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Design Analysis of Everyday Thing: Nintendo Wii Remote

I. Introduction:

Ever since being released in November 2006, the Nintendo Wii gaming system has revolutionized the gaming experience for all different types of users such as young, old, physically fit, disabled, kids, parents, teachers, etc. One of the biggest reasons why the Nintendo Wii has been so successful and usable over the years is because of its unique game remote controller that has a much more different (more usable) design and interface than previous Nintendo controllers such as Nintendo PlayStation and Nintendo GameCube. Whereas the oddly-shaped PlayStation and GameCube controllers do not fit comfortably into the user's hand and require the user to plug a cord from the controller into the game system itself, designers at Nintendo designed the wireless (cordless) Wii remote to mimic actual human motion by creating a small controller that conforms to the user's hand and by allowing users to freely move the controller just like he or she moves his or her arms and legs naturally on a daily basis. In other words, the usability of the Wii remote was primarily designed based on natural, kinesthetic movement of the body in real time.

The Nintendo Wii remote (*see Figure 1)* has two parts that connect together. There is the main controller (with all the buttons and controls), and there is the Wii Nunchuck (not used as often among users). In terms of usability, take specific note of the size and shape of not only the main controller but also of the Wii Nunchuck (shaped for the user's hand). Based on Donald Norman's five design principles (conceptual model, affordances, constraints, mapping, and feedback) in *The Design of Everyday Things,* both parts of the Wii remote

Figure 1: Wii Remote: Main Controller (left) and Wii Nunchuck (right) connected together. My everyday thing.

combine to form a very good example of an everyday usable device because the remote has a very simple conceptual model that allows users to easily understand what should be done with the object, its basic affordances show users how the complex, technical remote can actually be used in simple, everyday ways, the device is not very constraining to the user's mobility but limits the possible actions users have to learn and remember, the remote illustrates natural mapping between the movement of the controls or buttons on the device and the movement within a game, and the device gives users feedback about the results of the user's actions. From these design principles, it is overwhelmingly noticeable that the designers at Nintendo focused much of their attention on creating a positive user experience throughout their design process, and thus, the usability of a motion-sensor remote controller that puts the user in control of the gamer experience has proven to be quite exceptional.

II. Conceptual Model:

One of Norman's design principles that the Nintendo Wii utilizes and that makes this remote unique and more usable as compared to other game controllers is an effective, good conceptual model. Norman defines a "good" conceptual model as a model that "allows us to predict the effects of our actions" (Norman 13). In other words, a good conceptual model of a product allows users to easily figure out how to use the product based on past perceptions and experiences with other similar products or devices. "The mental model of a device is formed largely by interpreting its perceived actions and its visible structure" (Norman 17). If the users cannot picture in their heads some picture or image the designers had in mind when creating a specific device, then the device probably will not be very user-friendly when the users actually physically utilize and handle the device.

For the Wii remote, there are two distinct conceptual models that help users figure out how it works and what to do with it. The first conceptual model is a model that most people do not think of when they are trying to picture a video game controller and that model is of a typical television remote. By glancing at the shape and size of the Wii remote controller for the first time, first-time users can visualize how to hold it based on their experiences with handling a television remote. The controller's elongated (stretched-out) shape, its thin, small body, and the controller's buttons on top (the face) of the controller will make the mental image clearly visible to the users that this device is modeled after a television remote. Once users have the conceptual model of a television remote inside of their heads, they can mentally predict what will happen when they try to use it. For example, the users hold the Wii remote like a television remote, they push buttons (affordances) like a television remote, and they

move around the room with the Wii remote like a television remote because both devices are wireless (cordless). Thus, the simple visual structure of the Wii remote's design, which is modeled after another simple, everyday thing that people commonly use in order to play games on the Wii, makes this device a good example of usability because when figuring out how to hold and move the Wii remote, users have a conceptual model nearby them (usually in the same room), a model which is the everyday television remote. In basic terms, the television remote is the best metaphor for understanding how users will use and handle the Wii remote.

