Intuitive Rules Design Evaluation Methods and Case Study

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Abstract

Examined is a structured play testing methodology based on an observational study to evaluate if a board game has intuitive features, and what features of design a user will find to be confusing. By presenting a game with only the elements of the game to a set of users and performing an observational study of play, mechanics, objects, and themes. The rules booklets should only be used as a method of teaching a player as a last resort and place intuitive embeddings into the parts of the game itself. We examine a small set of games via the process as an initial proof of concept. Observational studies of intuitive features will enable games designers to ensure a swift transition from unsealing the game's container to enjoying playing.

Introduction

Intuitive design for board game design refers to ensuring that player is able to effectively learn the rule of a game in a reasonable time frame to allow players to enjoy playing the game rather than reading rule books. In 2011 at MIT, Daviau proposed what he deemed a sadistic experiment on a group of smart people who "spend most of their time inventing molecules or building cold fusion coffee makers" (Daviau 2011). His article looks at a number of features which he deems to be part of the intuitive design method, though these are not justified by the MIT results, which are not stated, he only makes an anecdotal statement that it was surprising how many correct statements about the games his players could gleam from game objects without rule books. This paper examines how such an anecdote can be developed into the framework of an observational study to aid in the design of board games. By targeting observers to the process, user difficulties can be discovered, the game parts leading to such difficulties identified, and actions to change the game can be qualified by these observed deficiencies.

This paper does not look at the results of any individual study but instead examines the refinements of the methodology and gives recommendations as to how to improve future studies with a focus on play testing for industry.

Use of qualitative play-testing alternatives such as Personas (Cooper 1999) can be seen as part of the games design process (Brown 2015)(Holmgård et al. 2014), in order to examine how users may view a product. However, their use has the dangers of not having been quantitatively shown to produce improvements to a design process (Chapman and Milham 2006). Furthermore, when using a Persona-based method, the developers' biases may, in fact, be more pro eminent (Hattula et al. 2015).

In (Hattula et al. 2015) managers were given example products to come up with a marketing plan for them. Those that were told to keep user demands were more likely to frame existing beliefs and did not respond well when challenged than those not primed to take into account their beliefs as to what a user would want. This is the same process which Personas use, taking into account a hypothetical user and such outcomes may expand from this study into these systems.

Hence, the best method in order to see if a design is usable and insinuative is still user testing, even with all of its inherent costs. Ergo, utilizing play tester time effectively to show problems in the design becomes a priority. (Petroski 1994) puts the process of design into an evolutionary framework, in which bad designs are simply not used, and good ones by virtue of their acceptance by a consumer to solve a problem, are selected and thus continue to survive. Card games, since their origins (Wikinson 1895), have followed this trend of evolutionary design as well (Bodle 2008). Accepting, this hypothesis of natural selection of objects, increasing the number of developed objects and making variation based on the evaluation of the user speeds up this process and leads to a more mature product. Woodruff provides a good review of the current state of board game testing and when to apply such techniques (Woodruff 2011).

Talking about object interaction, affordance theory is significant to understand action possibilities with objects and the environment. The word *affordance* was first introduced by psychologist J.J. Gibson and explained in his book *Ecological Approach to Visual Perception* (Gibson 2014). Affordances broadly consider all actions that are possible in the environment and they are dependent upon an individual's physical capabilities. In his book *The Design of Every Day Things* (Norman 1988), Norman referred to the term affordances as perceived affordances such as actions possibilities that are readily perceivable by the individual. Based on the idea of perceived affordances, Norman provides some of the basic thinking that a user experiences from a cognitive perspective and argues that objects should have *visibility* and *affordance*, that is to make the task clearly visible to the

user and design to allow that task to be completed and only that task. One of the most common examples used is that a door should have a handle on the side which is pulled, affording the task of pulling, and a bar on the side which is pushed, affording the task of pushing. The functionality is also visible without the need for a sign on the door, which could be considered a manual, saying push or pull. Norman states that four principles should be maintained in a design: actions should be *Visible*, the user should build a *Conceptual Model*, there should be a consistent *Mapping* in actions to outcomes, and the user should have both positive and negative *Feedback* on their actions (Norman 1988).

