Player Typology in Theory and Practice

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ABSTRACT
Player satisfaction modeling depends in part upon quantitative or qualitative typologies of playing preferences, although such approaches require scrutiny. Examination of psychometric typologies reveal that type theories have—except in rare cases—proven inadequate and have made way for alternative trait theories. This suggests any future player typology that will be sufficiently robust will need foundations in the form of a trait theory of playing preferences. This paper tracks the development of a sequence of player typologies developing from psychometric type theory roots towards an independently validated trait theory of play, albeit one yet to be fully developed. Statistical analysis of the results of one survey in this lineage is presented, along with a discussion of theoretical and practical ways in which the surveys and their implied typological instruments have evolved.

Keywords
Player satisfaction, game metrics, player typology, trait theory, type theory

INTRODUCTION
Categorizing entities based on their common characteristics allows for faster cognitive processing of complex systems, a motivation that underlies psychological typologies, as well as any attempt to classify players according to their playing preferences. This paper discusses a sequence of demographic studies aimed at developing a player typology along lines that parallel psychometric typologies, and considers the theoretical and pragmatic requirements that any such typology must address.

Proceedings of DiGRA 2011 Conference: Think Design Play.

The motivation for the studies in question was commercial, each having been conducted by the game design consultancy International Hobo as a means of clarifying the key factors affecting player satisfaction. Prior typologies were deemed inadequate both because they were narrowly focused (for instance, considering solely the players of massively multiplayer games) or because the psychological underpinnings of the research were vague. Only the first study was hypothesis-driven, the others being exploratory in nature. The research project is ongoing, and this paper serves to explain a significant change in direction for this sequence of research projects. The data presented is thus offered as a snapshot in an ongoing investigation, and the accompanying discussions serve to contextualize these studies in a wider framework.

Rather than deploying existing psychological models, it is argued here that there is an urgent need for researchers to co-operate towards the development of a trait theory of play, one expressly adapted for studying player satisfaction. Neither existing player typologies, nor existing psychometric inventories, are well suited to researching or analyzing player satisfaction in the context of digital games. However, contemporary research in the field is already beginning to identify viable candidate traits for a future trait theory of play that can quantify the relevant dimensions of play experiences with a view towards superior player satisfaction modeling. The data presented here contributes towards this goal.

PSYCHOMETRIC TYPOLOGY

At first glance, the idea of a typology based around personality factors (including those reflecting play style preferences) appears dependent upon a concept of underlying psychological *types*. In other words, the assumption is that each type represents a unique 'box' into which individuals can be reliably sorted. If these boxes have an empirical basis, sorting into types should be replicable and open to validation by a variety of methods. However, this kind of *type theory* of personality has come into significant doubt, particularly in the light of criticisms from McCrae and Costa (McCrae and Costa 1989) who favor a *trait theory* approach. This presents foundational issues any player typology must address.

Although there are now a wide variety of psychometric instruments available, the concept of personality type as a major psychological element is principally associated with Myers-Briggs typology and its commercially-administered test, the MBTI (a registered trademark of CPP Inc). Myers-Briggs typology uses four bipolar axes to type respondents into one of sixteen types indicated by a four letter code. These axes are Introversion (I) versus Extroversion (E), Sensing (S) versus Intuition (N), Thinking (T) versus Feeling (F) and Judgment (J) versus Perception (P). Thus an individual whose results suggest a preference for Introversion, Intuition, Thinking and Judgment would type INTJ.

The objections against the Myers-Briggs Type instrument (particularly McCrae and Costa) have focused expressly upon the type theory lying behind its original formulation, and the evidence now broadly suggests that type-theories may no longer be viable propositions. Earlier reports of bimodal distributions that supported type-theories now appear to be the result of limitations in method (Bess and Harvey 2001). While a bimodal distribution would have supported type theory (and item response theory), Bess and Harvey found using different quadrature points for the calculation of the MBTI resulted in a normal Gaussian distribution, which speaks in favor of trait-theories.

It should be noted that the authors of certain key studies impugning Myers-Briggs typology are committed to an alternative framework known as "Big Five," (John and Srivastava 1999) and thus cannot necessarily be taken as neutral on this subject. "Big Five"—also known as the Five Factor Model or FFM—is a descriptive personality model that lacks an associated theoretical framework. This model enjoys the advantage of having been confirmed by four research groups (Tupes and Christal 1992)(Krug and Johns 1986)(Saucier and Goldberg 1996)(McCrae and John 1992) although it has been criticized by others (McAdams 1995)(Block 1995).

Interestingly, the same researchers who criticize Myers-Briggs as a type theory also validate it as a trait theory, and demonstrate its statistical validity in respect of four dimensions of the FFM (McCrae and Costa 1989). As such, whatever its limitations, Myers-Briggs typology can be seen as a valuable forerunner to modern personality instruments, which when reinterpreted within a trait-framework can still be seen as a valid (if flawed) psychological instrument.

The relevant point is that the success of FFM demonstrates the triumph of the trait theory over the type theory in psychometric modeling, and therefore any reliable player typology that could be developed is likely to be equally dependent upon a trait-theoretical approach. However, there is some research that demonstrates that in a limited number of cases type-approaches can offer benefits over trait-approaches (Asendorpf 2003), and thus it pays to be open minded as to how these issues will resolve in the specific domain of player satisfaction modeling.

