in actuality it is merely colored paint on canvas and does not in any obvious way resemble a night sky. When a subject participates with a representative art work, they engage with it by playing a game of make-believe analogous to (but more sophisticated than) a child's game of make-believe through which they imaginatively enter into a fictional world, the contents of which are prescribed by the prop itself [15].

Because Walton's prop theory is already formulated in terms of games (of make-believe), it is ideally suited to being adapted for use in understanding play. The "virtual worlds" of digital games are no more or less than Walton's fictional worlds. All that is required to expand the theory to include artefacts for play is a distinction between the representational elements of props described by Walton and the functional elements of those props—a division parallel to Juul's distinction between fiction and rules [19]. As a result, the props of games can be understood as having dual roles—the representational role described by Walton's prop theory and the functional role within the game. These roles, however, are not distinct but intimately related. For example, the functional aspect of rolling a die in a tabletop role-playing game produces a number value, but this leads directly to a representational consequence such as the escape or death of a character within the fictional world of the game.

Prop theory helps to bring into relief the devaluation of representation in play, what can be termed "fiction denial." This is evidenced in Kirkpatrick's work but already has a long history within game studies, arguably commencing with Juul's 2001 paper "Games Telling Stories?" [20] with its vigorous attempt to exclude narratology from consideration as a means of understanding digital games. Given this

paper's publication in the first issue of the online periodical *Game Studies*, it is perhaps better understood as an attempt to assist in the formation of a game studies discipline by resisting invasion by preexisting fields such as narratology, but it nonetheless set a tone by which it was acceptable for scholars publishing in game studies to deemphasise the importance of fiction or representation in understanding digital games—elevating the functional aspects of games above their representational elements. This apparent bias may have contributed to the lack of attention paid to game aesthetics thus far.

A frequent touchstone in this regard (and one cited approvingly by Kirkpatrick [18, p. 123]) is Espen Aarseth's claim that the appearance of Lara Croft's character model in *Tomb Raider* (Core Design, 1996) is unimportant, and he would play the same even if the appearance was different [21]. It can be argued that this is merely a fact about Espen Aarseth (and others who play in a similar fashion), since for a great many players the appearance of the central character has a crucial effect on how the game is to be played by suggesting a role to assume within the fictional world of the game and hence ways to act whenever the game provides sufficient scope for self-expression. This kind of play might fit under what Aarseth has called *trangressive play* [22], since it arguably deviates from what is expected from the ideal player in any given digital game world, although research would be required to establish whether the "ideal player" concept had any empirical validity or whether it (like definitions of games) was always already a reification of prior aesthetic values.

It is true that in a *Tomb Raider* game the scope for this kind of free-form expressivity is radically less than it is in, say, a typical MMO game, but it would be premature to conclude that it was nonexistent. This is especially true when players enjoy digital games together but in a single-player context, as the contents of the fictional world of the game acquire new potentials for amusing (and often puerile) skits acted out using the character model as a doll. Indeed, following Walton's prop theory, the character model might best be understood by *direct analogy with a doll*, and *Imaginary Games* suggests the term *doll* [14] or *avatar-doll* [17] to distinguish between the avatar proper (which has always been conceived expressly as the capacity to interact with the fictional world of the game) and its representation (the character model, or avatar-doll). This distinction, which may initially seem trivial or pedantic, serves to emphasize that the term avatar is currently deployed in two contradictory senses—as the player's locus of agency within the fictional world of the game and as the representation of the fictional entity the player imagines as their surrogate within that world.

One of the key reasons for favoring a prop theoretical approach to game aesthetics over its alternatives is precisely that it foregrounds the importance of representation in the aesthetic experiences of the play of games and thus simultaneously puts games on a level playing field with other forms of representative art. These representational issues are not important to all players: Aarseth and Kirkpatrick, presumably, correspond to play styles that are (or are claimed to be) uninvolved with the representation or at least have lesser involvement with it. However, it is not unreasonable to suspect that even in these cases representation has an important role in

player satisfaction—if it did not, the digital games industry would presumably not have invested such astronomical quantities of time and money rendering their fictional worlds in such tremendous detail, since cheaper, purely abstract representations would have sufficed.

Interestingly, despite running contrary to many of Kirkpatrick's specific arguments, the prop theory of games provides no objections to the highlighting of performance found in Kirkpatrick's account. There is, in fact, potential for the core of form theory to be adapted such that it would be compatible with prop theory, and indeed in any situation whereby the principal interest concerned the functional aspects of the control mechanism (e.g., motion-controlled games), form theory could have far more to offer. Where prop theory has the advantage is in its better integration with other media, including other forms of games. Kirkpatrick asserts (drawing against game theorists such as Juul and Aarseth) the novelty and uniqueness of the digital game as a medium [18, p. 1]. This seems to cruelly deny the historical and genealogical connectivity of predigital games to their descendants.

This orphaning of digital games from other forms of play risks a significant loss of clarity: Not only are electromechanical games such as pinball or Sega's *Periscope* (1966) and *Duck Hunt* (1969) clearly a direct influence for the early digital arcade games that followed, but Kirkpatrick's form theory would ironically be just as well suited for application to these machines as contemporary digital games! What's more, as argued at length in *Imaginary Games*, tabletop games in general and *Dungeons & Dragons* (TSR, 1974) in particular are a major source of influence on the design of digital games, and elements originating in this game can now be found in everything from *World of Warcraft* (Blizzard, 2004) to *Call of Duty 4: Modern Warfare* (Infinity Ward, 2007), not to mention *FarmVille* (Zynga, 2009) [14]. When theory distorts our understanding of history, it is a clear sign it needs either modification or retirement.

To understand player satisfaction in the context of digital games, it is valuable to be able to deploy the resources of *both* current theories of game aesthetics—form theory in terms of understanding the crucial importance of control mechanisms, especially for those games involving quick reactions or fluid bodily motions, and prop theory in terms of appreciating the influence of representation on player enjoyment and expression. What neither theory can provide is predictions of the actual behavior of players in connection with digital games in general or in the context of specific cases. For this, theoretical game aesthetics must turn to its empirical cousins.

15.3 PLAYER SATISFACTION MODELS

The earliest player satisfaction model, Richard Bartle's *Bartle types*, was expressly qualitative in nature but was followed by Nicholas Yee's statistical study of a similar subject area and in many respects broadly validated Bartle's assumptions. However, probably the first empirical player satisfaction model is Nicole Lazzaro's four fun keys, which is roughly contemporaneous to International Hobo's DGD1 study. These

Table 15.1 Bartle Types

Bartle Type	Original Name	Player Focus
Achiever	Diamonds	Acquiring points, levels, equipment, or other attainable symbols of success within the game
Explorer	Spades	Engaging in learning about the game, discovering hidden places, creating maps, or otherwise "digging" into the nature of the game
Socializer	Hearts	Social engagement with other players
Killer	Clubs	Direct competition with other players

models, and their descendents, constitute the main points of reference for empirical game aesthetics thus far.

15.3.1 Bartle Types

In an article first published in 1996, Richard Bartle offered an informally derived, qualitative model of the players participating in early, text-based multiplayer game environments known as MUDs [23]. This paper formed the inspiration for other researchers to produce a test that would output one of four types [24], based on Bartle's original categories, as shown in Table 15.1. This work later inspired Yee to investigate the audience for multiplayer environments (at that point, no longer text based but graphically rendered), which afforded the possibility of assessing the empirical value of Bartle's qualitative categories [25]. Initial findings by Yee suggested that at least three of Bartle's patterns (all but explorer) had some statistical validity, and in a later analysis Yee offered two separate constructs which reflected the missing explorer, thus suggesting all four Bartle's types were gesturing in a sensible direction [26].

Unfortunately, while the model may survive some critical scrutiny, the Bartle test does not. As Yee notes, the "just-so" quality of the model risks becoming self-fulfilling: When the questionnaire asks its subjects to make a choice between the achiever and explorer patterns, a dichotomy results *as a result of the method used*, even if the underlying factors would not support such a distinction [25]. Additionally, the test is constructed on the basis of the subject choosing between pairs of scenarios, and specific pairings can introduce significant bias into the final results. However, the Bartle test was never intended to be a robust instrument, and the fact that it is not does not detract from the value of Bartle's model, which Yee's research demonstrates had some validity.