On the subject of board games, Browne examines the elegance of rule systems which exhorts the designer to produce rules which are self explanatory to players (Browne 2012). Further, in (Browne 2015) the Japanese idea of *poka-yoka*, or mistake proofing, is examined for a number of board games as a method to again express rules of games without rulebooks and prevent users from making mistakes during game play. By providing observational guidelines for rule systems testing, we also use a Japanese manufacturing process technique as an analog; the engineering practice of *Genchi Genbutsu* and *standing in the circle* as popularized by Ohno (Ohno 1988) and used in Lean production frameworks (Womack and Jones 2003).

Genchi Genbutsu, Americanized into "go and get your boots on", encourages an engineer or manager in a manufacturing process to go and see the problems and issues themselves and not rely on just reports. The *standing in the circle* was a story, perhaps apocryphal, that a chalk circle would be drawn on the factory floor and new engineers and managers would stand in the circle observing the process until they would be allowed to propose any changes. The observations lead to an understanding of the state of the system before any actions could be performed; time must be taken to understand the reality of a system before acting. In order for these observations to be informative, the observers must ensure that the study is done with *in situ* game play.

In order to allow for such understanding the conditions of any observations should be made in an environment as close to *in situ* game-play as possible. This process is similar to how gaming groups will utilize board games, pulling a new game out of the box and attempting to grasp the rules and play the game. By ensuring that rules are intuitive, for a conceptual model to be produced in a short time frame, this allows players to quickly start a session of play and is thus a desirable and marketable feature. The adage which games should stride towards is that they should be "easy to learn but hard to master"; allow new players to join into the game, but allow veteran players to still feel engaged in the game.

Methodology

An observational study is an empirical investigation to find cause-and-effect relationships if it is not feasible to apply a controlled experiment, for example when you cannot create a random sampling or assign participants at random to treatment and control groups, (Rosenbaum 2002). Such methodology is frequently applied to studies with human participants. The commonality is that in both a controlled experiment or an observation, a treatment is applied. In this case, the control group is uninformative — players who have the rule book being asked what the rules of the game are and then asked how they discovered the rules from the game will yield a response of "I read the manual you gave me" from a play tester. In order to focus on the question, these play testers are better used as part of a treatment group, as a cost saving measure.

Figure 1: A board game for the study, *Carcassone*(Wrede 2000).

This section imparts the methodological framework for examining intuitive design via the removal of rules during user testing. Subsection examines the operational process of the experimental method, how to set up the games and the process of receiving user responses. Subsection gives guidance to the observational team. Finally, subsection explores the limitations of the observational study method and possible solutions to factors which may lead to incorrect or inaccurate findings.

Experimental Design

Observational studies require that a treatment is applied in order to demonstrate the cause-and-effect. The treatment explored by this study of games is the removal of all rules from the game, e.g. the game in Figure 1 has the treatment applied in Figure 2. We define *Removal of Rules* as broadly including the removal of any quick reference guides or cards, play mats, and the game container, if it has any flavor text or framing to the game. As a consequence, play tester's actions should be based on solely their ability to produce a conceptual model of the game mechanics from the artifacts of game pieces and their embedded rules and framing. This refers to Norman's idea of perceived affordances. This methodology also enables users to try out actions they render possible. The removal of rules release them from any constraints and, as the process goes on, play testers have the opportunity to recognize actions that were not readily perceivable. This approach is fundamental to understand all sorts of object interactions that can take place even if the users do not perceive them immediately.

Parts should be represented as close to how they will be distributed in the game box as possible, perhaps even with any box inserts. This means that objects which need to be

Figure 2: The same board game prepared for the study, without its and rules booklet. Note: the tiles are still in the cardboard frames and meaples in the bag as they would be presented to a new purchaser of the game about to play it for the first time.

Figure 3: Participants being informed of the task. The games have been distributed without rules.

punched out of sprues and card, or parts which need assembly into larger constructions. Placement of objects within the box and their relations can, therefore, be accounted for as well as any build in the organization on the part of the developers to keep like objects with like. Developers could also use blank boxes, without identifying information or text. Note that it was stated in the Daviau anecdote that games were presented only without the rule books, hence there was no experimental control on the amount for information which could be inferred from the box (Daviau 2011).