Regardless of which psychometric theory is deployed, instruments can always be developed that produce a typology simply by dichotomizing a continuous scale. In this way, even a trait theory can be used as the basis of a typology. However, there are both conceptual and statistical limitations to this kind of approach (Pittenger 2004) that beg the question: is typology a prudent approach to psychometric measuring of certain psychological factors (such as playing preferences)?

One answer to this challenge is that a typology need not be understood as specifying rigid boxes, especially if the underlying methodology is trait-based. The process of converting a statistically validated set of psychometric observations into a qualitative inventory of types can aid in the explanation and dissemination of the core ideas in a way that a trait-based approach might make cumbersome. For instance, Drachen et al (2009) demonstrate the merits of qualitative player types for conceptualizing statistical data gathered from behavioral playing data. This study relates observational playing patterns to the concept of *personas*, commonly used to describe behavioral types in human-computer interaction.

The cognitive accessibility of the typological approach demonstrates the relevance of inventories of types for player satisfaction modeling. However, the move away from type theories in psychological instruments argues against continuing to pursue type theories of play. The criticisms that can be leveled against a type-based psychometric instrument apply equally to a type-based player satisfaction instrument. It would therefore be prudent for studies to focus on developing trait theories of play. The remainder of this paper discusses the problems with existing type theories of play, and details one of several concurrent attempts to move in this direction.

PLAYER TYPOLOGY AND TRAIT THEORIES

While psychometric typology for personality has been around for some seventy years, player typology is considerably younger, and trait theories of play still in their infancy. This paper is principally concerned with the development of a sequence of typological instruments over the last decade, although the oldest and most famous player typology predates this lineage by almost five years.

Bartle Types

In 1996, Richard Bartle introduced an informal, qualitative model of the kinds of players participating in the early online synthetic worlds known as MUDs (Bartle 1996). As noted by Bartle (2009), this paper was used by other researchers to produce a test outputting four types: Achiever, Explorer, Socializer, and Killer. Bartle's approach inspired Yee (2006) to investigate further, initially suggesting that at least three of these qualitative patterns (all except Explorer) had some statistical validity. In later analysis, Yee (2007) identified two separate constructs reflecting Bartle's Explorer type, suggesting all four of Bartle's types gestured in broadly sensible directions.

However, the Bartle test suffers significant problems that make it unsuitable as a general framework for player typology. As remarked by Yee (2006), the 'just-so' quality of the model risks becoming self-fulfilling: if a questionnaire asks respondents to choose between Achiever and Explorer patterns, the result may be a dichotomy even if there is no basis for one in underlying factors. A related problem is that the test is constructed on comparisons between specific scenarios that the respondent chooses between. Bias towards certain outcomes can occur as a result of specific pairings: if the same questions appear in alternative pairs, different results might occur for the same individuals. This reflects the fact that the Bartle test was constructed for entertainment purposes, and was never intended to be a robust instrument.

Yee's Motivations

The work conducted by Yee (2006, 2007) following Bartle's qualitative discussion of player types in massively multiplayer games led him to develop a prototype trait theory of play within the narrow remit of these kinds of games. Yee's motivations of play model identified more diverse patterns than Bartle's informal report – an inevitable consequence of exploring a far greater range of motivational patterns.

In terms of comparison to Bartle types, Yee reports that Bartle's Socializer type conflates Yee's Socializing and Role-playing motivations (with Relationship and Teamwork as further social motivations). Bartle's Achiever and Killer types appeared to overlap in the context of Yee's Advancement and Competition motivations, suggesting these were not distinct types. As mentioned above, two distinct motivations appeared to be conflated in Bartle's Explorer type – Mechanics and Discovery. Additionally, Yee suggested Customization and Escapism as additional motivations not discussed by Bartle.

However, Yee's motivations are problematic as the basis for a trait theory of play. As de Castell et al (2011) observe, the Daedalus survey upon which Yee's work is based "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. What's more, self-report is an unreliable source of data (a problem that also applies to the study presented in this paper); de Castell and colleagues demonstrate that in the specific context of player-avatar fidelity self-report is categorically not a reliable method for accurate data

gathering, and this finding serves to introduce a necessary note of caution regarding self-reported data of all kinds.

A final issue is that neither the Bartle type model nor Yee's motivations were ever intended to function outside of the narrow context of massively multiplayer games. If there is a need for a typology of players or a trait theory of play (and both Bartle's and Yee's work speak of this need) it would be prudent to identify a *general* model of play or players. As Bartle (2009) has noted, game designers "must understand their players", and player typologies are a significant step towards this goal.

DGD1 and Myers-Briggs Typology

The idea that the Myers-Briggs typology could provide a psychometric basis for player types prompted the development of the first Demographic Game Design model, known as DGD1 (Chris Bateman and Boon 2005). This was not a true player typology but an adaptation of Myers-Briggs typology to games, and thus an investigation of how the patterns within this inventory applied to playing games. This was the first of the sequence of research projects discussed in this paper, and its results are briefly summarized below.

FFM and Player Satisfaction

There have been some attempts to apply the Five Factor Model to player satisfaction, although the results have been in consistent. Teng (2008) and Teng (2009) suggest that the FFM traits of openness, conscientiousness and extraversion relate to online gameplay. However, reporting on a study that builds upon the DGD1 work, Zammitto (2010) compared FFM traits to an inventory of game genres and while confirming extraversion as relevant to online play, reported low scores for agreeableness and openness in this category, the latter directly contradicting Teng. The findings of all three studies contradict Bateman and Boon (2005), who reported higher introversion among players of online games compared to players of other digital games.