Another conceptual model that works well with the conceptual model of the television remote and that adds to the usability of the Wii remote is the model of a typical game controller. Even though, from a distance, the Wii remote does not visibly look like any normal game controller created in the past (for example, the Xbox game controller), looking at the overall structure of the Wii remote up close allows users to predict how to use the buttons, what each button is for, where each button is located while playing a game (which allows users not to look down at the controller in the middle of a game), and what will happen when a user pushes or moves a button on the device. For example, the conceptual model of a typical game controller (from looking at it up close) will have a power button up at the top on the front side, will have a button, which looks like a "cross" (known as the control pad), that moves game characters or objects on the screen left, right, up, or down, and will have a basic toggle-like control. On the Wii remote, one will find these aspects easily if they mentally picture the correct conceptual model the designers had in mind, a typical game controller. On the Wii remote, the power button is located at the top on the front (face) side. The "cross" button, or control pad, is located just underneath the power button, and the toggle-like control is located on the Wii Nunchuck, which is connected to the main controller. By combining the conceptual model of the television remote and that of the typical game controller, users can use everyday objects and past gaming experiences to create a complete conceptual model in their minds in order to quickly understand and learn the basic uses and functionalities of the unique and usable Wii remote.

III. Affordances

Not only can a conceptual model of an everyday object allow users to easily understand how that object works, but also, an object's affordances (its actual physical properties) allow users to determine what an object can do and how the object allows for certain actions. According to Norman, affordances are the physical properties of an object that "provide strong clues to the operations of things" (Norman

9). For example, the physical material and the size of the Wii remote are affordances. The lightweight plastic that the controller is made out of and its relatively small size allow the users to comfortably stand and move around without being constrained by a heavy remote, and thus, the lightweight material affords (or allows) users to move the remote in almost any humanly possible way both freely and easily without much constraint. Also, the motion sensor on the Wii remote is an affordance. The motion sensor is for "reading" the motion of the controller, transferring that motion to the console, and eventually that motion is seen on the screen in real time. Hence, the motion sensor affords standing (Wii controller cannot work [very well] when sitting). The sensor also affords kinesthetic moving or learning of physical activity (in fact, most users tend to use the Wii game remote for daily exercise). Overall, the motion sensor affords exercising (such as, swinging a tennis racket, bowling, punching, hunting, fishing, running, yoga, etc.) that typically constrains other game controllers to only button pushing. However, the Wii remote still has buttons and a control pad that need to be pushed, and thus, the buttons afford pushing. Users will know what to do with the buttons because they are just like the buttons on television remotes and on other game controllers. Buttons on all electronic devices are designed for pushing and nothing else. Finally, the distinct shape of the Wii remote, specifically the shape of the Wii Nunchuck, is an affordance. The small, distinct shape of the Wii Nunchuck is used for holding it in such a way that the user's hand and fingers wrap around it comfortably. In other words, the Nunchuck is an extension of the user's hand, and thus, it affords quick button pushing and quick, physical movements because the Wii Nunchuck (as in *Figure 1* on page 1*)* somewhat takes the shape of a closed human hand or fist.

All of these affordances are simple properties that help the user to easily understand the complex functions that allow the Wii remote to do what it does. Norman states that "complex things may require explanation, but simple things should not" (Norman 9). Therefore, a good argument can be made of this device's everyday usability because of its simple affordances that allow the user to be at the center of the Wii gaming experience by giving him or her more control with the remote, and hence, the user will be more at ease with the device.