The play tester groups are then assigned to a game and informed of the task, see Figure 3. The size of a play testing group should be no less than the number of players allowed by the game itself. This ensures that the testers can potentially attempt a round of game play. The testing teams are given a short demographic questionnaire examining their basic details as well as previous knowledge in playing board games. Other personality tests such as OCEAN evaluations could also be given as this point (Costa and McCrae 1992).

Figure 4: Participants looking at the game parts while under observations.

The play tester groups are then given time in order to evaluate the game while under observation, see Figure 4. This evaluation should be done in a set time period which is based upon the expected time of game play — e.g. a game which is designed to take fifteen minutes should not reasonably take more than fifteen minutes to learn. Shorter and longer time periods can be tested with a shorter time period expected to yield the immediately intuitive ideas of the game. For example, teams looking at games for very short periods of time may only be able to work out the basic features from colours, shapes, and numbers. Those with longer periods will begin to see relations.

Finally, the play testers give their rules for the game during a wrap up meeting, see Figure 5. This may be either a written report or a verbal report. Written reports allowing for a clear matching of rules to functions, and play testers can give their comments on the features linked with rules, allowing for a quantitative analysis using such methods as word stemming in responses. Linking common features and parts of the game to the commonly appearing mechanical concepts. Verbal comments are best for extracting information about the qualitative ideas of the game, how frustrated they were by the process and what rules were decidedly confusing. Frustration is verbally easy for an observer to recognize, one will eagerly tell you how they were not able to fill the answers, but will be likely to not appear in written reporting, or appear as a blank to a question's answer. Optimally an interview team should use both methods in order to provide a better evaluation.

Observational Study

This section explores the directions for observers, how they should question the play testing groups and open the dialog.

Observational teams should take care to see how such conclusions are made from the features of the games. For example, using chess as the game, the number of players in the game is determined to be two as there is a white set of pieces and a black set and both have the symmetrical types

Figure 5: Participants present their findings on the game; giving the rules which have been constructed.

of units. Further, observers should pay attention to how the player testers manipulate the objects of the game; are they sorted by size, shape, colour, or other factors.

The observational teams should direct the players to answer some basic questions about the games during the testing, such as:

- How many players does this game allow? (Min/Max)
- What is the order of play? (Turn-based, Turns with interrupts, all at once, etc.)
- How much time does it take to play?
- What are the winning condition(s)?
- What are the rules?
- Which game objects lead you to these conclusions?

The questions should include elements of relating the findings back into what parts of the game led them to such conclusions and observers should encourage play testers to justify their answers to be clear about what features of the game are including in this decision. Asking probing questions to elicitate such answers can come from the observers. However, observers should not prevent mistakes on the part of the play testers, nor give feedback or direction as to the rule of the game in order to not direct players past legitimate difficulties in the understanding. Responses can be made on both the individual and team levels, though responses from the team should meet with a measure of conscientious, much like how house rules during game play are made.

Case Study

The following presents a case study of this observational process.

Participants

Participants were all part of the Innopolis University Winter School and were attending a class on game design trends instructed by the authors.

There were ten male and four female participants. Their ages spanned from 21 to 32 with a median age of 25. Participants all had English as a second language at the intermediary level. All of the participants were university undergraduates.

Observational Setting

The group was presented with a set of games, each pair was allowed to select one in turn by their randomly assigned group number. They were told to select a game by the criteria that it could not be a game which they had played before. Teams then returned to tables with their game to examine them. They were then informed that they would be presenting on the game, showing others how it was played. Finally, they were informed that all rule books had been removed from the games (in this early study we did not remove all the boxes and rules objects in the box to conform with the Daviau study - though we do advise it for future works as it conflates information from the game objects and from the box's theme as mentioned above). We used a limit of fifteen minutes, longer than that used by Daviau, in order to account for potential issues in language, the games presented except one were all in English. *Carcassonne* was presented in the Russian edition, which was the native language of the participants, but other than the box, no other language was presented on the objects.