Part of the problem in trying to use FFM for player satisfaction modeling is recognized by Teng (2009), who 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. Zammitto adds an additional problem: personality factors in her study only explained 2.6-7.5% of game preferences. In other words, while statistical relations to FFM were obtainable, they were at best one variable among many that needed to be considered. The idea that FFM could be used as a reliable psychometric tool for the study of play appears questionable, and this problem is independent of the type-versus-trait model issues described above.

If the apparent success of FFM within psychology demonstrates the need for trait models to be preferred over type models, the comparative failure of FFM in game studies demonstrates the needs for trait models *of play* rather than adaptations of psychological instruments to game contexts. As de Castell et al (2011) have observed, the game studies discipline suffers severe theoretical and methodological restrictions when it relies on models imported from contextually distant disciplines, and there are both ontological and epistemological problems inherent in almost all work conducted thus far (including the work detailed in this paper). Games studies requires innovation in research methods rather than the application of received theories, constructs and models to the context of games and play.

THE FIRST DEMOGRAPHIC GAME DESIGN MODEL (DGD1)

The first of the demographic studies that are the main focus of this paper was gathered via online surveys and case studies conducted between 2002 and 2004, with the bulk of the data gathered in 2003. Bateman and Boon (2005) presented findings based upon a set of four play styles, with awareness that the derivation of these styles was limited not only by the use of Myers-Briggs typology on the one hand, but also by the methods of statistical analysis used, which had required considerable manipulation in order to become tractable. These four play styles: *Conqueror*, *Manager*, *Wanderer* and *Participant*, were also investigated in a series of case studies that provided some qualitative support for the results. These play styles did not appear to relate significantly with Bartle types.

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

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

These hobbyists can be contrasted to the mass market of players (the 'casual' market) who may well play games—and indeed may play regularly— but do not play anywhere near the range and diversity of titles that hobbyists engage with. The tendency to play a greater diversity of games (as observed in case studies) also leads to a greater comprehension of the general trends, patterns, implicit rules and other elements in the background of understanding for digital games. For this reason, it is reasonable to refer to such players as having superior *game literacy* (Buckingham and Burn 2007), and later studies (particularly DGD2) explore this point explicitly.

SECOND SURVEY (DGD1.5)

Following the original study, a survey was developed based around some of the themes that had been identified. Dubbed "DGD1.5", this was intended to be a step towards a replacement model for DGD1, which had been hampered by its dependence upon Myers-Briggs typology. Data from 319 questionnaire respondents was gathered. This research was not hypothesis-driven, and the results were not published.

The main distinctions between the 'hardcore' and 'casual' clusters in this survey were that players in the former seemed to be more concerned with games being "too easy", and more likely to be motivated by *fiero* (Lazzaro 2003), meaning triumph over adversity. Conversely, players in the 'casual' cluster (120 of 319) showed a greater tendency to lose interest in the face of tough challenges, reduced concern about games being too easy, less focus on fiero, and less interest in mastery. An 'unknown' cluster (38 respondents) was

similar to the 'casual' cluster, although showing an even lower tolerance for repetition and a greater desire to play alone.

THE SECOND DEMOGRAPHIC GAME DESIGN MODEL (DGD2)

While the interim survey was conducted, alternative theoretical approaches were explored. Temperament Theory, particularly as expounded by Berens (2000), was a main candidate, having the advantage of being transformable to Myers-Briggs and thus easy to connect to the original research since both Myers-Briggs typology and Berens' version of Temperament Theory use the same theoretical foundations. However, the most appealing aspect of Berens' research was reports of skill sets corresponding to the qualitative types, something readily adaptable to the context of play. Four sets of player skills (as shown in Table 1) could thus be investigated, and each directly relates to a type result from a Myers-Briggs instrument. For instance, INTJ matches the Strategic archetype (as does any Myers-Briggs type with preference for both Intuition and Thinking). Berens' framework thus appeared to offer the potential for a direct qualitative match between play styles and existing psychometric typologies.

Player Archetype	**Drawn to…**	**Behaves with…**	**Tolerant of…**
Logistical	optimization, planning, trading	caution, meticulousness	repetition, rules, procedures
Tactical	improvisation, operation, controlling single characters, thinking on the spot	impulsiveness, competence	risk, speed, variation
Strategic	solving, hypothesizing, controlling multiple units, thinking ahead	logic, perfectionism	complexity
Diplomatic	harmonizing, imagining, co-operation	empathy, morality	impressionism

Table 1: Four hypothetical play styles derived from Temperament Theory (Berens 2000).

The idea of creating 'game tests' to detect play preferences from behavioral data was considered, although this was not possible with the resources available at the time. Instead, a new survey was constructed. In retrospect, the decision to continue to pursue type theories as a basis for player satisfaction modeling was misguided, although the data gathered still serves as a pointer towards a future trait model of play.

