Team report

Nintendo Wii

Analysis of Value-Sensitivity

PI 0320 – Value Sensitive Design
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1.1 Applying the tripartite methodology

The methodology of value sensitive design has received significant reverberation in the literature (i.a. Friedman & Kahn 2000; Felten et al. 2000; Borning et al. 2004; Friedman et al. 2008; Czeskis et al. 2010). For a value sensitive design analysis, conceptual, empirical and technical investigation approaches should be applied. Conceptual investigations are philosophically informed analyses of the central constructs and issues (Freier et al. 2004).

This paper covers mainly the conceptual investigations applied to Nintendo Wii and analyses direct and indirect stakeholders in detail. During the conceptual analysis, the key values will be studied and value conflicts will be clarified for drafting effective and efficient design improvement suggestions. Analyzing several video-clips of different types of the Wii's usage should is an efficient approach to cover the empirical side in our rough value sensitive analysis methodology. Experiences we collected while playing with the Wii complement the empirical and technical picture.

1.2 Socio-technical context

Playing with the Nintendo Wii is inherently embedded in the social interactions that happen in its environment. We are referring to this social and cultural embeddedness as Wii's socio-technical context (Clegg 2000). The typical locality where the Wii is used is within the people's homes, may it be the living room, children's room or the eat-in kitchen. Crucial is that a TV screen or compatible display device is available in this place. Hence, it is unlikely that the console will be used in locations such as the doorway or the staircase. Yet, also playing in the basement, for example in a home cinema equipped with a digital projector, is imaginable. At home, the social context is usually well-known people such as family, friends or trustworthy guests. It is reasonable to assume that within a private context considerateness, responsibility and amicable game play are prevailing.

Another context where the Wii comes potentially to action is at the point of sale, for example in stores or at game fairs. The console is used for demonstration purposes and consequently the coherent game sequences played by a single player are much shorter than in a home context. This is a result of the public social environment as also other customers or visitors are waiting to give the Wii a try. The purpose of game play is testing and familiarizing instead of competition. In contrast, at game parties dozens of players are gaming several hours or days for the sake of contest and video game enthusiasm. The social context is an agglomeration of skilled gamers that play together in large halls. Although exchange and sharing of experiences is an inseparable part of game parties, players might also want to keep their formula of success secret (Durham 2003). In public environments other issues, for example theft and vandalism, which are not relevant in a home context become important.

2 Stakeholder analysis

Until a video game console or a game reaches the customer, there are many steps with different people involved. Also while playing, the player is not the only person, who is affected by this process. Therefore, this paper distinguishes between stakeholders and analyzes them in two groups: direct and indirect stakeholders. Direct stakeholders are interacting with the Wii and thus are directly affecting the values or affected by them. On the contrary, indirect stakeholders are people, who do not interact with the Wii but still have an influence or are influenced by the values (Friedman 2008 et al., p. 85).

2.1 Direct stakeholders

Nintendo is a direct stakeholder, since they are the producer of the Wii video game console. They yield the returns from console sales, but also have to bear responsibilities for their system, its actions and interaction with the customers. First of all Nintendo should ensure the quality of the product, should design it to have a positive effect on customers and to be accountable for software or hardware sided problems, which may occur during the interaction. In the long run, Nintendo has to listen to their customers' wants and needs and should improve the weak points based on the customer comments. Hardware problems can be hard to improve once the console is deployed, but software problems can be handled with the help of firmware updates.

Game developers are also in the category of direct stakeholders, because they use the Wii platform for developing and distributing their games. Their products can also directly affect the customers' values. Therefore, besides the common values like accessibility issues or security of data transmissions, they should also consider ethic and moral values of players.

While speaking of direct stakeholders of a video game console, the most important ones are definitely the players, because the system should be designed to meet their wants, needs and desires. Players engage in Wii gaming because they receive intrinsic benefits like fun and joy. However, to prevent any harm, they should be and feel secure while playing games. For example, the games should give them warnings about possible accidents or side effects, e.g. "Make a 15 minutes break after playing for an hour" or "Put every obstacle away in order to prevent a bump against them".