15.3.2 Yee's Five Motivations

Following Bartle's qualitative discussion of player satisfaction in MUDs, Yee's work attempts to develop a prototype trait theory for player satisfaction within the narrow

Table 15.2 Yee's Motivations

Motivation	Focus	Closest Bartle Type
Relationship	Developing meaningful relationships with other players	Socializer
Immersion	Engaging with fictional world as an imaginative exercise, including desire to role play	—
Grief	Objectifying other players for purposes of entertainment or gain	Killer
Achievement	Becoming powerful within fictional world of game	Achiever
Leadership	Operating in group context and taking command of those groups	—

context of massively multiplayer games [25, 26]. Such a model inherits the limitations of the Bartle-type model in terms of being extremely domain specific but has greater empirical validity since it is derived from statistical analysis of test results. Yee offers a set of five motivations as his player satisfaction model, as shown in Table 15.2.

However, Yee's motivations have been subject to criticism from de Castell et al., who note that the Daedalus survey which Yee's work is based on "likely draws far more upon the self reports of more invested and expert players" and therefore cannot necessarily be generalized to all players of massively multiplayer games [27]. De Castell and her fellow researchers also note that self-report is an unreliable source of data, demonstrating this robustly in their own research on player-avatar fidelity. Self-report is categorically not a reliable method for accurate data gathering, and this recognition places severe limits on almost all the player satisfaction models developed thus far. Nonetheless, there is a pressing requirement for player satisfaction models, even when they are flawed. As Bartle himself notes, game designers "must understand their players" [24], and every method of exploring how and why people play specific games will run up against limitations.

15.3.3 Lazzaro's Four Fun Keys

The most robust empirical study of player satisfaction conducted thus far is that conducted in the early 2000s and which resulted in Nicole Lazzaro's four fun keys model [10]. Lazzaro built on the work of emotions researcher Paul Ekman and used Ekman's Facial Action Coding System (FACS) to examine the emotions players displayed while playing their favorite games. Lazzaro has been key to the dissemination of the relevance of one of Ekman's emotions to play, specifically what Ekman termed *fiero*, after the Italian name for the experience of triumph over adversity [28]. Fiero—the intense feeling that causes winning athletes to raise their arms aloft or pump their fists—transpires to have a key role in some (but not all) players' enjoyment of games, as will be discussed below in detail. Lazzaro's work also highlights

Table 15.3 Lazzaro's Four Fun Keys

Fun Key	Original Name	Emotions	Player Experience
Hard fun	—	Anger (experienced as frustration) and fiero	Struggles to attain victory, attainment of which is highly rewarding
Easy fun	—	Wonder, awe, curiosity	Attention maintained by interest rather than by motivation toward winning
Serious fun	Altered states	Excitement and relief	Engaged with game's core tensions
Social fun	People factor	Amusement, schadenfreude (pleasure in misfortune of others), and naches (satisfaction in success of someone mentored)	Engagement with game secondary to engagement with other players via game

the importance of curiosity to play, something that was foreshadowed by the work of Thomas W. Malone in the early 1980s [29, 30].

Lazzaro produced a player satisfaction model based on four sets of emotions, where each grouping corresponds to a particular play experience observed in her study [11], as described in Table 15.3. The empirical foundations of Lazzaro's approach are strong, although the final model is quite coarse grained. Despite its flaws, precisely the merit of Yee's model is its wider scope and its applicability to practical design issues. Lazzaro's model, conversely, is lacking in internal distinction: All play that results in fiero is taken as expressing hard fun (precisely because the category is defined by the emotions displayed) so distinctions such as the leadership motivation in Yee or the killer archetype in Bartle are bleached out. Similarly, the range of play experiences which express excitement and relief is vast, and there are likely to be severe limits to what can be concluded by treating them as equivalent, especially (as discussed below) when fear is also considered in the context of play.

15.3.4 DGD1 and Myers–Briggs Typology

At the same time that Lazzaro was conducting the research into the emotions of play, International Hobo Ltd. was investigating the application of instruments originating in psychology to the question of how and why people play games, in the first case by taking Myers–Briggs typology and using it as the basis of a survey investigation. This research set out to investigate a prevailing unstated hypothesis within the digital games industry that characterized the enjoyment of games primarily as the overcoming difficult challenges, a perspective sometimes characterized as "hardcore." This term was simultaneously applied to the most dedicated players of digital games (such as the typical member of staff at a games developer) and contrasted against "casual" players, about whom rather little was known at that time.

The study was conducted between 2003 and 2004, with the results originally published as a booklet [31], and the following year as part of the book *21st Century Game Design* [5]. In both cases, the name *demographic game design 1* (DGD1) was used to describe the study. The DGD1 model was the first attempt to provide a quantitative complement to Bartle's qualitative model of player types and, moreover, the first attempt to provide a model of player preference across *all* kinds of play, including tabletop games. It was motivated by the hypothesis that players who would self-identify as hardcore would primarily show higher scores in the Myers–Briggs axes of introvert, thinking and judging, or perhaps just introvert and thinking. However, this was not what was found. Although hardcore players *did* score more highly in introvert, as predicted, the only other axis bias in the hardcore cluster was towards intuition—something not considered prior to the study. In the light of Walton's make-believe theory, the significance of this finding becomes clearer, since in the psychological literature the intuition axis in Myers–Briggs typology (like openness to experience in "Big Five") is associated with imaginative faculty: The dedicated players of games were not more deeply into challenge; they were more deeply into *imagining* [14].

However, the findings with respect to the motivating hypothesis were less interesting than the general pattern that was revealed in the relationships between the hardcore and casual players surveyed. When arranged according to four best-fit clusters within a hardcore and casual grouping, there was a match between hardcore players fitting one part of the Myers–Briggs spectrum and the equivalent casual players. Thinking and judging—purportedly matching hardcore players' supposed desire for tough challenges—did correctly predict challenge seeking, but it found such players (termed *conquerors*) in *both the hardcore and casual clusters.* Furthermore, thinking without judging constituted a play style apparently focused on strategy games and other heavily decision-focused types of play, and again players matching this pattern (which we termed *managers*) could be found in *both* the hardcore and casual clusters. The same pattern occurred in the other two "boxes" produced by the grouping—whatever style of play was expressed by subjects in the hardcore grouping, a similar style of play was found to be expressed by the equivalent subjects in the casual grouping.

This was the principal discovery of the DGD1 survey: Hardcore and casual were not different play styles at all but rather expressions of a different degree of interest in games as a hobby. Hardcore players could be better understood as gamer hobbyists [9]—players who bought and played many games and spent a lot of their spare time playing them. Casual players were simply the remainder of the population once these hobbyists were set aside. We found four different play styles, each of which had a hardcore and a casual version (although in the case of our fourth category, termed *participant*, a bug in the survey program meant radically incomplete data and an inability to draw convincing conclusions). The fact that four play styles were found is unimportant, being a consequence of the analysis methods used: The important discovery was that there were distinctly different play styles that could be identified. The four reported play styles are described in Table 15.4.

Table 15.4 DGD1 Play Styles

DGD1 Type	Player Motivation	Four Fun Key Equivalent
Conqueror	Pursuit of difficult challenges in order to overcome them	Hard fun
Manager	Puzzle solving or pursuit of strategic problems	Hard fun
Wanderer	Engagement with fictional world of game	Easy fun
Participant	Involvement with other players or with fictional characters within world of game	Social fun

These findings have significant parallels both with Lazzaro's four fun keys and with Bartle's "suits": The participant partially reflected Bartle's socializer type, while Lazzaro's hard fun perfectly matches the DGD1 conqueror play style. There was also the possibility that the wanderer play style was reflective of Lazzaro's easy fun and Yee's immersion motivation. However, this study suffers from all the limitations of Yee's work, as critiqued by de Castell et al.—it relies heavily on self-report—and furthermore inherits significant limitations from the psychological instrument on which it was based [7].