IV. Constraints

Whereas affordances allow users to do specific actions, constraints limit the number of actions that can be used to operate the device. Comparing the Wii remote to other game controllers in the past, a user might not find many constraints, if any, of the Nintendo Wii remote because of its lightweight, small

size that the user's hand can grasp comfortably and because it allows for fluid, unrestricting motion. Like mentioned earlier, the motion sensor on the remote affords standing and moving around. However, the motion sensor also is a constraint because it limits the user to only standing (the user cannot sit down and play a game because the motion sensor will not "read" the motion of the controller, and thus, there would be little or no feedback). This constraint is significant to note because it makes the Wii gaming experience more user-centered, and the user can better and more easily interact with the characters in the game. The constraints of the motion sensor give clues to the user on what they cannot do with the remote (that is, users are not allowed to sit down while using it). Similarly, the small size of the remote is an affordance. It allows the user to easily hold and grasp the remote in his or her hand, but it is also a constraint because users with large hands might have a more difficult time holding the remote, moving it around fluidly, and pushing buttons quickly. At the same time, the small size and the lightweight plastic material the remote is made out of constrains the users to only quick, fluid motions with the Wii remote. Finally, the small, few (limited) number of buttons on the front (face) of the main part of the remote allow the user to push the buttons to have more control over the game (an affordance), but at the same time, the small size of the buttons and the limited number of them are physical properties of the Wii remote that provide constraint and limit the possible number of actions the user has to learn and remember in order to play the Wii system. The usability of the device is thus partly due to the fact that users only have to recognize the affordances and the constraints to understand how it works. They do not have to memorize them.

As a result, because of the constraints that the Wii remote offers by constraining sitting down, limiting the physical properties, and by simplifying those properties, the Wii remote is more accessible to a wider audience base because of its easier learnability and memorability than other game controllers. Users can easily locate the different controls and buttons on the device to do specific actions because there is not much memory work involved on the part of the users. Hence, the device represents good usability because children, teenagers, and adults can figure out what to do with the remote by its constraints, limitations, and by the specific actions that it cannot perform.

V. Mapping

Perhaps one of the most important principles of design of the Wii remote that affects its usability is mapping. As mentioned by Norman, "mapping is a technical term meaning the relationship between two things, in this case between the controls and their movements and the results in the world"

(Norman 23). The Wii remote is a good example of what is called natural mapping, which basically just means that the relationship between the movement of the remote in reality and the movements that happen on the screen is intuitive and easy to understand. The natural mapping of the Wii remote gives a more distinct, complete conceptual model of how to go about completing real-world actions (punching, swinging a golf club, skiing, swinging a tennis racket, etc.) with the remote in the user's hand, actions in which result in similar actions on the screen. The example of Wii Tennis illustrates this principle of natural mapping. In Wii Tennis, users swing a "tennis racket" inside of the game by swinging the Wii remote with the same natural hand motions and in the same way that a tennis racket is supposed to be swung in real-life situations. In other words, there is naturalness to the design of the Wii remote. How users move the remote to interact inside of the game is the result of similar actions in the real world. For example, moving and holding the remote like a golf club in the real world will result in the same (or similar) movement within the game. If the user moves the remote up, the resulting action in the game will be up (or something similar). If the user holds and moves the remote like a fishing pole, the resulting action in the game will be the movement of a fishing pole.

Hence, for the Wii remote, all actions and movements of the remote by the user are mapped out and designed spatially. This spatial mapping makes the Wii user experience more interactive and engaging for the users because it provides instant learnability as a result of the fact that the Wii remote closely mimics real-world behaviors and actions (plus controls and buttons) people are already familiar with. The natural movements of the remote and of the human body result in an intuitive understanding of what will happen inside of the game being played. The instant learnability, the intuitiveness of the remote's design, and the natural, spatial mapping (where users can find and use the controls on the remote easily and quickly) increases user interactivity and user satisfaction, and thus, the Wii remote's everyday usability will not frustrate its users.