2.2 Indirect stakeholders

Watchers are one of the indirect stakeholders of the Nintendo Wii. They have actually an important role on the gaming experience, because they either disturb the interaction by limiting players movements or could get hurt by a rapid movement of the player. Consequently, watchers should sit or stay out of the reach of the player in order to prevent any accident. If passively watching games is enjoyable over a longer period of time is subject to further investigation.

Game publishers are also playing an important role indirectly, because they are deciding, where the games are getting shipped. Most publishers are distributing the games worldwide, but they should consider the values of countries or groups. For an example, they should not ship a game to African countries, if the game is about killing African people. Game publishers also have to let the games rated by ESRB for preventing any unwanted purchase (ESRB 2011).

Third Party Accessory Companies produce OEM spare parts and utilities for the Wii such as input devices, sometimes at lower prices as the original equipment. They benefit from but also depend on the existence of the Wii platform. They should consider the same quality guidelines while designing their products, e.g. do not designing sharp objects, if the products target group contains also children. Hence these companies are solely accountable for any hardware problems and design issues of their products.

Stores should care about the age limitations of the games and do not sell games for matures to children. They also play a vital role in the reverse supply chain for the disposal of Wii components. Stores can also benefit from a secondary market of old games, because if the customers cannot find them easily on the market, their willingness to pay increases.

Families are the most important indirect stakeholders. Parents should care about the type of games their kids are playing (shooting games vs. learning games à ESRB Rating). They should also spend time for other family activities and set limits for play to prevent any issues leading to family conflicts.

3 Conceptual investigation of key values

This section reviews the values implicated by the current design of the Wii. Effects on its acceptance among potential users are discussed. Values are principles and considerations persons or groups of people judge as important and valuable in their lives. Not only values regarding the function or context of the Wii are investigated, but also values that have ethical significance to the users or society (Friedman et al. 2008, p. 70).

3.1 Accessibility

The developers at Nintendo state that Wii "brings a revolution of motion controlled gaming to people of all ages and families everywhere." (Nintendo 2010). At the heart of Wii's development are accessibility considerations in order to address a broader population of potential gamers (Casey 2006). Nevertheless, it was supposedly not the generous goal to enable gaming for segregated people that has driven Wii's development, but to increase market share and penetrate market segments with poor competition known as "blue oceans" (Kim & Mauborgne 2004). According to Shneiderman (2000, p. 91) one challenge for widening access of a technology to a larger population is the diversity of users. The ACM Code of Ethics (1992) approaches accessibility from a more universalistic view and states: "In a fair society, all individuals would have equal opportunity to participate in, or benefit from, the use of computer resources regardless of race, sex, religion, age, disability, national origin or other such similar factors."

Considering the single components of the definition, Wii supports for differences in age, sex, race and national origin. For disabled people, however, only limited accessibility is provided. While bringing people of different age and sex to play together is at the heart of Wii's concept, differences in race are remediated by supporting customizable characters called Mii including changeable skin color. Different language versions for the console and games should balance differences in nationality. Moreover, Wii is globally available, therefore not excluding specific parts of the world.

Another barrier to accessibility can be the pricing of the console. In the United States the console's retail price is $199.99 effective September 27th, 2009 (Phillips 2009). Based on a per capita GDP (current prices 2009) of $45,934 (IMF 2010) the console's price accounts for 0.44% of the annual value creation of an average US inhabitant. For the emerging and developing economies the price accounts for 3,51% of the 2009 per capita GDP of $5,702 (IMF 2010). It is therefore more than eight times as "expensive" foreclosing access to broad levels of the population in developing countries. Moreover, Chen (2008) points out that in a bundle with four controllers the Wii is actually as expensive as its traditionally more pricey competitors, the Microsoft Xbox 360 and Sony Playstation 3.