Key Features of the Games

As said, our aim is to determine if specific game design choices may impact how intuitive a game is. To perform such determination, we need to define the key set of features that characterize a games design, these are the independent variables. Once we have found them we will compare how the different games perform when the instructions are removed and we will try to link back these performances to such features. Since this is an observational study, we will not employ any inferential statistical technique to draw conclusions.

The key features that we have identified are:

- **Container** of the Game (the Box, Bag, etc.)
- **Cards**
- **Tokens**
- Game **Board**s or Play-space — where we define a play-space to be an inferred board created by actions in the game such as the discard, playing a card in front of you, and draw piles on a table. These actions could have a board created for them, and such play-mats exist for a number of card games such as poker or blackjack tables.

The selected tabletop games are examined in this section. The majority have widely varied items used in their construction: cards, wooden cubes, meaples (a portmanteau of 'my people'), tiles, dice, counters, and pawns. Also, they have a mix of both European and North American style designs. Some have won awards for their design, such as Carcassonne winning the Spiel des Jahres and the Deutscher Spiele Preis awards in 2001 (Wrede 2000). The goal of this initial study was not to see how these objects differed, but

only to provide a wide variety to the groups so that no two were attempting the same game to allow for diversity in the final classroom discussion. We give a short description of each game in this section and what was removed from the game as part of the experiment.

To simplify the analysis in this section we summarize the features we have in Table 1. We omit the board as a feature, as in all cases but the two which use score boards, *Carcassone* and *Condottiere*, it is defined by the play.

Analysis of the findings

From the observation above, Table 2 summarizes the outcome of students and their ability to use the parts examined to create an understanding of the game, that is, which features of the game helps the most in its understanding it without having to go through its manual.

The final results show that a particular assemblage of parts is not enough to ensure the imparting of knowledge about the game rules. For example, games which came in boxes were likely to have the number of players printed on the box, yet the team for *Flip City* did not find this information, whereas in *Hive Pocket* without a number of players printed on the bag this information came from the games other parts, the number of players was defined by tiles having only two colours. Thus, the connection from a game part type to a game rule is rather weakly connected via our initial observations. Our summary does show that *PirateFluxx* and *Carcassone* were the easiest game for the teams to understand. *PirateFluxx* embeds the rules to the cards almost completely and *Carcassone* uses both colours and forcing functions, the *poke-yoka*, for tile placements.

Our least well defined game was *Condottiere*, which has the most interacting parts. A player must conceptually understand the scoring board of Italy and a set of tokens, and a large set of cards. These cards give no text as to their context in the game and symbolically give information to the player by a combination of colour, number, and image. The cards also cause effects, such as where tokens will be placed on the map, who can take the first turn next, if there needs to be a modification to all values, or if they are protected from such a value modification. It is very unlikely that even an advanced game player would be able to infer all the rules from just the parts alone. The contextual framing of the images helps the game, it being about two armies clashing in the Italian Renaissance, but it would be unlikely for a player to realize that the scarecrow card has the mechanical of taking an army card from the playing area and drawing it back into one's hand for a later turn. Though in framing context this obvious in hindsight once described — it was a decoy army.

On processes of discovery

Observing the students and their methods in order to find the factors which would allow them to make rule discovery, we saw a commonality in the process used in the discovery. The students used the game boxes to allow for the inferences of the theme of the game and used the text on it as a stating point. As some of the game boxes made mentions a number of players and of various mechanical actions within the game — e.g. *Flip City*:

> "The citizens of Flip City want you to expand and renovate their neighborhoods – but if you ask for too much in taxes all at once, they won't be happy!
>
> To keep them at ease, you will:
>
> - Play from the top of your deck (no hand!)
> - Push your luck
> - Build your deck
> - Upgrade Cards by flipping them"(Zhifan 2014)

The theme of the game was an important factor in understanding, as identified above in *Condottiere* as well. Parts then underwent some type of classifications, by factors such as colour, shape, and type. Items which expressed or inferred numbers were more heavily scrutinized by the students, such as the values in *love letter*. For games without descriptive boxes, i.e. *Hive*, the name of the game made an implication which was hard to ignore — the idea of the the tiles acting as cells in a hive structure. The colour also was able to allow for implications of the number of players, the two players in *Hive*, five in *Carrcassone*, or six in *Condottiere*, directly stem from the colour on the tokens used in their representation. Note that games, where there were the most confusions on a number of players, were the card games without the use of tokens, except the player number for *PirateFLUXX* was discovered via the package.