Methods

At this point in the sequence of studies, hypothesis-driven approaches had been abandoned in favor of exploratory methods. The comparatively low response rate to the DGD1.5 survey prompted a reconsideration of how to gather data. In order to attract respondents from a variety of different sources, the previous two surveys offered prizes for participation, and advertised the 'competition' on sites that were not related to gaming. Moving forward, it was considered a priority to increase the number of

responses, with 'branding' a likely key issue. With this in mind, a third study was launched in September 2007 under the banner of "Ultimate Game Player Survey" and promoted (as before) in non-digital game websites as well as among the gaming community. Data was gathered from 1,040 participants, with the survey administered using a custom php script, and taking approximately 5-10 minutes to complete.

The strategies for analysis were exploratory. Initial factor analysis indicated possible areas for enquiry, which in turn led to specific inferential tests. While the theoretical motivations for the research were used as a stepping point, the majority of investigations of the data set this framework aside, seeking patterns within the data rather than attempting to validate prior conceptions. Self-selection served as a significant limitation on the study, although one that had to be accepted since the resources were not available for more robust options. Similarly, self-report is a severe limitation on the data gathered, although equally unavoidable because of the methods used. All findings reported can thus be understood solely as directions for possible future research.

Measures

The first section of the survey gathered demographic data, and asked a few supplemental questions. This was followed by a section enquiring about playing preferences and game types, with questions based upon a system inspired by Caillois' patterns of play (Caillois 2001; Bateman 2009). The following responses were offered (scored in the manner of a 5-point Likert scale, shown in parentheses):

- I prefer to play games like this when possible. (5)
- I enjoy playing in this kind of way, and often play this way. (4)
- I sometimes enjoy this sort of thing. (3)
- I don't really enjoy playing this way. (2)
- I don't play this way ever. (1)

The next section used Lazzaro's adaptation of Ekman's emotions (Lazzaro 2003), asking respondents to rate their enjoyment of specific emotions based on Ekman's terminology (Ekman 1992) and Lazzaro's inclusion of 'curiosity' as an emotion-like behavior. (These scores assessed the degree of enjoyment relating to a particular feeling, and also whether respondents experience that emotion; in retrospect, these two aspects should perhaps have been separated). The following responses were offered (scoring in parentheses):

- Yes, and I seek out games that give me this feeling. (5)
- Yes, and it enhances my enjoyment of a game. (4)
- Yes, I sometimes feel this way, but it doesn't matter to me. (3)
- Yes, I sometimes feel this way, and I don't like it. (2)
- No, I never feel this way when playing games. (1)

The final section enquired about game skills. In addition to the Temperament Theory skills sets, this included questions concerning basic game literacy, specifically: understanding how a game works without looking at a manual (game comprehension), and moving around a game world using mouse and keyboard or two joysticks (3D controls). The following responses were offered (again, with scores in parentheses):

- I find this easy, and I'm very good at it. (5)

- I'm reasonably good at this. (4)
- I am okay at doing this. (3)
- I have some difficulty with this sort of thing. (2)
- I cannot do this kind of thing at all. (1)

Participants

The new study produced 1,040 respondents, with results gathered primarily (576=55.4%) from North America, about a third (317=30.5%) from Western Europe or the UK, one in twenty (52=5.0%) from Australasia, and a scattering of responses from across the rest of the world. The majority of respondents reported playing games every day (65.9%), with many of the others playing every week (26.4%). Interestingly, of those that self-identified as 'hardcore', 81.0% reported playing every day, and of those that self-identified as 'casual', 49.4% reported playing every day. It seems that even people who see themselves as a casual player are still playing digital games quite frequently.

The most consistent response in the survey was in the context of a supplemental question concerning game stories. An overwhelming consensus (92.8%) reported either that stories are very important to their enjoyment of videogames (35.7%) or that stories help them enjoy videogames (57.1%). A mere 5.1% reported that stories were not important to their play, and just 1.3% expressed a preference for digital games without stories.

Results: Descriptive Statistics

Emotions

The scores afforded to emotions did not conform to expectations. The emotions of play expected to score highly were *fiero*, *excitement* and *curiosity*. However, *amusement*, *contentment*, and *wonderment* all scored higher than these 'big three'. Of the three, 'contentment' had been hypothesized prior to the survey as being a key emotion of play that might be overlooked. The results confirmed this prediction, although there was little expectation that amusement and wonderment would rank so highly. Although Lazzaro later noted that wonderment was "a full-body emotion, as powerful as […] fiero" (Lazzaro 2009), and connects it to curiosity.

Naches is a positive emotion identified by Ekman (1992) that occurs when a parent or teacher enjoys the success of their child or student in a context they have prepared them for. A strong response to naches was shown in the survey, demonstrating that players actively enjoy training their friends and family to play games, with 53.4% reported naches enhances their enjoyment, and another 12.9% reported seeking out games that give them this feeling. Only 10.9% reported never having the experience in the context of digital games.

The Conqueror style of play identified by the DGD1 survey, which corresponds to Nicole Lazzaro's "Hard Fun" and its associated emotions of frustration (i.e., anger) and fiero (Lazzaro 2009), draws attention to an important aspect of the emotions of play: even negative emotions may have a role in enjoyment. About one in five (20.5%) respondents stated that anger increases their enjoyment of play (consistent with the Conqueror play style), while the majority (42.0%) of respondents had a powerfully negative response to this emotion, reporting that they *avoided* games that make them feel that way. This distinction may be an important aspect of any future trait theory of play.