A similar argument applies to the costs of Wii games. The retail price of a Wii game ranges between $20 and $60 (GameSegment 2011; VideoGamePriceCharts 2011). That is between 10% and 30% of the consoles price in the United States. Possibly the game industry is not pricing its products cleverly as media reports suggest that discriminating and making game prices more flexible can lead to increased sales (Irwin 2009). In contrast, Parrack (2008) argues that Wii games provide good value for money when the time of entertainment is taken into consideration. Compared to an average DVD that costs $15 and gives you about 4 hours of pleasure if watched twice, a Wii game that costs $60 offers more than 20 hours or in the case of role-play games even as much as 100 hours. Hence, the hour price is quite competitive to other forms of entertainment.

Designing a video game platform for an international audience bears the problem that graphics, colors, symbols and icons have different meanings in different cultures (Sears 2003, p. 35). Similarly, when designing for children, legal issues including privacy, parental consent and age-appropriate content must be considered (Sears 2003, p. 32). As a consequence, Nintendo of America has released video content guidelines to ensure that "products do not contain material that society as a whole deems unacceptable". This includes, among others, the censoring of graphic illustration of death, sexually explicit content, nudity and "symbols that are related to any type of racial, religious, nationalistic, or ethnic group, such as crosses" and pentagrams (McCullough 2010). Surprisingly, these issues are not censored in all language versions of Wii games. For example, the Wii game "Call of Duty: World at War" was censored for Nazi reference in the US-American and German version, while it is not in the international version (Henkel 2008).

In order to make the WiMote controller more attractive for technology-illiterate users, it resembles a TV remote control. (Business Week 2006) For people with physical impairments and disabilities WiiMote can render the interaction with games easier or more difficult depending on the type of the impairment or disability. Consequently, Wii opens up gaming opportunities at least for some groups of people with special needs. Nevertheless, many accessibility issues remain. For disabled with perceptual impairments including visual, hearing and cognitive disabilities little help is provided from Wii's interface (Sears 2003). For example, no alternative means such as subtitles for indicating audio output are provided.

3.2 Well-being and emotions

Playing Wii can have positive effects on the well-being of individuals. In the United States, an average individual spends more than four hours per day in front of the TV having detrimental consequences for health. Nawyn et al. (2006) developed a remote control for a home entertainment system named ViTo that employs strategies for changing behavior in watchers to help them getting active. Similarly, the WiiMote encourages physical exercise in front of the TV screen especially in connection with the game "Wii Sports" that is already in scope of delivery in most parts of the world. In addition, Nawyn et al. (2006) identified four challenges for the adoption of devices that support TV behavior change and can also be applied to the Wii. Playing with the WiiMote must be non-obtrusive to gaming and should not require additional time-effort. Moreover, active usage of the Wii must be sustainable over the course of years which can be achieved by playing different and novel games reducing the risk of annoyance and

increasing elements of fun. Third, Wii provides a game-like experience that does not nag the user to move or promote exercising as a form of punishment. Fourth, the behavioral change should also persist when the technological aid is removed and playing Wii sports games can induce the desire to make "real" sports.

The number of seniors over the age of 65 will almost double between 2000 and 2030 in the United States (Ahamed et al. 2007, p. 782). In a four month study in three retirement homes for the elderly in Germany, Ulbrecht et al. (2010) found out that playing Wii can have positive effects on the cognitive and sensomotor capabilities of seniors. Graf et al. (2009) coined the term "exergaming" and measured that energy-expenditure during playing an exercise-like video game is comparable to walking at a medium pace. However, also some negative reports of the effect of playing Wii on personal well-being and health can be found. A patient that played Wii Tennis for several hours complained about acute pain in the right shoulder, called "Wiiitis" (Bonis 2007). Moreover, Eley (2010) reports from Wii associated injuries that include traumatic hemothorax from a fall while playing, fractures, dislocations and head injuries.