Further, the findings highlight some games were quick reference cards and other rules aids can improve the play. Looking for example in *PirateFLUXX* which has the majority of its rules and play embedded in the cards, the student's mistakes as to the number of cards at the beginning of play in one's hand, and what the initial actions be fully embedded on the single removed "Basic Rules" card — those rules being that you draw three cards to start and when no other rules are overwritten you must draw one card and must play a card on your turn. Similarly, *love letter*'s quick reference card gives the turn order, a short description of the value of each card, and the number of that type of card in the deck. Such information as the number of each type of card would be known to advanced players but not apparent to novices. Given that some of the card's powers are based about guessing as to opponents hands, such knowledge of a number of potential cards in play allows players to *card count*. This information being part of a quick reference card held by all players allows for both novice and advanced players to apply such strategies and increases the speed of formation of the conceptual model.

On Development of New Rules for Old Games

Decks of cards, meaples, marbles, and even chessmen, have had a number of games created for their use. Early rules for chess limited the movement for the queen to one to three spaces, and later this was changed to the entire board[1]. A

[1]The change occurred sometime in the late Medieval to Renaissance period and was known as the Mad queen variant or in Italian *alla rabiosa* and was historically mentioned in Scachs d'amor (de Castellví, Fenollar, and de Vinyoles 15th century) as part of a poem dialog. The chessmen in this game were also stated to be red and green rather then the current white and black designations.

Game	Container	Cards	Tokens
Carcassonne	Box with game art and description	Tiles	Meaple followers and a meaple scoring token
Cthulhu	None	None	Score Counters
Hive Pocket	Bag with title of game	None	Hexagonal titles
PirateFLUXX	Box with game art and description	Keeper, Action, Creeper, Surprise, Rule, and Goal Cards	None
Love Letter	Bag with title of game	Face cards with value	Score Counters
Flip City	Box with game art and description	Double sided building cards	None
Condottiere	Box with game art and description	Battle Cards	Faction score tokens, Pope, Battle

Table 1: Features of the games

Game	number	rules	strategy
Carcassonne	yes	?	yes
Cthulhu	yes	no	yes
Hive Pocket	yes	?	?
PirateFLUXX	yes	?	yes
Love Letter	no	yes	?
Flip City	no	?	?
Condottiere	yes	no	?

Table 2: Summary of how the students understood the games. A "yes" means that the students overall understood mostly correctly the feature, while a "no" means that they did not, and a "?" that it was mostly undecided.

deck of 52-cards (or the 78-card French Tarot deck) can be easily used for *poker, hearts, bridge, and euchre*. Variations and house rules have been common in such games. The process of rules discovery has shown in this study to allow for the creation of new games with old parts. The team for *Hive* seeing the game more like *droughts* or *Stratego* than *chess*, placed all the tiles in a rank order, and allowed for moves based on rank. A move would be allowed if a piece outranked the one over which it was moving. Given some play testing such a game might be found to have a consistent set of rules allowing for the playing of the new game as a variant.

Limitations

You cannot expect in mechanically complex games that all rules will be in the end meet with an intuitive requirement. Even in the relatively simple game of chess, the rule of *en passant*[2] does not come naturally to even players well versed in the rules, and situations for its application are limited during play.

During observations, the emotional state of the observed before the study and their demographics should be controlled features. Players with experience of numerous board games may be able to make a determination of rules which are not expressed by the game itself but via the use of these previous experiences. This "filling the gaps" via the scaffolds of previous learning can both assist in understanding if the conceptual models are close, or can hinder learning if the conceptual model is opposed to previous models of games. Players with differing experience in game play should be put in separate treatment groups; experienced and non-experienced. Some groups could also be designed with various experiences in order to understand the amount of information transfer based on this scaffolding to other players.