15.3.5 The Five Factor Model and Player Satisfaction

The use of Myers–Briggs typology in studying empirical game aesthetics can be contrasted to work connecting the five-factor model (FFM) to player satisfaction, although in this latter case the results have lacked consistency. Teng reports that the FFM traits of openness, conscientiousness, and extraversion relate to a preference for playing online [32, 33]. However, reporting on a study that builds on the DGD1 work, Veronica Zammitto compared the FFM traits to an inventory of game genres. While this work confirmed extraversion as having some relevance for online play preference, it associated low scores for agreeableness and openness in this context, directly contradicting Teng [34]. All three of these studies contradict the DGD1 survey, which suggested higher introversion was to be expected among online game players when compared to the players of other kinds of games [5].

Just as with Myers–Briggs typology, there are inherent problems trying to deploy FFM for player satisfaction. Teng notes that if personality measures obtained in a game context differ from those obtained in a real-world context the validity of FFM (or any other psychological instrument) would be irreparably disrupted [33]. Zammitto identifies an additional problem, in so much as personality factors in her study explained only 2.6–7.5% of game preferences [34]. While statistical relations to FFM are obtainable, it is clear that they are at best one variable among many. As several researchers have argued, models of play produced by importing theories from other fields suffer inherent and insurmountable limitations, and thus there is a pressing need for game studies to develop new theoretical frameworks that are *expressly focused on play* [7, 27].

15.3.6 Other DGD Studies and BrainHex

The DGD1 was conceived as the first of many models (hence the 1), and the next two studies by International Hobo, known as DGD1.5 and DGD2, were conducted in 2006 and 2007. The former study produced some evidence pertaining to the strengths and flaws of the DGD1 model, while the latter study received far more robust statistical analysis than any earlier survey, although results were not published as a paper until 2011 [7]. As this later paper attests, the reason for the lack of publication was the researchers' general disappointment in the survey method as a reliable tool for player satisfaction modeling, and an increasing distrust of type-based psychological instrumentation as a reliable tool for sorting subjects.

One final survey-based study, BrainHex, was conducted by International Hobo in 2009, and this final survey (which can be considered DGD3) produced radically greater quantities of data: Whereas DGD1 had attracted 573 respondents, DGD1.5 had sourced 319 subjects and DGD2 some 1040 respondents, BrainHex rapidly cleared 50,000 responses and has been taken by at least 80,000 subjects to date. Drawing from hypotheses drafted after an extensive literature review of contemporary neurobiology that was published as the paper "The Neurobiology of Play" [12], a number of papers have reported on the results of the BrainHex survey [7–9], but the real value of this model is as a signpost toward future research. Whereas the inventories of play styles produced by earlier surveys had been conditioned by elements of the design of either the surveys or their statistical analysis, the play styles presented in BrainHex were all hypothetically specified, since each corresponded to a different neurobiological mechanism that had been reported in the literature [12].

Table 15.5 BrainHex Play Styles

BrainHex Class	Player Motivation	Other Models
Daredevil	Enjoyment of time–pressure and intense excitement	Lazzaro's serious fun
Survivor	Preference for experiences producing fear	—
Achiever	Desire to complete long-term tasks for their inherent satisfaction	Bartle's achiever, Yee's achievement motivation
Conqueror	Preference for difficult challenges and consequent emotional reward of fiero when these are overcome	Lazzaro's hard fun, DGD1 conqueror
Mastermind	Enjoyment of puzzles and strategic problems	Lazzaro's hard fun, DGD1 manager
Socializer	Desire to engage with other players	Bartle's socializer, lazzaro's social fun, Yee's relationship motivation, DGD1 participant
Seeker	Enjoyment of curiosity and wonder and desire to engage with elements of games as fictional worlds	Bartle's explorer, Lazzaro's easy fun, Yee's immersion motivation, DGD1 wanderer

The seven play styles of the BrainHex model are as described in Table 15.5. However, these play styles can also be interpreted as the basis of candidate traits for a future *trait theory of play*, something game studies requires if it is to adequately address the problems of player satisfaction modeling [7]. The remainder of this chapter explores these candidate traits and the play styles that relate to them as well as describe the neurobiological foundations on which they are based.

15.4 NEUROBIOLOGICALLY GROUNDED PLAY STYLES

As a result of all the research into player satisfaction modeling conducted thus far by various researchers, a set of eight candidate traits for a future trait theory of play can be proposed, seven of which are related to specific play styles in the BrainHex model, as described by Table 15.6. As noted, these candidate traits draw directly from the literature of neurobiological research, albeit hypothetically. A switch of focus to neurobiology, rather than direct observation of play behavior and emotional responses (such as in Lazzaro's research), involves a trade-off, as all shifts in focus and scale entail. Going "deeper" into the biology gives advantages in terms of hypothetically stronger foundations to any research—as well as the potential to unlock

Table 15.6 Candidate Traits for Future Trait—Theory of Play

Candidate Trait	BrainHex Equivalent	Description
Openness to imagination	—	Proceeds from finding of DGD1 that distinction between gamer hobbyists and mass market players appears to relate to capacity to imagine.
Frustration endurance	Conqueror	Ability to enjoy fiero from difficult challenges requires ability to withstand frustration requisite to attainment of eventual victory. This can be characterized as frustration endurance.
Boredom endurance	Achiever	In order to attain the satisfaction of completion of particular aspects of a game, it is necessary to keep playing even when other players would lack interest in doing so. This boredom endurance may relate to the enjoyment of achievement in games.
Confusion endurance	Mastermind	Ability to enjoy fiero attained from overcoming difficult puzzles requires the endurance not of frustration but of the confusion implied by the uncertainty of an unsolved problem. This can be characterized as confusion endurance.
Time–pressure preference	Daredevil	Enjoyment of stress produced by limited time requirements, for example, challenges that must be completed within certain target time.

(*Continued*)

Table 15.6 (*Continued*)

Candidate Trait	BrainHex Equivalent	Description
Fear preference	Survivor	Enjoyment of "unpleasant" emotions such as fear and disgust and of game play that enhances experience of fear, such as survival–horror games, which limit supplies in order to heighten anxiety.
Group preference	Socializer	Enjoyment of social context of group of players as opposed to desire to play games alone.
Interpretive preference	—	Enjoyment of those situations which provoke curiosity, those that are richly interpretable.

new research options by utilizing recently developed tools and equipment. Against this, there is the loss of particularity involved in retreating from the actual observation of behavior to its mere substrate. This kind of abstracting away from experience is sometimes presented as a gain in clarity, but there is always a corresponding risk of becoming confused about the causal relationships entailed, especially at the extreme end of the scale, where evolutionary or genetic claims attempt to substitute for the subtleties of actual life, as critiqued in *The Mythology of Evolution* [35].

In the case of BrainHex, the motivation for the change of focus was pragmatic: The psychological instruments being used in the DGD studies were clearly placing limits on what could be concluded and did not attain to a degree of robustness that could survive transition from one context to another, for example, from generalization of behavioral preferences to generalization about play preferences. Frankly, it was not even clear they were sufficiently robust in their home domains, since type theories were coming under increasing scrutiny and criticism [7]. The best case would be the creation of new instruments expressly developed for the relevant domain (that is, play), but how would such instruments be grounded? Neurobiology seemed a plausible avenue of investigation, especially since other than Lazzaro's FACS work, biometric measures had proven rather disappointingly vague at characterizing the diversity of play experiences except in certain narrow contexts [36].

Another advantage of the switch of focus to neurobiological mechanisms was that there was still a clear continuity with earlier work. Both Lazzaro's research and the DGD surveys made emotions of play central to research, with DGD2 being expressly structured as an investigation via self-report of player's emotional preferences in the context of play. These emotions could all be linked to underlying neurotransmitters and brain regions (albeit with some loss of psychological detail as a result of the shift). Further, after the comprehensive literature review detailed in "The Neurobiology of Play" [12], it was clear that the hypothetical play styles would broadly form a superset that could incorporate not only the work of the DGD studies and Lazzaro's four fun keys but potentially Bartle types and Yee's motivations as well, adding to the sense that this move could serve as a unification of prior research and a stepping point for further investigation.