Player Skills

The overwhelming majority of respondents gave themselves one of the top two marks in basic game literacy skills (91.2% for game comprehension and 90.1% for ability with 3D controls), despite only 50.1% of respondents self-identifying as 'hardcore' gamers (40.9% self-identifying as 'casual', and the remaining 9.0% being unsure). This arguably brings into doubt the system of using self-identification to separate hardcore and casual players, or suggests that self-identifying casual gamers are more game-literate than is usually assumed.

A bug in the data gathering program affected the Temperament Theory skill set data, with most of the data on Diplomatic skills never reported. As a result, analysis had to focus on the other three skill sets: Logistical, Strategic, and Tactical.

Social Preference

The most popular approach reported was to play alone (40.6%), with just a few reporting that they played single player games with pad passing or some similar group play (7.1%). The remaining players all preferred some kind of multiplayer format, whether in the same room (17.1%) or over the internet (18.9%, of which 5.3% reported a preference for team or clan play), and the remaining 16.4% preferring Massively Multiplayer Online games.

Obsessive Tendencies

The question "Do you ever feel yourself compelled to acquire everything that you can possibly find, or to repeatedly pursue actions because you know you can make big gains by doing so?" was intended to pursue obsessive tendencies and/or persistency, and used the emotions scale. About a third of respondents gave the top two marks for this question (34.7%), with 9.3% actively seeking out games that would foster this experience.

Results: Inferential Tests and Factor Analysis

The elements of the survey were grouped into measures based upon the theoretical motivations, which were then tested using various statistical analysis tools. The following sections present some of the more interesting results (all tables of data referenced below are listed in the appendix).

Female Players

Female respondents consistently rated their gaming skills lower than male players (Table 2). These findings were significant at the 0.01 alpha level. Similarly, in the context of the emotions of play (Table 3) the trend was for male respondents to rate higher. In the case of excitement and surprise, men self-assessed higher than women. For emotions such as anger and schadenfreude, men also self-assessed higher than women. Similarly, men self-assessed the importance of fiero higher in their play. These distinctions were statistically significant at the 0.05 alpha level.

When examining the patterns of play respondents enjoyed (Table 4), a similar trend was revealed: female respondents gave lower numbers than men for challenge, escapism and systems-related play. However, female respondents rated sandbox-type play more highly than male respondents, which was an expected result. All these results were significant at the 0.01 alpha level.

Player Skills

Part of the investigation conducted with DGD2 concerned the validity of the skill set

model from Temperament Theory. With this in mind, a variable was generated indicating whether respondents ranked the Logistical, Strategic and Tactical skill groups high (scored with a 4 or 5 value on a scale of 1 to 5) or low (scored with a 1, 2 or 3), as shown in Table 5.

A principal component factor analysis with orthogonal rotation (varimax) was performed, and a Kaiser-Meyer-Olkin measure verified the sampling adequacy for this analysis (KMO = .903). Two components were extracted, with the rotation converging in 3 iterations. Within these results, questions concerning basic game literacy loaded together with Tactical skill questions (component 1, Table 6), and Logistical questions loaded with Strategic questions (component 2, Table 7).

Given the overlap in the factor analysis, a series of t-tests compared the high and low subgroups for each of the skill sets against one another (and against basic game literacy), to investigate the distinctiveness of these groupings. All of the t-tests conducted had p-values of .000, confirming that there was a basis for treating these separately. Thus, against expectations, there were signs that the three Temperament Theory skill sets for which data was successfully collected (Logistical, Tactical, Strategic) had some validity.

However, the factor analysis (Tables 6-7) identified only *two* components – loading basic game literacy with Tactical skills, and Strategic with Logistical skills. In respect of the second component, DGD1 had linked Strategic and Logistical skills, although this was assumed to be an artifact of the methodology. Re-examination of the Logistical questions suggests significant overlap between the Strategic themes and the questions being asked – Logistical questions 2 and 3 have an ambiguous quality that overlaps the original theoretical definitions of these two skill sets. Logistical question 1 is closest to the theoretical definition of this skill set, and loads more weakly with component 2.

Social Preferences

Tables 8-10 presents analysis in terms of multiplayer (including team play) and single player preferences. Respondents were grouped according to their preferences into two distinct groups ‘single’, who preferred to play alone (or to play single player games with other player) and ‘multi’, who expressed preference for multiplayer games, team play or online multiplayer experiences. These distinct groups were then compared according to the measures derived from the data.

Multiplayer preferring respondents (Tables 8-10) gave much higher ratings for challenge-oriented play ($p<.001$), fiero ($p<.01$) and the fiero-enhancing emotion of anger ($p<.01$). Additionally, multiplayer-preferring respondents had a statistically significant higher preference for social emotions ($p<.000$) and random elements in games ($p<.000$), as well as a lower preference for sandbox play ($p<.05$). They also rated themselves much higher in terms of Tactical skills ($p<.000$), which is not surprising given that the most popular multiplayer digital games all depend upon Tactical skills (first person shooters and racing games, for instance).

Obsessive Tendencies

As Table 11 shows, ‘hardcore’ respondents showed higher mean response to the obsessive tendencies question. Although players strong in Logistical skills were shown to rate obsessive tendencies higher than those who were weaker in this skill set (a predicted result), players high in Tactical and Strategic skills *also* showed this pattern (contrary to

predictions). It seems the higher someone rates their game abilities, the more likely they are to report obsessive tendencies. All these results had a p-value of .000. (Note that neither gender nor social preference showed any equivalent pattern).