Playing the Wii also addresses the affective sphere of humans including primary and secondary emotions. Primary emotions are basic emotions that appear quickly and do not require extensive cognitive processing. Sudden and unexpected animations, for example a tennis ball directly flying in the direction of your face in Wii Sports, or shrill and loud sound effects can trigger startle-based fear. Complementary, secondary emotions like joy, pride or frustration build upon primary emotions as they require extensive cognitive processing. Although you initially got scared from the threatening tennis ball, you subsequently feel joy as the ball went into the out. (Brave & Nass 2002, p. 6)

3.3 Identity

Wii has an own concept for representing a gamer's identity called Mii. To express the self-representing capability "Mii" can be associated with "me". A Mii is an avatar that can be created by users in the Mii channel. They look like cartoon caricatures and possibly look like you, another person, for example a celebrety, or an imaginary individual (Mendoza 2010). Originally, in Sanskrit an avatar refers to the manifestation of a deity but in the virtual world avatars are "general graphic representations that are personified by means of computer technology" (Bélisle & Bodur 2010, p. 743). In a controlled randomized experiment, Jin (2009) examined the effects of self-priming, the discrepancy between actual and ideal self, on interactivity and immersion in the exergame Wii Fit. Participants that designed their avatar according to their ideal self *perceived* that more interactive Mii design options are available to them. Moreover, they felt to be more involved in the avatar creation process. Those who contemplated their avatar mirroring their actual selves experienced less interactivity and immersion. A similar effect was found for avatar self-connection, which is defined as ''the extent to which game players feel a personal connection to the avatar they create.'' (Jin 2010, p. 568).

The support of Miis for the value of identity can be measured along the laws of identity proposed by Cameron (2005). The principle of user control and consent is only partially realized as the user has clear control over which Mii is used in a game, but few control when the Mii is visible or transferred to others. Moreover, there is no protection against deception since everyone can create an identically looking Mii. Minimal disclosure of personal information is only achieved if no cue to the gamer's real-world identity is included in the Mii's design. In contrast, it is neither justifiable to which parties, such as other players or Nintendo, the identity is presented, nor is the authenticity of these parties ensured. By creating public and private Miis, Wii supports the concept of directed identities. For example, the Mii Parade function in Mii plaza makes it possible to show only public Miis to your friends. With intent, Wii does not consider for puralism of technology because Miis cannot be easily ported to other console technologies, like the Sony Playstation, for instance. By allowing users to personalize their avatars in numerous ways including the basic head shape, 72 hair styles and 48 eye shapes (Mendoza 2010), human integration into the identity concept is fostered. Miis also allow a consistent experience across contexts. Not only the same identity can be used across several games, also identities are "thingified" by presenting them as "objects" wandering around in the Mii plaza. Making identity copying and transferring via the Internet and WiiMote possible also underpins the object character of identities. (Cameron 2005) A Wii console can store up to 100 Miis, but it is likely that the cognitive scalability is

undermined at this quantity as there is a huge burden of managing such a large number of identities (Dhamija & Dusseault 2008, p. 25).

3.4 Sustainability

From a broad perspective, the sustainability of a design affects the environment, public health, social equality and justice. Especially material effects and environmental impact are of interest in connection with hardware like the Wii. Because the Wii promotes interactive game play instead of energy-intensive high-end graphic rendering, it consumes three times less power than its competitors, Microsoft's Xbox 360 and Sony's Playstation 3. However, as additionally reported in a study of the Natural Resources Defense Council (Neugebauer et al. 2008) a significant part of energy is wasted because users do not turn the console off after playing. Particularly to blame is WiiConnect24, the Nintendo around the clock online updating service. Integrating an automatic power down feature into the Wii could save additional 66 kWh of energy per year (Neugebauer et al. 2008, p. 6). Nintendo points out the innovative aspect of reducing Wii's energy consumption, as this is usually only a goal for handheld gaming devices, such as the new Nintendo 3DS (Anantula 2006). According to a Greenpeace report (Brigden et al. 2008), all three consoles, the Nintendo Wii, Microsoft's Xbox 360 and Sony's Playstation 3, contain hazardous materials such as polyvinyl chloride (PVC) and brominated flame retardants (BFRs). As PVC is dangerous for human beings and the environment, Nintendo plans to reduce its use (Portsmouth 2010). In the current Greenpeace (2010) guide to greener electronics, however, Nintendo is among the environmentally worst consumer electronics producers, with Nokia and Sony Ericsson rated much better.

