**1. Introduction**

There are 9 main concepts being introduced and discussed in Chapter 3 and Chapter 4. Concept 2 Knowledge in the Head is a high-level concept containing two subconcepts under its definition. For concepts 1-9 and the two subconcepts of concept 2, I will give a definition for each of them, then apply each to a practical example and explain its importance. The order of concepts is by the order of their appearances in the book, including subconcepts.

**2. Concepts**

1. Knowledge in the World

(a) The knowledge in the world refers to readily available information and cues that can be easily perceived. It reduces the necessity for learning(Norman, 2013, p. 77, p. 79). (b) One example of knowledge in the world is the object's shape: people can always tell if the shape of a certain object fits the target slot. In website design, this instinct can be used and is being used for human verification, which are the tests dragging different shaped objects to the corresponding positions. (c) If a website uses strange formulas such as log1010, sqrt(4), ... to represent normal numbers 1, 2, …, then the contents will be hard to read. Visitors may take some time to understand or don’t understand at all. It is an unanticipated situation that proves the importance of using this concept practically.

1. Knowledge in the Head
   1. Short-Term/Working Memory

(a) Short-term memory is the limited amount of information or experience acquired automatically and without effort. The time span is recent or still ongoing(Norman, 2013, p. 92). (b) If a website requires a text message verification code for login, then the design of web pages should be thoughtful. The code is stored in short-term memory, so there shouldn't be other pages or popup windows containing unrelated information that may distract users’ attention or prevent users’ input behavior. (c) In other words, this concept is important because it guides designers to make the certain website operation process continuous and uninterrupted, based on the consideration of short-term memory. In this case, it is the receiving, reading, and then inputting process.

* 1. Long-Term Memory

(a) Long-term memory is the opposite of short-term memory, it is the information or experience from the past, with time and effort such as study(Norman, 2013, p. 95). (b) An example of applying this concept is language: language can be considered as the result of long-term memory because it needs and can be studied by anyone. If a website’s target users are English speakers, then the designers should provide English interfaces to them. (c) With the same example, if the website fails to provide proper interface language options, the users may spend extra time, effort, and resources for translation. It may affect the user experience, therefore the long-term memory concept is important.

1. Natural Mappings

(a) The mapping is the relationship between controller and object being controlled, it is the combination of knowledge in the world and knowledge in the head. Natural mappings are mappings that have obvious relationships provided by logical constraints(Norman, 2013, p. 95, p. 130). (b) An example of a natural thing is color, the designers can group components and their controllers together by aligned colors: for a green frame component, it has a green button, same for other components with red, blue, yellow, etc frames. (c) The importance of natural mappings is the obviousity of the logic relationship. With the same example, if a colored button connects to a component with different color, users need to spend time to figure out the logic behind the color assignments. It is a waste of time and has a great impact on a good user experience.

1. Physical Constraints

(a) The physical constraints are the realities and facts that limit possible operations on the objects(Norman, 2013, p. 125). (b) In website design, this concept can remind designers to adjust the sizes of pages and components properly. The website page should fit users’ devices accordingly, while components should resize based on the change as well in order to maintain a good reading experience. (c) If a website sets cursor speed to a very low value which makes users can’t move their cursor from one side of the screen to the other within a reasonable physical distance, the design is failed and unacceptable. Therefore, the concept of physical constraints is important and it has to be considered during the design phases.

1. Cultural Constraints

(a) The cultural constraints are the social situations, every different society has its own set of allowable and forbidden actions that may not be universally accepted(Norman, 2013, p. 128). (b) In Japan, many people believe in Buddhism, which is known for no killing. If a website design is targeted at Japanese customers, then the designers should avoid using elements related to killing and blood. (c) If cultural constraints are being ignored, in this example, people may refuse to use the website or even take action against the stakeholders. That’s why cultural constraints are important.

1. Semantic Constraints

(a) The semantic constraints are the relationships between the meanings of control situations and possible actions, it depends on both human knowledge and the situation of the world(Norman, 2013, p. 129). (b) In website design, an example of this concept is the submit button. If the auto-submit function is working, which means the user's information will be automatically uploaded when they finish input: the submit button is no longer needed. (c) Without applying this concept, the submit button will still be there. It is a waste of computing resources because the button component does nothing and is fully replaced by another function.

1. Logical Constraints

(a) The logical constraints are common senses or obvious observation from discoveries, normally related to spatial or components’ functional layouts. It is the main support for natural mappings(Norman, 2013, p. 130). (b) In website design, using this concept in practice can be putting control components next to the components being controlled. Such as putting the show button next to the password input text box, so users can easily map this button to the unhide password function. (c) One example that fails to apply this concept is the light switches in my home which are illogical. There are two switches and two cycles of lights, one controls the outer cycle and another one controls the inner cycle. Each time I walk towards the switch I always think the switch closer to me controls the outer cycle, but obviously, there are fifty percent wrong situations. If each switch controls half of the lights closer to it, there will be no confusion and this is why logical constraints are important.

1. Conventions

(a) The conventions are forms of cultural constraints that are related to people’s behaviors in different societies(Norman, 2013, p. 131). (b) In India, the left hand is considered unclean so the designers should treat this convention seriously. For example, in a website design, the components can be closer to the right side to make it much more right-hand friendly. (c) If the concept of conventions fails to apply in this situation, the hand operations will be hard to perform. Especially when multiple people work on the same device or pass the device to each other, while they have to avoid left-hand contact: this fully illustrates conventions’ importance.

1. Using Sound as Signifiers

(a) The use of sound is necessary sometimes when something cannot be visible. It is able to provide information in another way, which is an example and inspiration for exploring new methods to deal with constraints(Norman, 2013, p. 131). (b) Using sound as signifiers itself is a practical example. In website design, designers can use sound to help users get attention such as new message notifications, process status, etc. (c) Without this concept, sometimes it may be dangerous. For example, old tea kettles make whistle sounds when the water is boiling. If there are no sounds as signifiers, people may forget they are boiling water and it is dangerous. Therefore, the sound is necessary sometimes as signers.

**3. Conclusion**

In conclusion, knowledge in the world and knowledge in the head are the two main concepts proposed and discussed in Chapter 3. The natural mappings at the end of Chapter 3 provided a practical example of using and combining them, as well as connecting Chapter 3 and Chapter 4 by explaining logic constraints are an important part of natural mappings. Chapter 4 mainly introduced four different constraints, the discussion of conventions is an example of cultural constraints, and the use of sound as signifiers is an exploration of dealing with constraints.

**4. References**

Norman, D. (2013). *The Design of Everyday Things*. [Revised & expanded edition]. Basic Books.