Discussion

From Type to Trait

Between the commencement of the DGD2 study discussed in this paper and its conclusion, the focus of the research project that this survey analysis contributed towards had shifted from adapting psychometric typologies to examine patterns in play styles, to examining play styles in order to identify possible candidate traits for a future trait theory of play (see the discussion above concerning type versus trait theories). One such possible trait, openness to imagination, had already been identified by the preceding DGD1 survey. Four additional candidate traits were suggested by the results of the DGD2 survey, as discussed below.

Female Players

An interesting discovery in terms of gender was that female respondents consistently rated their gaming skills lower than male players. This does not necessarily mean female players are not as skilled as their male counterparts—there is no way of assessing this from survey data—but rather that female players underrate themselves, or (alternatively) that male players overrate themselves, when compared to the other gender. The same pattern of lower ratings by female respondents when compared to male was repeated in the importance of emotions to their play, and enjoyment of various patterns of play.

In terms of emotions, male respondents self-assessed higher for the fight-or-flight emotions excitement and surprise, which can be related to the neurotransmitter epinephrine, as well as for anger and schadenfreude, which can be related to the neurotransmitter norepinephrine. Additionally fiero (triumph over adversity), an emotional reward that generally requires prior states related to the fight-or-flight emotions, was rated higher by male respondents. It could thus be concluded that female players are slightly less interested in play resulting from the fight-or-flight response than male players.

Emotions

Beyond the distinctions mentioned above regarding gender and fight-or-flight emotions, the descriptive statistics showed a potentially vital distinction between players who recognize that anger enhances their enjoyment of play (consistent with the Conqueror play style identified by DGD1, or Lazzaro's "Hard Fun") and those who actively avoid games that cause them to feel angry, the latter group outnumbering the former by two to one in the sample (20.5% versus 42.0%).

This suggests that tolerance to frustration is a viable candidate trait. Further investigation, preferably using biometrics rather than self-reporting, is essential to clarify the significance of anger to certain player's enjoyment of games.

Player Skills

The investigation of the skill set constructs from Temperament Theory was hampered by a bug in the survey software, but data for three skill sets was collected, and although some validation was found for the Logistical, Tactical and Strategic skill sets, factor analysis suggested just two relevant components. Logistical and Strategic

skills loaded together, but probably only because the questions were inadequately constructed.

However, the component linking basic game literacy with Tactical skills may be indicative of a pattern worthy of further investigation. Again, an overlap of questions can be construed as the cause of the results, but all of the questions concerned relate to the respondent's capabilities in respect of controlling (or understanding how to control) avatars, vehicles etc. in the fictional worlds of games. This component could perhaps be characterized as competence with real-time controls, and may be a candidate for a trait dimension in future models.

Social Preference

Players preferring multiplayer games (including team play) demonstrated play preferences distinct from those preferring single player games. Multiplayer gamers tended to self-report as challenge-oriented, and willing to be aroused to anger presumably since this enhances their eventual reward in fiero (and possibly schadenfreude) when they attain victory. It seems they are not only enjoying fiero, they are also enjoying the social element of multiplayer games such as the sense of belonging to a team, feelings of envy and gratitude, and the feeling of naches – the satisfaction of seeing someone you taught to play perform well.

Conversely, single player gamers (statistically speaking) self-reported a lower interest in random elements. This could be interpreted as greater interest in control over the space of play – random elements add variety to play, although they also mean the player has less direct control over outcomes. The same group self-reported a higher interest in sandbox play, which might also be interpreted as an increased interest in having complete control over the play space.

Social preferences for play have not usually been considered particularly significant, although this data identifies distinctive patterns. It seems that the emotional reward of fiero may be more attractive when it is earned against (or with the assistance of) human players—beating a single player game might be less satisfying because it was not a person that was overcome. For the gamers in this survey for whom multiplayer competitive play is appealing (36.0%), playing together is doubly rewarding: not only do they get the emotional benefits of social play, the taste of victory appears to be all the more sweet when it is won from a human opponent. Social preference appears to be another possible candidate trait worth further investigation.

Obsessive Tendencies

It was initially expected that preference for Logistical skills would relate to obsessive tendencies. Although this pattern was found in the results, it seems that the same pattern was found for the other skill sets – suggesting higher someone rates their game abilities, the more likely they are to report obsessive tendencies. Although this pattern is vague, it may indicate a candidate trait worth further study, namely degree of persistence. Neurobiological studies relate persistence with testosterone levels, which suggests a further avenue for investigation (Andrew and Rogers 1972).

BRAINHEX

The results of the research up to this point became the inspiration for a new player satisfaction model, BrainHex. At this point in the development of this sequence of player

typologies (i.e., in Spring 2008), an increasingly robust collection of neurobiological papers were available (Rolls 2000)(Shizgal 2003)(Biederman and Vessel 2006) allowing for some hypothetical connections between the emotions of play and underlying neurobiological mechanisms, discussed in detail by Bateman and Nacke (2010).

The possibility thus existed for substituting subjective measures of emotions for subjective measures of neurobiological responses. This kind of formal reduction was applied not out of a belief that the biological explanation would be superior to the psychological explanation—both descriptions are important—but rather in an attempt to narrow in upon likely candidates for robust traits that could be used for a player instrument. In moving forward to the next survey, questions relating to emotion were directly geared to what is known about their neurobiological basis in the hope of reducing problems relating to the self-reporting of emotional states. The results of this study are currently being analyzed.