A brief digression concerning the concept of "basic emotions" is prudent. As already noted, Lazzaro's study is founded on the work of Paul Ekman [28, 37], which involves cross-cultural observation of facial expressions relating to emotional experiences in order to establish a suite of emotions that are "basic"—a term defined by Ekman in this context as meaning the phenomena in question has distinctive physiology, universal signals (e.g., facial expressions), universal antecedent events, unbidden occurrence, and unconstrained targets [38]. As valuable as Ekman and Lazzaro's work is in understanding how and why we play and as groundbreaking as Ekman's work has been in overturning a once-prevailing view of culturally embodied emotions, the basic emotions project risks misguiding emotional studies into a state whereby a given claim is viewed as well founded only in so much as the emotions in question fit criteria Ekman has reported *descriptively* of the emotions that were *easiest* to validate as universal.

The nature of this criticism is that psychology papers referring to basic emotions sometimes mistakenly claim that the "basic emotions" are those which Ekman has *already* demonstrated fit his universality criteria, namely, anger, fear, surprise, sadness, disgust, contempt, and happiness [28]. Ekman himself *does not* hold this view and asserts that he believes evidence will be forthcoming to support a further 10 emotions he has described but *not yet* demonstrated universally, namely, sensory pleasures (visual, auditory, tactile, gustatory, olfactory), amusement, relief, excitement, wonder, ecstasy, naches, fiero, schadenfreude, and rejoicing, many of which are of crucial importance to play, as Lazzaro's work demonstrates [10]. The necessary evidence may not emerge if the work is not done to complete the research Ekman began, and this requires a certain agnosticism as to which emotions will ultimately prove to be "basic" in Ekman's sense.

Furthermore, there are good reasons for suspecting that the basic emotions construct drafted by Ekman will need to be revised before a complete appreciation of this issue can be attained. The examination of the neurobiological foundations of emotional experiences pertinent to play demonstrates that there is an alternative way of characterizing the fundamental components of emotional experience that would view universal facial expressions as *consequent* on underlying neurobiology, rather than consistent with the purported basic property. In other words, there are complementary "top-down" (psychological investigation of basic emotions) and "bottom-up" (neurobiological investigation of neurotransmitters and brain areas) research methods to be deployed, each of which risks being misleading if taken in isolation. Considerably more research *in both avenues of investigation* is required before strong conclusions about a universal suite of emotions (whether these are to be termed basic or otherwise) can be attained. In the meantime, however, Ekman's list of emotions—even including those which are excluded from universality on technicalities, such as guilt, shame, embarrassment, envy—can usefully provide a common vocabulary, irrespective of the unknown final outcome of the basic emotions project.

What follows is a description of the seven hypothetical play styles of BrainHex, their neurobiological inspirations and associated emotions, and their links to other player satisfaction models. Although this serves as an inventory, it is neither a

requirement nor an expectation that these seven play styles would form a type-based theory of play—indeed, *precisely the opposite is intended*, namely, that abstracted to plausible candidate traits (described above) these patterns might be the partial basis of a future *trait theory of play*, which would need confirming by empirical game aesthetic studies. The descriptions of the play styles explain their connection to the literature and also provide the transition to the candidate traits.

Each of the play styles presented in what follows represents a persona archetype associated with a hypothetical trait, and the terms *archetype* and *persona* are used interchangeably in what follows to refer to the metaphorical player for whom a given play style is a perfect fit. The advantage of the persona representation is cognitive accessibility [39] and should also be understood as a part of the "marketing" of the BrainHex survey, which attracted more respondents by couching the questionnaire as a tool for self-discovery (its public face) rather than a coldly rational scientific investigation (its private face). It is a fringe benefit of this approach that BrainHex provides an accessible summary of the state of research into the putative neurobiological foundations of play and the emotions of play.

15.4.1 Daredevil: Epinephrine, Excitement, and Time Pressure Preference

In his groundbreaking study of the diversity of play, Roger Caillois drew attention to four specific patterns that he felt typified interesting relationships within cross-cultural play (without wishing them to be construed as a taxonomy) [13]. When linking Caillois' patterns of play to neurobiology, one of his four patterns can be identified as being, in a certain sense, more fundamental than the others [6]: *ilinx*, or vertigo, those kinds of play that involve a momentary disruption of perception that can "inflict a kind of voluptuous panic upon an otherwise lucid mind" [13, p. 23]. Caillois' ilinx is the joy of rollercoasters, a kind of fear-without-fear that is psychologically linked to the emotion of excitement and biologically linked to the neurotransmitter epinephrine (known more commonly as adrenaline) [6]. This play experience is fundamental (or foundational) since *all* forms of play involve excitement, in some role, but only ilinx concerns solely or primarily this experience.

The DGD studies had not been formulated in a way that allowed for the concept of an excitement-focused play style to come into focus, in part because their approach was concentrated on clear areas of psychological diversity and with respect to excitement there is much greater commonality—as the DGD2 study revealed, only 1% of respondents reported they do not enjoy experiencing excitement, and even this figure may reflect incorrectly completed surveys or inaccurate self-report rather than a genuine phenomenon [6]. However, case studies revealed a particular way of playing games that was expressly interested in excitement to such a degree that it putatively constitutes a play style in its own right, namely, preoccupation with time and speed. This behavior is typified by what is known as a "speed run" whereby players are focused on completing a (familiar) section of a game, or the entirety of a game, in the fastest possible time.

For BrainHex, this active interest in time pressure became the daredevil persona, although this archetype was the least popular in the survey, making up only 5.8% of the respondents. However, in terms of identifying the diversity of play, minority play styles are just as interesting (if not more interesting) than majority play styles, since they reflect ways of playing that are normally invisible, or barely visible, since other forms of play tend to obscure them. In the case of the daredevil, what is also interesting is the converse case: The commercial success of *Bejeweled* (PopCap, 2001) can in part be attributed to its ground-breaking decision to offer players a choice between playing with or without time pressure. Based on case studies and informal discussions, it appears that a great many players were drawn to *Bejeweled* precisely because they could play without the anxiety associated with time pressure. There seems, therefore, to be a potentially measurable trait associated with time pressure, which in the case of the daredevil archetype serves as a positive draw toward enjoyment of play, and in the case of contrary inclinations serves as a negative influence away from participation in play. This time pressure preference putatively manifests as a predilection for turn-based play at one extreme and real-time play at the other and can be considered a candidate for a future trait theory of play.

This time pressure preference, and the closely related daredevil persona, have useful lessons for practical game design by drawing attention to a key difference in how people approach games. While the vast majority of players want to be excited, the experience of play will only be perceived as exciting—rather than stressful and unpleasant—while the player remains within their "comfort zon." Giving players a choice to opt out of time pressure (as in the example of *Bejeweled*) expands the potential audience for any game whose design affords this possibility. Furthermore, in games where different difficulty levels are offered, varying the degree of time pressure by offering extra time on lower difficulties (or even eliminating time pressure entirely on low-difficulty levels) provides a way of ensuring superior player satisfaction in the relevant cases.

Conversely, inclusion of design elements that *enhance* this kind of time pressure are likely to *narrow* appeal while enhancing the enjoyment of players for whom time pressure is acceptable or desirable. One example of this is the use of what is called, after *Shenmue* (Sega AM2, 1999) *Quick Time Events* or QTEs, a type of mechanic that has recently become widespread. *Resident Evil 4* (Capcom Studio 4, 2005) is a stand-out test case, since earlier games in the franchise have no equivalent mechanic, and reviews (especially user reviews) single out the inclusion of QTEs as questionable. In this case, their inclusion likely serves the conqueror archetype's focus on victory over difficult challenges (since the QTEs represent additional challenges) more than they serve the daredevil archetype's enjoyment of time pressure, although further study would be required before drawing any conclusions.

15.4.2 Survivor: The Amygdala and Fear Preference

If Caillois' ilinx can be characterized as fear without fear, there is also a closely related play experience which could be better characterized by Walton's term

quasi-fear [15, 40]. According to Walton, when we participate in fiction, we experience some emotions that are analogous to genuine emotions but also recognizably disjunct from them, terming these *quasi-emotions*. In the case of quasi-fear, which Walton's philosophy is particularly associated with, the subject has a genuine emotional experience but it is not plausible to consider it fear, per se, since "Fear emasculated by subtracting its distinctive motivational force is not fear at all" [15, pp. 201–202].