Another question that remains open is what has happened with the Wii's predecessor, the Nintendo GameCube. Although the GameCube hardware became obsolete with the introduction of Wii, at least GameCube controllers and games can be reused with the Wii, following the item "achieving longevity of use" in Blevis' (2007, p. 506) rubric for sustainable interaction design. Moreover, the Wii's Internet channel limits the purchase of additional living room nettop PCs, as the Wii also allows web browsing from the sofa.

3.5 Value conflicts

Following the identification of key values, potential conflicts between these values are investigated. For the design improvements we are going to propose subsequently, these conflicts should not be regarded as binary decisions for one value but rather as constraints that limit the choices within the design space (Friedman 2008, p. 89). Instead of focusing on typical and obvious value conflicts such as privacy versus security we are focusing on specific and less common conflicts that can be observed in context of the Wii.

There is a trade-off involved in the identity gain connected to Mii avatars and the forfeit in privacy. Gamers that create a Mii that represents their actual self run into danger that personal information is unintentionally revealed to other gamers (Jin 2009). For example, gamers that use their real name as the Mii name and a Mii avatar that includes real-world characteristics like the hair color could be easily identified by other gamers.

Another value conflict regarding Miis reaches into security, identity and autonomy. Since Mii characters can be stored on the portable WiiMote, subtle forms of identity theft are possible, for example when playing on a foreign Wii console at a game party. While transportability of Miis increases the autonomy of users by allowing them object-like control over their identities, security is not adequately ensured as there is no sufficient protection mechanism hindering Mii copying.

In physically active video gaming there is a conflict between the phenomenon of flow captured by the value of emotions and the gamer's health respectively the physical integrity. The concept of flow was explored by Csikszentmihalyi (1997) and refers to the full involvement and focus on one activity. Having a flow experience is not only about coming into a state of happiness, it is more about being fully concentrated on one task. Especially in (video-) games a state of flow is often experienced and as Csikszentmihalyi (1997, p. 47) puts it: "For the duration of the game the player lives in a self-contained universe where everything is black and white". In active video games, like Wii games are, there is a risk of gamers injuring themselves, other players or damaging surrounding objects because they get too involved into the game play. For example, a player trying to catch the virtual ball with his WiiMote

prior to the opponent player might collide with his partner or a nearby table in the overeagerness of the situation. There is also a risk that the WiiMote suffers damage, for example by accidentally throwing the WiiMote like a real bowl in Wii Sports Bowling. Hence, the WiiMote should have sufficient structural stability to endure rough game play.

While designing Wii games for an international audience, universal usability can come into conflict with the value of courtesy (Wynn & Ryan 1992). Following the recommendations in the accessibility literature, expressions and symbols that have a different meaning in different cultures should be removed from video games (Sears 2003, p. 35). However, by eliminating all culture-specifics a game might be experienced as impolite and discourteous. For example, a Christian priest character that leaves with the words "See you!" instead of "God bless you!" might not offend the religious feelings of players having faith in no or another religion, but might be perceived as strange, inappropriate or ill-mannered by game players from Christian cultures.

Within the design of the Wii high-end graphic quality was traded off against a cheaper price of the console's hardware. Nintendo opted for keeping the entry-level price of the console low in order to ease accessibility in an economic sense instead of competing with Microsoft's Xbox 360 or Sony's Playstation 3 in terms of rendering power. This could have been a smart move as the classic Nintendo games such as Mario Cart are based on comic-like graphics not requiring extensive graphical power in order to satisfy the target group of gamers (Fulks 2010; Shuman 2006).

4 Design improvements

As outlined in the value analysis, there is still space for improvement. We have done some practical research talking to people who use the Wii regularly – mostly youngsters who are playing games with it, but also adults who utilize it for health reasons. In the following we present design improvements and link them to human values, especially to those with ethical significance.