The new survey and model moves explicitly towards examining play from the perspective of hypothetical neurobiological factors, and away from pre-existing psychometric models such as Myers-Briggs, Temperament Theory or FFM. While the use of these models has proven useful in establishing a framework for player typology, we are approaching the point whereby it will necessarily become more valuable to establish typologies or trait theories on play-specific foundations. BrainHex is a transitional point in this regard, hinting at the possibilities of a more robust approach that could be pursued using more empirical measures, while still being bound up in the limitations of the self-report survey format that until now has been the only approach deployed. If new empirical methods of study are indeed imminent, player typology could be about to 'graduate'.

CONCLUSION

A qualitative inventory of types, especially one that is built upon a statistically validated trait theory, can provide a vital tool for game studies, although the necessary foundations for a robust player typology are only just emerging. It is already clear, however, that certain typological assumptions—particularly the division into 'hardcore' and 'casual' players —can no longer be sustained. A focus on game literacy, one which qualitatively identifies certain player as gamer hobbyists as opposed to the mass market for games, may be a step forward in this respect.

By studying the players of games in the context of psychometric typology, some interesting pointers have been uncovered, with hints that specific qualitative play styles may legitimately be founded upon a trait theory of play based on future research. Possible elements of such a trait theory include (1) openness to imagination (2) preference for anger as a fiero-enhancer versus avoidance of frustration, (3) degree of tolerance for real time play (4) preference for group play versus solo play, and (5) degree of persistence or obsessive play, which may partly relate to testosterone levels.

However, we may have reached the limit of what can be achieved by applying of models that were created for radically different purposes. A future player typology robust enough to serve the game studies community and the digital games industry will need to leverage theoretical resources currently in their infancy. Nonetheless, such a model is plausible, and is certainly desirable, and as such it is only a matter of time before a viable player typology can be developed for use by game developers, researchers and players alike.

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APPENDIX

Female Players

Measure	Gender	N	Mean	Std. Dev.	t value	Degrees of Freedom	Significance (2-tailed)
Game Literacy	Male	891	4.61	.55	8.22	153.05	.000
	Female	141	3.88	1.03			
Logistical Skills	Male	891	3.96	.67	3.36	172.52	.001
	Female	141	3.72	.80			
Strategic Skills	Male	891	3.81	.69	3.05	172.61	.003
	Female	141	3.59	.82			
Tactical Skills	Male	891	3.95	.72	7.40	167.90	.000
	Female	141	3.35	.92			

Table 2: Analysis of skill measures by gender.

Measure	Gender	N	Mean	Std. Dev.	t-value	Degrees of Freedom	Significance (2-tailed)
Positive Emotions *(Contentment, Relief, Bliss)*	Male	891	3.56	.97	1.78	184.75	.078
	Female	141	3.40	.99			
Negative Emotions *(Sadness, Disgust, Contempt, Guilt, Embarrassment)*	Male	891	2.16	.75	1.41	184.42	.162
	Female	141	2.06	.77			
Social Emotions *(Gratitude, Naches, Envy, Belonging)*	Male	891	2.99	.81	1.33	174.59	.186
	Female	141	2.88	.94			
Excitement *(Excitement, Surprise)*	Male	891	3.83	.75	2.59	169.73	.010
	Female	141	3.62	.93			
Anger *(Anger, Schadenfreude)*	Male	891	2.82	.88	2.44	180.98	.016
	Female	141	2.62	.93			
Curiosity *(Curiosity, Wonderment)*	Male	891	4.05	.78	4.01	164.26	.000
	Female	141	3.67	1.08			
Amusement	Male	891	4.30	.71	1.46	169.15	.145
	Female	141	4.18	.89			
Fiero	Male	891	3.93	1.15	2.52	177.93	.013
	Female	141	3.65	1.27			

Table 3: Analysis of emotions by gender.

Measure	Gender	N	Mean	Std. Dev.	t-value	Degrees of Freedom	Significance (2-tailed)
Challenge	Male	891	2.60	.66	3.05	171.85	.003
	Female	141	2.38	.80			
Escapism	Male	891	3.49	.73	5.79	169.88	.000
	Female	141	3.03	.91			
Systems	Male	891	3.87	.90	3.17	167.42	.002
	Female	141	3.54	1.17			
Sandbox	Male	891	2.97	1.02	-2.62	176.45	.010
	Female	141	3.24	1.15			
Random Elements	Male	891	3.47	1.02	0.70	177.84	.483
	Female	141	3.40	1.13			
Role-play	Male	891	3.32	.72	-0.59	169.77	.556
	Female	141	3.37	.89			

Table 4: Analysis of game types by gender.

Player Skills

Skill Set	Variable	Frequency	Percent
Logistical	Low(<4)	623	59.9
	High(>=4)	417	40.1
Strategic	Low(<4)	726	69.8
	High(>=4)	314	30.2
Tactical	Low(<4)	638	61.3
	High(>=4)	402	38.7

Table 5: Divisions of skill sets by high or low ranking.