As developed in *Imaginary Games*, Walton's notion of quasi-emotions presents particularly interesting questions in the study of games since there are many situations in which it may be impossible to distinguish between an emotion and a quasi-emotion [14], but in the case of quasi-fear the distinctions are apparent: No matter how much the person emerging from the horror film at the end of the screening says they were afraid, it is apparent that they were *not* afraid in a genuine phenomenological sense since they still remained seated throughout [40]. In both fear and quasi-fear, the neurochemical responses are essentially identical—epinephrine is released by the adrenal glands, just as it is in excitement, but unlike excitement there is also a response from the amygdala, a part of the limbic system associated with preconscious emotional reactions, including fear responses [41]. Crudely speaking, both excitement and fear are founded on epinephrine, but it is the amygdala which "decides" whether we feel afraid.

Oddly, whereas fear is expressly a negative experience, quasi-fear can be highly enjoyable—as the success of horror movies appears to indicate. Philosopher Noël Carroll's theory concerning horror pleasure denies that it is the fearful aspect of the experience that is the origin of the appeal, preferring curiosity as the relevant element [42]. However, Eduardo Andrade and Joel Cohen have suggested an explanation based on empirical research that (indirectly) supports Walton's quasi-fear interpretation by suggesting it is the awareness of the fact that what is being experienced is fictional that creates the conditions for enjoyment [43]. Regardless of the specific explanation, the distinction between excitement and fear as experiences creates another hypothetical play style within the BrainHex inventory, that of the survivor.

Whereas the daredevil's interest was functional—speed and time targets—the survivor's interest is expressly representational—terror and (perhaps) disgust. Like the daredevil, it is a minority archetype, constituting just 6.6% of the respondents, but equivalently to the daredevil, the fact that some players actively seek out disturbing or disgusting experiences whereas others actively avoid them suggests that the survivor persona is a pointer toward another potential element in a trait theory of play. Fear preference would hypothetically distinguish between those individuals who actively desired or sought out experiences of quasi-fear and those at the other extreme for whom quasi-fear constitutes a reason to avoid a particular article of media. This would not only be a contribution toward a trait theory of play; it could potentially be part of a wider trait theory of representational aesthetics as well.

In terms of practical game design, the important lesson from fear preference is similar to that of time pressure preference: Elements that add enjoyment for one portion of the audience for games may also narrow appeal to the remaining portion. This may be especially true of the experience of horror in games—those who are

undeterred by scary, horrific, or disturbing themes (which should not be equated with blood and gore, which in itself may divide the audience) can have their enjoyment of a game significantly enhanced by the horror movie's playbook of tricks. However, other players will not want to play any game that operates in this space, making it vital to ensure that both representational and functional elements of a game's design are sensibly connected to its intended audience.

15.4.3 Achiever: Dopamine and Boredom Endurance

Named after the Bartle achiever type, this play style is positioned in the BrainHex inventory as essentially central, in as much as all play involves enjoyable emotions whose neurobiological substrate includes the neurotransmitter dopamine. In the case of the achiever, these core rewards are the dominant theme; in the case of other personas, alternative mechanisms that also trigger a release of dopamine play a greater role [8]. In Bartle's work, the achiever is sometimes presented in a social context, as a desire to attain status through excessive success within the parameters of any given game, for example, to acquire a particularly rare type of equipment to "show off" to other players [23], but the BrainHex achiever persona does not make any presumptions as to social motivations and solely focuses on the relationship between actions taken in games and the consequent emotions. What the BrainHex achiever and Bartle type achiever share in common can be characterized as the desire to 100% games: to complete every challenge that is set and to attain every accolade that can be awarded.

Note that although the achiever is conceived as a persona pursuing the completion of challenges, overcoming challenges is *not* the de facto motive of a player who fits this archetype. The conqueror play style is expressly challenge motivated in this way, while for players matching the description of the achiever (in direct contradiction to conqueror-style play) some difficult challenges may be undertaken and defeated *without* that process being intrinsically enjoyable. This also means that some players whose attitudes can be characterized in the manner of the achiever persona will be content to use unorthodox means to attain specific goals, even if this voids the challenge itself (a form of play that would be anathematic to players fitting the conqueror archetype). In other words, an archetypal achiever may be willing to cheat if it gets them the necessary rewards, because their ultimate goal is having completed everything and *how* that is attained may be of lesser importance.

Neurobiologically, the achiever play style reflects the basic motivational structure of the limbic system: Dopamine is released (primarily from the nucleus accumbens) on the completion of goals [9, 12]. This goal completion is, in principle, rewarding for *all* players, and thus what makes people fitting this archetype interesting is not that they are motivated toward attaining goals but rather that players fitting this archetype are *completist* about goals. This choice of term implies that the achiever persona tends toward obsession, and this implication is intentional: Particularly when viewed through the eyes of other players, the achiever play style seems to lean heavily toward obsessive-compulsive tendencies, which fits with the

growing body of research linking obsessive-compulsive behavior to dopamine and not serotonin as previously presumed [44, 45].

In terms of a future trait theory of play, the achiever play style points to a possible trait that could be termed *boredom endurance*. Although the research literature only hints at the experimental investigation of this trait (such as in "Implicit Game Aestehtics" [3]), observations of players who fit the achiever archetype suggest that such players are more than willing to tolerate tasks that other players would consider repetitive or uninteresting—to undertake "the grind" [14] to a degree other players would consider unacceptably tedious. Hypothetically, the pursuit of the future reward exemplified by the 100% goal state provides motive to endure boredom. It has been established that the nucleus accumbens provides dopamine in response to "near misses" in gambling [46], and it is plausible that a similar mechanism applies in the case of players fitting the achiever archetype who may experience dopamine release in connection with steps contributing toward an overall goal state of attaining 100% equivalent to the gambling near-miss effect. Further empirical research could shed light on this phenomenon and help explicate the biological substrates of the achiever persona's purported aesthetic preference for completism.

The connection with gambling also relates to Caillois' patterns of play, since one of the patterns Caillois identifies, *alea*, is expressly associated with gambling and all games of chance [13]. Accepting that the Caillois ilinx is (in a sense) fundamental since all forms of play entail some degree of excitement, there is a sense that alea is the next step in the path since it adds to the raw experiences of excitement (or fear) the possibility of winning, which is underpinned by dopamine [6]. In mild form, these manifest as enjoyable emotions such as contentment, which in the context of DGD2 had been hypothesized as having a bigger role in play than had been previously suggested, a claim broadly confirmed by the DGD2 survey [7]. However, under certain more extreme conditions the emotional experiences putatively connected with dopamine become much more intense. These powerful experiences of victory are the subject of the next BrainHex archetype, the conqueror.

Considered in the context of practical game design, boredom endurance may appear to have little to offer since clearly no player knowingly enjoys being bored. However, what boredom endurance brings to light is the difference between the experience of grinding—that is, knowing and saying that one is grinding—and the design of game systems that can be "ground" (i.e., repetitive reward structures). In fact, repetitive reward structures—whether randomly constructed or based on fixed progression requirements—are almost universally compelling and indeed addictive [47]. The problem of grinding is not that repetitive play is offered, since almost all successful games are designed around repetitive core game loops. Rather, the problem of grinding is the player's *awareness* that they are pursuing repetitive actions *solely* for the purpose of progression or advancement.

In this respect, the successful functional designs that lead to grinding (such as the class and level systems of computer RPGs, the mechanics of which originate with *Dungeons & Dragons*) are categorically not the problem. The issue is the connection between the representational level of the game world and these mechanics, since it is precisely when the disconnect between these two aspects comes into focus

that players complain about grinding. Consequently, superior representational design offers the potential to alleviate complaints about grinding by securing the game mechanics into more symbiotic relationships with the fictional world of the game. Players of tabletop role-playing games *do not* complain about grinding, even though the mechanics are the same as in computer RPGs: The richer fictional world maintains their attention, and the mechanics fall into the background. It is precisely when boredom with the fiction sets in that players become aware of the repetitiveness and complain about the grind.