4.1 Accessibility

As mentioned above for people with perceptual impairments only limited accessibility is provided. This could be resolved by designing audio helpers like headsets, which guide impaired people through the games. Visual help can be granted through subtitles in games.

Figure 1: Audio Headset

Another important issue is the price of the console and the games. As mentioned above pricing is relatively high especially in developing countries. Although compared to other gaming consoles the Wii is not so expensive, Nintendo should rethink their pricing model to eventually gain more customers in emerging countries. Hence, for the consoles and games we propose a pay-per-use model. The console could be leased from a Nintendo partner store only for the time period it is needed. Also games can be billed on the basis of actual usage via the WiiShop channel utilizing the already existing pre-paid Wii points. This pre-paid model would be suitable for developing countries, where credit card diffusion is low.

4.2 Well-being and emotions

Figure 2: Wii bike

Like discussed above, players could get into a flow experience while gaming so that they completely forget about their surrounding and focus only on one activity – the game (Csikszentmihalyi 1997). This bears the danger that kids forget about the time they have been actually playing. Therefore, we suggest that parents should be able to set a timer in the settings of the system kids are allowed to play in a row. The memory of this timer has to be permanent so that children cannot circumvent the protection by switching the console off and on again. Recall the tennis player suffering from "Wiiitis" because of excessive playing (Bonis 2007). With this possibility he would have stopped his session earlier.

Not only the WiiMote can be damaged by using it as a substitute for a tennis racket or a bowling ball. It can also seriously harm players who are intensively caught in the game. We think that a new product like a "very soft cover" for the WiiMote (i.e. a Wii SoftMote) could prevent most injuries so that players are secure.

For exergames simulating a bike-ride, the Nintendo-solution of having people tap their feet on the Wii balance board is inappropriate. A better way to exercise in this way would be using a real "Wii"-bike like depicted in Figure 2.

4.3 Identity

Figure 3: Typical Mii - avatar

We have learned from regular players that they love how Miis look like and that their reduced minimalistic design is part of Wii's success. However, what is valid for representing a traditional gamer's identity does not necessarily need to attract other target groups, especially elderly people who might identify themselves more with realistic avatars. Also compared to other console games this could be perceived as a competitive disadvantage. Still, Mii avatars are appreciated in the Wii community and thus we propose to *complement* Miis by more realistically looking avatars we call the "realistic Mii" or Rii. Nevertheless, this improvement should not put too high demands on the built-in ATI Hollywood GPU (Graphics Processing Unit) in order to keep energy consumption and hardware cost of the console low.

To prevent identity theft of Miis stored on the console or WiiMote a password protection for copying should be implemented. Also an online similarity check service for Miis could be introduced. Miis that are more than 99.99% similar to the Mii of any other player in the world should be rejected in order to avoid Mii reengineering.

4.4 Sustainability

For further reducing Wii's energy consumption we propose to include an auto-power off feature into the Wii. If no input is detected within a certain period of time, the console should automatically turn itself off. Also the WiiConnect24 service should be enriched by a wake on LAN functionality, so that the console is only activated when actual data transfer is in progress. Moreover, to ease recycling the Wii's housing should be manufactured from biodegradable plastics.

4.5 Improvements tackling other ethically significant values

Figure 4: Additional sensors

Storing personal training data collected by input devices such as the Wii balance board is a potential threat to privacy. Although training data is being stored in a "private" session on the system, it is neither encrypted nor protected through a personal code. Hence, not only local data theft on the console could be possible, but also systematic and distributed collection of data via Wii's Internet connection. Hence, a PIN code could help hiding intimate data.

Although people like to play games like boxing or golf where they turn around 360 degrees, we experienced connection problems of the Wii-Mote to the IR sensor bar placed on or beneath the TV screen. For example, this could happen when the player is hiding the Wii Mote behind his body by preparing the next golf swing. As a consequence, we suggest placing more sensor bars into the room, at least one additional in the back. Moreover, another technology for position-detection like using Bluetooth or wireless LAN for triangulation could be taken in consideration.

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