VI. Feedback

Natural mapping shows the intuitive relationship between the real-life movement of the controls and the simulated movement on the screen, but how users of the Wii gaming system, and specifically of the Wii remote, know that an action has been successful or not relates to the final design principle that Donald Norman mentions, which is feedback. Norman defines feedback as "sending back to the user information about what action has actually been done, what result has been accomplished" (Norman 27). The Wii remote provides feedback through a small speaker towards the center on the face (front

side) of the controller. This speaker provides users with audio, which is in addition to the audio source of the television, of specific actions that happen in the game. For example, the sounds that come out of the speaker on the Wii remote give the users feedback or audio information about the actions that have just taken place on the screen. So, if the user uses the remote as a "tennis racket" in Wii Tennis to hit a ball, the Wii remote will provide instant feedback to the user through the speaker on the remote to let the user know that the ball indeed did collide with the "racket."

Another example of feedback for the Wii remote, which is also an example of feedback for other game controllers, is the rumbling function of the remote. The rumbling functionality of the remote provides feedback by allowing users to actually feel the results of their actions within the game when they hold the remote in their hands. The rumbling motion users feel in their hands gives information to the users that usually something serious or important just happened in the game. The rumbling motion of the remote provides feedback to the users that the action is intense. Thus, the usability of the audio and rumbling functions enhance the user experience because these functionalities place the user in control of their actions and of the game. More control over the device usually means it is easier to understand the complexity of the device because it means the designers of the remote were thinking of the users first throughout the design process, which results in higher satisfaction and usability of the Wii remote.

VII. Overall Assessment of the Wii Remote's Everyday Usability (Conclusion)

After discussing Norman's five principles of design and their applications to the functionality of the Wii remote, it can be argued that the Wii remote was purposefully designed to enhance the user experience that previous game controllers failed to do. In other words, the user-centered design of the Wii controller is a good example of usability because the design does not only fulfill Norman's design principles, but also, the design offers easy learnability, little need for recall or memory of how it works, and offers user satisfaction through user interactivity and the naturalness of the remote.

The conceptual model of a television remote that users have of the Wii remote design allows users to predict how the remote works just by observing the device. Users can understand that it is wireless (so, movement is required), they can understand how to hold it and move it in relation to their bodies, and they can predict the basic functions on the remote because the visual relationship between the Wii remote and a television remote allows users to mentally operate the object before physically using it. In addition, the Wii remote represents good usability because the affordances (the size, shape, physical

material, motion sensor, etc.) show the users clearly what the device can do and what the user can do with the device (stand, move freely, push buttons, kick, punch, play golf, etc.). These affordances are simple properties that do not need much further explanation to the user, and thus, the overall remote is easy to use. The constraints of the object that limit the number of actions and controls the users can do adds to the simplicity of the remote, its quick learnability, and its ease of use. Users only have to be familiar with how to use a limited number of buttons and controls, they can find the controls and buttons quickly with natural mapping, and the device's constraint in terms of physical size tells users what they cannot do when they use this everyday object (that is, sit down while playing a game). However, the most important principle in terms of user satisfaction is mapping. The Wii remote is mapped out spatially so that the relationship between how the users naturally move and interact with the remote is intuitively linked to the movements and actions within the game. In other words, by using the Wii remote in this manner, the users of the remote are participating in the gamer experience in real time. Thus, the users are more engaged, interactive, and physical with the game, which usually leads to higher user satisfaction. Higher interactivity and higher user satisfaction of the device mean good usability for everyday tasks such as physical fitness. Finally, the audio and rumbling functions directly on the remote add to the device's everyday usability because they provide feedback through auditory feedback and motion (or sense of physical feeling) feedback to let users know that tasks within the game have been successfully accomplished or that specific actions are taking place. As a result, feedback minimizes user confusion when a user presses a button, moves the remote in a specific manner, makes an error, or is trying to complete a task within a game.

Overall, the different types of motions and controls users have to learn in order to become proficient with the Wii remote can be complicated, but based on Donald Norman's design principles that were just analyzed in relation to this everyday device, the design of the Wii remote allows users to make the complex more simple in how to understand the various uses of this object, a fact that makes the Wii remote a good example of usability and of designing for the user.

Works Cited

Norman, Donald. *The Design of Everyday Things.* New York: Doubleday, 2002. Print.