15.4.4 Conqueror: Fiero, Testosterone, and Frustration Endurance

The essence of the conqueror play style is challenge, specifically the struggle to overcome difficult challenges. The term *conqueror* was coined in the DGD1 model to describe the approach to play which prior to the research had been associated with the term *hardcore*. However, the DGD1 survey, as already noted, discovered that a proportion of both self-assessed hardcore and casual players matched the characteristics of the conqueror persona. Within Caillois' patterns of play, the relevant kind of games are termed *agon*, or competitions, and indeed players fitting the conqueror archetype thrive on direct competition and tend to perceive all play as being competitive, whether directly or indirectly. Continuing the stance of viewing Caillois' ilinx as fundamental and alea as adding winning to excitement, what agon adds to the emotional experience of play is frustration, which is to say *anger*.

Key to the importance of fiero for play is not that it is triumphant, but that this victory occurs against a background of struggle. This is the connection with anger (experienced as frustration), which Lazzaro notes is not a *necessary* prerequisite to experiencing fiero although it is an exceptionally common precursor [11], and even when anger is not felt or expressed *immediately* before an experience of fiero it may still be in the implicit background. For example, a player that beats a challenge they know (from previous experience) is difficult, but without problems in their current attempt, may experience fiero. Such a player is likely to have felt frustrated (angry) during the prior experience that established the particular pursued goal was challenging, and as such the essential relationship between anger and fiero is preserved.

The conqueror persona's emotional experiences of difficult play can be related to the fight-or-flight instincts first reported by Walter Cannon in 1929 [48]. The "flight" instinct corresponds to the survivor archetype described above (fear, resting on epinephrine as its substrate), while the "fight" instinct corresponds to the conqueror archetype. It is anger (experienced as frustration) that provides the motive to fight rather than flee or, in the context of sport and games, to rise to the challenge instead of retreating from it [6]. Neurobiologically, the principal underlying chemical in the case of anger is norepinephrine [12], which is not only chemically similar to the epinephrine underpinning excitement and fear, but both chemicals are synthesized from dopamine, the chemical basis of biological motivation [14]. It has been hypothesized that fiero will eventually be demonstrated to be a large release of

dopamine [12] and on this basis we can putatively suggest that anger serves as a "fiero enhancer" inasmuch as the greater the challenge (the stronger the experience of frustration) the more intense the experience of eventual triumph.

The importance of the conqueror play style to digital and other games is not simply in its positive description of a particularly potent way of enjoying games but also in its *negative* implications. While one in five (20.5%) respondents in the DGD2 survey reported that anger increases their enjoyment of a game (as is consistent with the description of the conqueror archetype), the majority of respondents (42.0%) reported that they actively avoided games that made them feel angry [7]. Although problems of self-report apply, this observation is backed up by case studies that repeatedly demonstrate a significant divide between players who are open to conqueror-style play (those who are willing to endure frustration for the eventual reward of fiero) and those for whom this play style is simply not enjoyable. This *frustration endurance* will be an important aspect of any trait-based theory of play [7].

What is more, there is strong evidence supporting the hypothesis that frustration endurance will correlate with levels of testosterone, since testosterone has long been associated with persistence [49, 50]. Given the inherently negative experience of frustration, it is plausible that there is some factor involved in a player's tendency to continue playing a game that generates powerful, unpleasant emotions, and the existing literature strongly supports testosterone as this element. Indeed, recent studies have established testosterone as a major factor in competitive play [51, 52]. Further research is required to confirm that testosterone and frustration endurance correlate, however, and one competing hypothesis that must be taken seriously is the idea that the "near-miss" effect (discussed above) may provide sufficient motivation to persist in the face of failure [9]. Likely, future research will find influence from both factors.

Although testosterone is an androgen and women have lower levels of the hormone, the essential effects of testosterone are the same in both men and women, since the latter have greater sensitivity to testosterone that is proportionate to their typically lower levels of the chemical [53]. In general, female testosterone is less studied and less well understood than male testosterone [54]. The BrainHex data suggest (unsurprisingly) that the conqueror persona fits more men than women: Conqueror is the most popular play style for male respondents (29.8%), while it ranks in fourth place among female respondents (15.0%). However, the fact that the BrainHex survey data originate in a self-selected test places severe limits on any conclusions to be drawn in this regard, no matter how intuitive the findings may seem, particularly since the number of women surveyed is approximately one-eighth of the men surveyed. As ever, further research is required.

The practical application of frustration endurance to game design lies in the recognition of the double-edged sword of difficult challenges. On the one hand, conqueror is a popular play style, especially with young men, and thus it is difficult for digital games to avoid the necessity of designing challenging games. However, it must also be recognized that the current data suggest that roughly between two-thirds and three-quarters of players *prefer play styles based on something other than the pursuit of fiero*. This does not mean that such players do not enjoy fiero when

they get it—everyone like it when they win big. However, it *does* suggest that frustration endurance is something that cannot be counted on and that any game expecting its audience to be willing to endure endless and repetitive irritation solely for the reward of eventual victory is falling short of its potential.

One final observation with respect to the aesthetic values associated with the conqueror persona is worth noting. I have suggested that the definitions that individuals defend in connection with the term *game* are indicative of aesthetic value judgments, in a manner parallel to the way that definitions of *art* are indicative of aesthetic value judgments in that field [3]. As anyone who has been engaged in a discussion in an online forum concerning the definition of game can attest, those who view conqueror-style play as the *sine qua non* of "gameness" tend toward an aggressively adversarial stance defending this understanding of the term game. This behavior is entirely consistent with the presumed relationship between testosterone and conqueror play preferences, since testosterone levels and aggressiveness have a demonstrable relationship [55]. Given the marginal dominance of the conqueror play style among men, this may also have some bearing on why the digital games industry has such a poor track record when it comes to issues of gender employment [56], the representation of women in games [57], and the slow pace at which well-established gender-inclusive design practices have filtered out into the game development community [58].

15.4.5 Mastermind: The Orbito-Frontal Cortex and Confusion Endurance

Tolerating frustration is not the only route to the emotional reward of fiero, however, and the BrainHex inventory includes another play style that relates to this experience: the mastermind. In this archetype, fiero occurs not so much in relation to frustration but in the context of the solution of specific puzzles, whether expressly couched in terms of problems to be solved, or occurring naturally within a game context that is amenable to formal or intuitive solution. In Lazzaro's four fun keys, the mastermind persona's essential experience is conflated with the conqueror persona for one simple reason: Lazzaro groups according to the emotions displayed on faces, and hence all forms of play eliciting fiero fall into the same box [10]. Observation of players, however, reveals definite distinctions between the kinds of challenge-focused play that are archetypal of the conqueror play style and the kind of problem-focused play that is archetypal of the mastermind play style, even though some overlap of preferences is often entailed.

Biologically, the approach to play typified by the mastermind persona relates to a brain network including the orbito-frontal cortex, which has an exceptionally close relationship with the nucleus accumbens, the primary producer of dopamine in the brain [59]. In essence, mammal (and other) brains are constructed in such a way as to ensure that making good decisions, or (equivalently) solving puzzles accurately, is a direct means of triggering the release of the motivation chemical dopamine. This is the putative neurobiological substrate underlying the fun of puzzle solving which

lies at the heart of the mastermind play style. As intimated, the kind of problem solving involved can be applied in a great many cases, whether or not it is formally mounted in terms of a puzzle. In particular, strategic thinking (which entails making decisions at a level of abstraction beyond the particulars of any given situation) is quintessentially a form of problem solving, and players for whom the mastermind persona is a good fit often cite strategy games as favorites, along with more expressly puzzle-focused games such as classic point-and-click adventures.

Whereas the conqueror play style was situated in the context of frustration endurance, the kind of problem solving associated with the mastermind play style need not involve intense or overt frustration. Rather, players whose aesthetic values in play correspond to the mastermind persona seem to show a willingness to tolerate an absence of explicit information, or even an active dislike of games that are too explicit about what to do. The aforementioned point-and-click adventures (and even more so the text adventures they descended from) require a willingness to experiment under conditions of incomplete information until a solution to a specific problem emerges—at which point fiero will be experienced, if the process of devising that solution was sufficiently difficult *and* the ultimate solution is deemed logical or reasonable. As such, the mastermind play style can be associated with *confusion endurance*.