Question	Component	
	1	**2**
Basic Game Literacy 1: "How good are you at understanding how a game works without reading a manual or asking someone for help?"	.717	.219
Basic Game Literacy 2: "How good are you at moving around in 3D worlds using either a mouse and keyboard together, or using two sticks at once on a console (whichever method you know best)?"	.814	.040
Tactical Skills 1: "How good are you at throwing yourself into the thick of a situation and then working out how to get out of it as you go?"	.601	.293
Tactical Skills 2: "How good are you at using special abilities or vehicles, or anything else with unique controls, in a game?"	.703	.269
Tactical Skills 3: "How good are you at negotiating virtual landscapes, or positioning yourself favorably with respect to foes?"	.685	.316

Table 6: Factor analysis: Basic Game Literacy and Tactical skill set (Component 1).

Question	Component	
	1	**2**
Logistical Skills 1: "How determined are you to complete goals that have been set for you – will you attempt the same task over and over again until you complete it?"	.350	.453
Logistical Skills 2: "How good are you at managing the supplies or resources (such as ammunition or money) in a game?"	.247	.579
Logistical Skills 3: "How good are you at anticipating and discovering risks or dangers?"	.442	.568
Strategic Skills 1: "How good are you at solving puzzles that you find in games, or thinking around problems?"	.031	.705
Strategic Skills 2: "How good are you at finding the *best* way to do something in a game, or an optimal approach to a particular problem?"	.172	.742
Strategic Skills 3: "How good are you at making game decisions that involve many different factors?"	.317	.634

Table 7: Factor analysis: Logistical and Strategic skill set (Component 2).

Social Preferences

Measure	Social Pref.	N	Mean	Std. Dev.	t-value	Degrees of Freedom	Significance (2-tailed)
Game Literacy	Single	496	4.44	.75	-3.27	966.03	.001
	Multi	544	4.58	.62			
Logistical Skills	Single	496	3.88	.71	-2.19	1016.22	.028
	Multi	544	3.97	.67			
Strategic Skills	Single	496	3.74	.72	-1.87	1021.79	.062
	Multi	544	3.82	.70			
Tactical Skills	Single	496	3.77	.80	-3.68	1015.60	.000
	Multi	544	3.95	.75			

Table 8: Analysis of skill measures by social preference.

Measure	Social Pref.	N	Mean	Std. Dev.	t-value	Degrees of Freedom	Significance (2-tailed)
Positive Emotions *(Contentment, Relief, Bliss)*	Single	496	3.51	1.00	-0.84	1014.22	.402
	Multi	544	3.57	.94			
Negative Emotions *(Sadness, Disgust, Contempt, Guilt, Embarrassment)*	Single	496	2.13	.76	-0.52	1025.29	.601
	Multi	544	2.16	.75			
Social Emotions *(Gratitude, Naches, Envy, Belonging)*	Single	496	2.73	.80	-9.44	1029.81	.000
	Multi	544	3.20	.80			
Excitement *(Excitement, Surprise)*	Single	496	3.78	.80	-1.03	1015.33	.302
	Multi	544	3.83	.76			
Anger *(Anger, Schadenfreude)*	Single	496	2.72	.87	-2.61	1033.33	.009
	Multi	544	2.87	.89			
Curiosity *(Curiosity, Wonderment)*	Single	496	3.96	.86	-1.25	1015.77	.212
	Multi	544	4.03	.81			
Amusement	Single	496	4.25	.80	-1.27	974.12	.204
	Multi	544	4.31	.67			
Fiero	Single	496	3.79	1.2	-2.63	1011.13	.009
	Multi	544	3.98	1.13			

Table 9: Analysis of emotions by social preference.

Measure	Social Pref.	N	Mean	Std. Dev.	t-value	Degrees of Freedom	Significance (2-tailed)
Challenge	Single	496	2.47	.65	-4.40	1037.95	.000
	Multi	544	2.66	.70			
Escapism	Single	496	3.40	.79	-1.07	1022.02	.285
	Multi	544	3.45	.76			
Systems	Single	496	3.79	.98	-1.00	1012.0	.317
	Multi	544	3.85	.92			
Sandbox	Single	496	3.09	1.04	2.40	1028.76	.017
	Multi	544	2.93	1.04			
Random Elements	Single	496	3.34	1.05	-3.56	1018.23	.000
	Multi	544	3.57	1.00			
Role-play	Single	496	3.33	.71	0.20	1037.78	.845
	Multi	544	3.32	.77			

Table 10: Analysis of game types by social preference.

Obsessive Tendencies

Grouping	Subgroup	N	Mean	Std. Dev.	t-value	Degrees of Freedom	Significance (2-tailed)
Game Literacy	Hardcore	521	3.14	1.18	4.84	895.89	.000
	Casual	425	2.76	1.22			
Social Preference	Single	496	2.92	1.21	-0.14	1029.66	.890
	Multi	544	2.93	1.22			
Gender	Male	891	2.92	1.20	-0.41	179.63	.684
	Female	141	2.96	1.30			
Logistical	Low(<4)	623	2.77	1.18	-5.17	864.26	.000
	High(>=4)	417	3.17	1.23			
Strategic	Low(<4)	726	2.81	1.20	-4.74	593.81	.000
	High(>=4)	314	3.20	1.20			
Tactical	Low(<4)	638	2.81	1.17	-4.04	810.40	.000
	High(>=4)	402	3.12	1.25			

Table 11: Analysis of obsessive tendencies.