Further, game framing and cultural experience can lead to differing results and should be controlled as a biasing factor. For example, the game *Condottiere* (Ehrhard and Vitale 1995) is framed as a simulation of the wars in Italy during the Renaissance period. Card's imagery (soldiers, city spaces, siege engines), tokens (the Pope), and the game board (a map of Italy segmented into city-states) all conform to this theming. A player (un)familiar with this time period may have a (dis)advantage in determining the rules of the game based on this theme. Studies in theming of problems have shown that correct theming can increase the solution to even simple logic puzzles, such as the *Wason selection task* framed as drinking age(Cosmides and Tooby 1992), the theme acts as a scaffold for previous experience. Controlling for this issue could involve using placeholder art which is not heavily themed in some of the tests in order to allow for other factors to be evaluated independently. However, theming could also be a factor of development and be used as another method to allow for an intuitive experience, so this is highly dependent on the game and design objectives in question.

Conclusion

Through the use of a guided play-testing method removing the rules from the game and observing game play sessions, designers can extract the features which allow for intuitive play. While Daviau presented an anecdotal account (Daviau 2011), such an account did not examine how to place such an interesting method of examining insinuative designs into a proper research framework; we present a design of an observational study using this treatment method. The observational study of play testing has further benefits for the discovery of larger trends in the development of games. In future works, currently being undertaken, the results of such observational studies will be presented on a number of well known board games. This work presents our exploration of the experimental design alone and is meant to act as an operational guide for designers and developers to utilize the observational framework.

These studies seek to quantify, via existing games, how

[2] *en passant* coming into existence sometime in the 1800s when pawns were allowed to move twice on the first move but not being accepted for a number of years after (Hooper and Whyld 1992)

well the design ideals rule as presented by (Norman 1988) and (Browne 2012), (Browne 2015) exist. This completes the development cycle from their ideas of pretests, with this framework forming a post test. Thus, examining the results over a series of games with multiple play testing teams, the rules which are extracted most often based on the types of parts in the game and compared against the rules presented in terms of the embedding. While most likely they will compare to those examined by Browne, it will prove to be a verification of the embedding methods, the *poke-yokes*. The development of such critical feature lists, backed up by the user evaluations, can construct an objective score for a potential design. Such an evaluator can be used as a fitness function or objective function within the processes of automated games development, allowing for human aesthetic concerns to be placed within the framework.

Finally, the process can be used as part of not only a rules evaluation but as part of a rules development method for common parts. The rules seen in *According to Hoyle* (Frey 1985) contains over two-hundred games which can be played using a standard deck of 52-cards, none of which would be any more *correct* for an observed team to develop during this process than any others. Hence, for board games being developed with this play test method, new games can be conceivably developed during play testing. Such outcomes then could be refined by designers into either a variation of the game or into a new game itself. In one example the game of *Hive* (Yianni 2010) was viewed by a group of play testers to have less in common with *Chess* and more in common with *Chinese Checkers*. The observed team placed all the pieces in a hexagonal grid and giving them scores moved them over one and other with the goal not of capturing pieces, but to move all of the tokens to the same location on the other player's board.

This study applied to a set of random parts asking players to come up with rules for them could become a practical means of brainstorming. Particularly, companies with intellectual property rights[3] to game parts could utilize this as a method to create new games from said proprietary parts. This protects and utilizes their current patents with new innovations.

An extension of this experiment over a wider group in a more controlled setting would be able to provide a clearer picture of the role of intuitive design. Are there common themes what makes a game intuitive and can we use this method as a classifier of games. By looking at a proper measure in the difference between the rules created by the participants against the real rules. If there is also a large difference between participant teams on the same game then this should be identified as unintuitive points in the design.

Our games were not selected to meet with a well defined selection over the set of board games. Nor did we apply more than one team to each game, as the immediate concern was providing an engaging class and not a detailed experimental design. Such a design, now that we have seen the encouraging outcome of this observation, should be undertaken. We would also remove more of the packaging in this study, in order to better look at only the parts themselves and not the framing of the game box.

Developments upon this process first examined in this study have lead to findings in the differences of age (Aslam, Brown, and Reading 2018). We are interested in also examining the differences in the rules found in games due to other lenses such as gender.

[3]Such as *Loony Labs*' Pyramids for which developer is reported to aim for construction of games which utilize this IP.

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