This confusion endurance has not yet been studied, but it is plausible to connect this to the "near-miss" effect since this also involves the orbito-frontal cortex [46]. If this hypothesis is valid, it would mean that players engaging in mastermind-style play are motivated to persist under conditions of incomplete information because they subconsciously assess that a solution to the currently considered problem is close at hand (whether or not this is objectively the case), thus providing intermittent release of dopamine, which creates conditions motivating persistence. Confusion endurance, in other words, would be a kind of self-confidence expressed in the context of puzzles and problems—a self-belief in the individual's capacity to solve any mental challenge faced. It is possible that this may also involve testosterone as a factor, and only further research could settle this issue. Informally, however, not only the kind of play but also the temperamental disposition of players fitting the mastermind archetype rather than the conqueror archetype is significantly distinct (colloquially, "geeks" compared to "jocks"). It is thus reasonable to provisionally deduce that some trait other than frustration endurance is required to adequately account for these differences.

In terms of practical implications for game design, confusion endurance raises similar issues to frustration endurance, but compounded by the fact that the mastermind archetype fits fewer players than the conqueror. There is a reason that games based around puzzles have a smaller share of the market than games that do not require puzzle solving, and this can be linked directly to the lack of confusion endurance in the audience at large. Game designers face a problem the moment they place puzzles directly in the spine of their game: too hard, and they will lose most players to irritated confusion. Too easy, and the very players who might find the puzzle rewarding will not be satisfied. One way around this problem is to remove puzzles from the spine of the game and place them in the optional materials; another is to

offer a range of support options to help players who are stuck (something currently being explored by Nintendo in all their major titles). Generally speaking, if the help is solicited by the player, those who do not want assistance will simply avoid it and nothing significant is lost to them, while players who would get stuck have a mechanism to help prevent confusing and frustrating bottlenecks.

15.4.6 Socializer: Oxytocin and Group Preference

The socializer persona is named after the Bartle type, the earliest recognition of this particular play style [23]. The participant in DGD1 is broadly equivalent, but the specification of this play style became muddied by confusion over what the relevant hardcore and casual expressions of this aesthetic preference might be, a matter only complicated by the failure of the DGD1 computer program to gather complete data in this area [5]. In constructing the inventory for BrainHex, Bartle's original term was preferred on the basis that the oldest term in usage warranted preservation, and in the case of the socializer persona Bartle's original description remains entirely apposite [23]:

> Socializers are interested in people, and what they have to say. The game is merely a backdrop, a common ground where things happen to players. Inter-player relationships are important: empathising with people, sympathising, joking, entertaining, listening; even merely observing people play can be rewarding—seeing them grow as individuals, maturing over time.

In terms of biology, this play style can be putatively connected to the neurotransmitter oxytocin, which has a demonstrable role in prosocial behavior, including trust and cooperation [60], although only in relevant social contexts [61]. However, enjoyment of sociality is also associated with particular dopamine receptors [62], and both dopamine and oxytocin have been connected to the formation of specific social bonds in mammals [63]. Whatever the details of the specific biological substrate, the fact remains that individual aesthetic preference for social interaction varies—and this has significant implications for empirical game aesthetics. A future trait theory of play will need to allow for variability in *group preference*, which ranges from a strong desire to play games alone at one extreme to the kind of playful social interactivity that the socializer persona captures at the other.

Game designers wishing to leverage group preference for their designs should be aware that simply adding the possibility of a social dimension to play will not be enough to "court" those players who fit the socializer archetype. Group preference implies a desire to play in groups, but not all games generate the circumstances that make group play necessary or desirable. Inherent to most MMO designs are precisely the relevant kind of scenarios which entail a natural group-oriented play; many kinds of games do not support the necessary depth of interaction required to make this effective. For instance, no matter what you do to your block-stacking puzzle game, or what kind of multiplayer mode you attach, you probably will not be appealing to the socializer persona—although *Yohoho! Puzzle Pirates* (Three Rings, 2003) shows that it is possible!

It is also important to recognize that the archetypes in the BrainHex inventory are not perfect boxes: Each individual player will manifest preferences scattered among the different play styles. A player who expresses socializer tendencies who *also* expresses the conqueror archetype may be very satisfied with multiplayer competitions as a source of social interaction. Conversely, a player who expresses group preference but lacks frustration endurance will require cooperative play that does not involve repetitive failure. More than any of the other candidate traits, group preference seems to fluctuate according to the circumstances of the games it is expressed within, since different games imply different social groups. Whatever the situation, however, socializer preferences cannot be mistaken for a guaranteed desire to meet strangers—individual players may strongly desire social contact, but only with people they already know. In this as in so many cases, generalizations are a poor guide to individuals.

15.4.7 Seeker: Endomorphin, Curiosity, and Interpretive Preference

Sketching the relationship between Caillois' patterns of play and the neurobiological research motivating the BrainHex inventory, this chapter has thus far presented each of Caillois' patterns as building on the previous ones—each adding an emotion (and corresponding neurotransmitter substrate) to the previous patterns. His final pattern, *mimicry*, extends this pattern to its logical conclusion, since what is entailed by Caillois' mimicry is nothing less than the entirety of the domain of representative art [13], via which any emotional experience is in principle attainable. However, it is worth noting that while Caillois' ilinx, alea, and agon form a neat sequence adding one element at each stage, mimicry stands alone: As discussed previously in the context of prop theory, representation and function are related in play and are not entirely reducible to each other. In the context of aesthetic values for play, however, what is the motive that can be ascribed to players who are more interested in representation than function, or equivalently: What motivates players who are less interested in winning?

A possible answer to this question can be found in the philosophy of art in the context of the appeal of films. Pondering how cinema came to be the most successful popular art form in the twentieth century, Noël Carroll concluded that on the one hand the medium was cognitively accessible to a wide audience and on the other there was something significant to the way that movies were constructed that contributed to their appeal [64]. This dovetails with earlier observations regarding the imaginative faculty required for games: Movies require significantly "less" imagination than other forms of representation, since the vast majority of what it is prescribed that the audience imagines is directly depicted. By contrast, the reader of a novel must construct a mental image of the events—which involves greater application of the faculty of imagination, particularly in literary works, which tend to imply rather than state key aspects of the narrative. There is significant variation in imaginative capacity, and (as hinted at by the DGD1 study) a degree of *openness to imagination* is a likely candidate for a future trait theory of play.

The other aspect Carroll alludes to concerns the structure of film narrative, in particular what he terms the *erotetic* model of narrative. This is based on the assumption, founded on observations made by the pioneering Russian film-maker Vsevolod Pudovkin that "earlier scenes be related to later scenes as questions are to answers" [64, p. 493]. Carroll's innovative suggestion is that it is precisely this kind of question-and-answer narrative which provides movies with their capacity for widespread and intense engagement [64, p. 494]:

> Given the erotetic model, we can say what it is that audiences expect: they expect answers to questions that earlier events have made salient. . . . If it is a general feature of our cognitive make-up that, all things being equal, we not only want but expect answers to questions that have assertively been put before us, this helps explain our widespread, intense engagement with movies. Even if the question is as insignificant to us as whether the suburban adolescent in *Risky Business* will be found out by his parents, our curiosity keeps us riveted to the screen until it is satisfied.

Needless to say, the erotetic model proposed by Carroll extends comfortably into digital games, although in such cases the question-and-answer process may not be solely representational (as in Carroll's movie example) but also *functional*—which is to say, the kinds of questions that may engage the player's curiosity in games may be either at the level of the fiction or within the mechanics. Often, the two are so deeply interrelated it may be difficult to specify one or the other as the dominant factor. This connection with curiosity is found in Lazzaro's "Easy Fun" [10] and was also reflected in the wanderer play style from DGD1 [5].

Within the neurobiological literature, discussion of curiosity can be found under the related term *interest*, in particular the work of Irving Biederman and Edward Vessel on perceptual pleasure [65]. According to their research, curiosity can be understood as a natural preference for *richly interpretable* information, the biological substrate for which is the neurotransmitter endomorphin, which research has shown can directly trigger the dopamine motivation system in the brain [66]. Digital games are even more richly interpretable than movies, since they can ask erotetic "questions" in both fictional and functional ways and are thus capable of being enjoyed in a highly engaging curiosity-focused style that is radically different from the success-focused implications of the daredevil, achiever, conqueror, and mastermind personas.

It can be reasonably assumed that *all* digital game players are gaining a part of their enjoyment from the satisfaction of their curiosity. Certainly, the brute impact of powerful emotional rewards such as fiero may skew individual player awareness of this factor, but what is less clear is why some players tend toward the play style epitomized by the seeker archetype—the second most popular persona among female respondents (21.9%) and the third most popular persona for male respondents (18.2%). Is this a positive preference for curiosity or simply a negative preference away from frustration, boredom, and confusion? In the absence of any decisive way to resolve this uncertainty beyond further research, it is prudent to assume that a future trait model of play may have to reflect something like an *interpretive preference* that favors play motivated by curiosity and quite possibly other factors yet to be established over express victory or other more tangible rewards. (The term

interpretive here is used in reference to Biederman and Vessel's "richly interpretable" information).

The practical implications of interpretive preference for game design lie in the idea that it is precisely richly interpretable information that provokes our curiosity—and games are particularly effective at delivering sufficiently rich situations that can be interpreted. This is true on many levels—a player's curiosity can be awakened on a functional level by a specific game system or mechanic, and curiosity can also occur in a representational level (as Carroll notes it is for films). This means that a story is one way that games can evoke curiosity, but it also means that game stories can be more effective than film stories at keeping interest if they manage to make the functional and representational elements align. Consider, for instance, how the doll house that is *The Sims* (Maxis, 2000) generates an implicit narrative from its game mechanics that engage players in just the same way that an explicit narrative would. Game designers should also note the capacity to apply Carroll's erotetic model to game mechanics: The game can raise questions in the player's mind that *future mechanics* will answer, thus keeping their interest via entirely functional means.

In many respects, interpretive preference is the weakest of all the putative elements that currently can be proposed for a trait theory of play, and this is in part because it is far from clear whether such a trait contributes something specific to the resultant model. If those who prefer the more interpretive play of the seeker archetype do so because they do not possess the endurances associated with achiever, conqueror, and mastermind (boredom endurance, frustration endurance, and confusion endurance, respectively), then those traits by themselves could be sufficient. Or, as is perhaps more likely, it may be that the openness to imagination that reflects an increasing capacity for an individual to engage in imaginative activities corresponds to interpretive preference, in which case that trait alone would be required in the putative trait theory of play. It is also quite possible that there is no viable research method that could resolve these tensions completely, since any trait theory of play will necessarily be limited by its internal assumptions. Either way, empirical game aesthetics must recognize that the rewards inherent to the play experience of digital games extend beyond mere victory alone.

15.5 CONCLUSION

As a field, game aesthetics is emerging as a serious contributor to the study of digital and other games. Although seen as the genus within which player satisfaction modeling is one empirical species, it has already been a crucial contributor to the understanding of how and why people play games. It is already clear that the way players experience games is conditioned by a variety of aesthetic values and that these values entail more than is considered in the aesthetics of representation alone. There are, in other words, functional aesthetics of play that are explicitly relevant to games and other forms of play and that are a significant topic for further investigation.

Game aesthetics offers multiple paths to explore, and these include both empirical and theoretical research areas. Whereas game studies have thus far considered theoretical matters chiefly from psychological (and occasionally narratological) stances, game aesthetics invites a productive dialogue with philosophy of art, with the attendant advantages of potentially securing games as an expressive medium and hence as an artistic medium. The entire argument of *Imaginary Games* expressly attends to this need [14], which has pragmatic consequences for legislation, particularly in the United States, where free expression is afforded protection under the First Amendment and indeed where cases are periodically advanced to censure and restrict digital games [67] under claims such as "the true nature of video games, as games rather than as a form of communication, may lead a court . . . to deny first amendment protection to the actual play of the games" [67, pp. 113–114]. Application of prop theory to digital games can significantly derail these kinds of legal arguments for game censorship.

Dialogue between game studies and philosophy of art in the context of game aesthetics also makes available significant theoretical resources for the understanding of digital games, as can be seen in the case of Kirkpatrick's form theory and the aesthetic dimensions of controller usage [18] and in terms of the role of fiction and imagination in digital games via prop theory [14]. Both avenues suggest a considerable volume of potential research endeavors, and these two game aesthetic theories may be only the tip of the iceberg when it comes to cross-pollination of ideas, as the relevance of arguments originating in film philosophy to digital games, demonstrated above, amply demonstrates. An interdisciplinary perspective always widens the available tools for enquiry and may also serve to clarify *what* is being investigated: Thinking in terms of "player satisfaction" invites different conclusions to thinking in terms of "game aesthetics."

Empirical game aesthetics can build on the successes of player satisfaction modeling and take the investigation of how and why we play games even further. The preceding discussion explored eight distinct candidate traits, any or all of which might be the basis for future empirical game aesthetic research, and it is likely that there are other candidate traits that will need to be considered. The first of the eight candidate traits already under consideration is *openness to imagination* [9] and directly relates to prop theory. Since individual imaginative capacity is variable, as indicated by existing psychometric instruments not tailored for use in the context of play, it would seem prudent to investigate this phenomenon in the explicit context of game aesthetics. Empirical measurement of this trait may be difficult, but the challenges involved are no more or less great than those involved in psychological trait theories in general.

Next there are the three candidate traits characterized as *endurances*, since these entail accepting negative experiences as a prerequisite to future positive experiences. These are (1) *frustration endurance*, (2) *boredom endurance*, and (3) *confusion endurance*. A variety of empirical experiments can plausibly be constructed to investigate these putative traits, although the immediate prospects are strongest for frustration endurance, which may have the potential to be tracked in relation to testosterone levels. If so, this would provide an exceptionally strong empirical measure of this

particular aspect of game aesthetics. Results in this area could potentially overturn prior claims made about testosterone, since the existing literature associates high testosterone levels with low frustration tolerance (specifically in terms of observable irritation) [68]. It may transpire that low frustration tolerance paradoxically corresponds to high frustration endurance.

Finally there are those candidate traits characterised as *preferences*, which represent immediate biases toward or against certain aspects of a play experience. These are (1) *time pressure preference*, (2) *fear preference*, (3) *group preference*, and (4) *interpretive preference*. The first three of these are all suggestive of experimental procedures for further investigation and indeed could be explored via case studies sourced relative to specific games or game types, for example, real-time versus turn-based play for time pressure preference. Fear preference stands out as somewhat distinct in that its concerns are expressly representational, and as such the fear preference trait may be equally amenable to other contexts, including the aesthetic pleasures of films and books. Interpretive preference, however, is weakly construed at this time and may not be a significant contributor to a future trait model of play.

Game aesthetics is a new field, but one with much to contribute to the industry that it is dependent on for its objects of study. Understanding which different aesthetic values players may hold and how they are distributed has clear commercial benefits, but it also has clear ethical implications. If the digital games industry is excessively focused on certain narrow play experiences (as it is frequently accused of being), and if the aesthetic values associated with those experiences vary significantly by gender (as the data currently imply), then further study of game aesthetics might contribute toward the breaking down of the barriers that inadvertently exclude many women from careers in this industry. Ironically, this would also have likely commercial benefits, since greater gender diversity in the workplace may contribute to more aesthetic diversity in the play experiences being developed and thus a wider audience for digital games.

Empirical game aesthetics is an emerging field with a long history—a history as long as game studies itself or, in its connection to philosophy of art, as long as the history of civilization. It already has much to teach about the diversity of play and the different ways that games can entertain, satisfy, challenge, bemuse, provoke, thrill, and intrigue. It still has much to learn about how and why players become frustrated, confused, bored, excited, curious, gregarious, and in general *moved* by something as apparently trivial as play. If games have struggled thus far to attain the cultural esteem associated with the term art, empirical game aesthetics can at the very least serve to show that the glorious depth and range of the human experience can be found mirrored in all its incredible variation in the endless panoply of games that we make and play.

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