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**info 608 assignment 2**

**DOET-02 Summary of Chapters 3-4**

**Chapter 3: Knowledge in the Head and in the World**

The chapter start with the story about borrowing a car from a friend who mentioned he’d need to put the car into reverse gear to be able to remove the key from the ignition that is something he could never have figured out by own. In another example he discussed how people can generally use foreign coin accurately, based on the metal and relative size of coins. These two examples clearly show the difference between knowledge in head and knowledge in the world so I’m happy that I learn this difference in this chapter and how both of these are needed for daily functioning.

3a. What does Norman mean by “knowledge in the head” vs. “knowledge in the world”? Explain the differences and how each type of knowledge is used, with examples. How do the two types of knowledge complement each other, in system use – why is this important for system design?

Ans:

**Knowledge in the head**

Norman says that the things which we use or have knowledge in head is called memory because we use that thing regularly and interact with our life daily like cash instead of coins like penny. Technically knowledge can only be in the head, because knowledge requires interpretation and understanding but once the world’s structure has been interpreted and understood it counts as knowledge.

Requires learning, which can be considerable. Learning is made easier if there is meaning of structure to the material (or if there is a good mental model).

**Knowledge in the world**

Norman also says much of the knowledge a person needs to do a task can be derived from the information in the world. Knowledge in the world is everything else. External information or related information about the thing which we need to be remembered.

Learning not required. Interpretation substitutes for learning. How easy it is to interpret information in the world depends upon how well it exploits natural mapping and constraints.

**Usage with examples of each**

Knowledge in the head is used like if knowledge in the world external knowledge a valuable tool for is remembering but only if it is available at the right place, at the right time, in the appropriate situation. Otherwise, we must use knowledge in the head. In the mind. A folk saying captures this situation well: “out of sight, out of mind.”

Knowledge in the head Example is glass of pens on my desk which I placed corner side on my desk, so I know where I put my all pens in cup it on corner of my desk. Other examples are typing and riding bike.

Knowledge in the world is used like if a person needs to type large amount of material regularly, further investment is worthwhile: a course, a book, or an interactive program. The important thing is to learn the proper placement of fingers on the keyboard, to learn to type without looking, to get knowledge about the keyboard from the world in the head. It takes a few weeks to learn the system and several months of practice to become expert. But the payoff for all this effort is increased typing speed, increased accuracy, and decreased mental load and effort at the time of typing.

Knowledge in the world Example – Traffic signal everyone knows in the world that if the red light is there we have to stop and green light it there we can drive this thing is knowledge in the world.

**Tradeoffs Between Knowledge in the World and in the Head**

|  |  |
| --- | --- |
| Knowledge in the world | Knowledge in the Head |
| Information is readily and easily available whenever perceivable. | Material in working memory is readily available. Otherwise, considerable search and effort may be required. |
| Interpretation substitutes for learning. How easy it is to interpret knowledge in the world depends upon the skills of the designer. | Requires learning, which can be considerable. Learning is made easier if there is meaning or structure to the material or if there is a good conceptual model. |
| Slowed in the need to find and interpret the knowledge. | Can be efficient, especially if so well-learned that it is automated. |
| Ease of use at first encounter is high. | Ease of use at first encounter is low. |
| Can be ugly and inelegant, especially if there is a need to maintain a lot of knowledge. This can lead to clutter. Here is where the skills of the graphics and industrial designer play major roles. | Nothing needs to be visible, which gives more freedom to the designer. This leads to cleaner, more pleasing appearance at the cost of ease of use at first encounter, learning, and remembering. |

**Important for system design in system use**

Performance of a product is best when people have considerable knowledge and experience using that product (knowledge in the head) and that product itself has sufficient cues into the design (Knowledge in the world). Good performance results, even in the absence of the former if the latter is present. Ideally, the design model and user model are the same. The designer must ensure that the system image is consistent with and operates according to the proper conceptual model. The purpose of the system design process is to provide sufficient detailed data and information about the system and its system elements to enable the implementation consistent with architectural entities as defined in models and views of the system architecture.

Behavior is determined by combining by knowledge in the head with that knowledge in the world. Whenever knowledge needed to do a task is readily available in the world, the need for us to learn it diminishes. For example, we lack knowledge about common coins, even though we recognize them just fine. Knowledge in the world is usually easy to come by. Signifiers, physical constraints, and natural mappings are all perceivable cues that act as knowledge in the world. This shows how they complement each other.

Everything we discussed here is the most effective way of helping people remember the ways to use your product is to make remembering unnecessary and put all the information required into the product itself instead of asking the user to retain in head.

3b. How does human memory work and what are its main limitations? What mechanisms can we design into systems and devices, to compensate for the limitations of human memory?

Ans:

**The Structure of Memory**

Norman said in book if human try to aloud the numbers 1,7,4,2,8. Next without looking back, repeat them.

Try again if you must perhaps close your eyes, the better to hear the sound still echoing in mental activity. Have someone read a random sentence to you. What were the words? The memory of the just present is available immediately, clear and complete, without mental effort. Here he says that human memory works well in recent talks or recent work what they did. If someone reminds about week ago or month ago talk or information, it’s difficult to recognize what they said because of mental effort.

The human mind or memory has a limit of about 3 to 4 items. This means that without doing any memory tricks, the average human can only remember 3 to 4 things at a time. These things may include numbers, names, or tasks.

**SHORT-TERM OR WORKING MEMORY**

This short-term memory is also called the working memory. STM retains the most recent experiences or material that is currently being thought about. It is the memory of just present. Information is retained automatically and retained automatically and retrieved without efforts. But the amount of information that can be retained this way is severely limited. Something like five to seven items is the limit of STM, with the number going to ten or twelve if the material is continually repeated, what psychologist call rehearsing. Multiply 8 times 256 in your head. If you try to do it the same way you would with pen and paper, you will almost definitely be usable to hold all the digits and intervening answers within STM. You will fail. The traditional method of multiplying is optimized for pen and paper. There is no need to minimize the burden on working memory because the numbers written on the paper serve this function (knowledge in the world), so the burden on STM, on knowledge in the head, is quite limited.

**LONG-TERM MEMORY**

This long-term memory is also called the explicit memory. LTM is memory for the past. As a rule, it takes time for information to get into LTM and time and effort to get it out again. Sleep seems to play an important role in strengthening the memories of each day’s experiences. Note that we do not remember our experiences as an exact recording rather as bits and pieces that are reconstructed and interpreted each time we recover the memories, which means they are subject to all the distortions and changes that the human explanatory mechanism imposes upon life. For most people the question requires considerable effort just to recall which house is involved plus one of the special techniques described in chapter 2 for putting yourself back at the scene and reconstructing the answer. This is an example of procedural memory, a memory for how we do things, as opposed to declarative memory, the memory for information. In both cases, it can take considerable time and effort to get the answer.

**MEMORY FOR ARBITRARY AND MEANINGFUL THINGS**

Memory for arbitrary things. The item to be retained seem arbitrary, with no meaning and no relationship to one another or to things already known.

Memory for meaningful things. The items to be retained form meaningful relationships with themselves or with other things already known.

**Precise Behavior from Imprecise Knowledge**

We can have precise behavior on how to do a task without precise knowledge of the task due to 4 reasons:

1 Information is in the world: much of the information required to do the task can reside in the world. Behavior results from combining information in the head with the information in the world.

2 Great precision is not required: precision, accuracy and completeness of the knowledge are seldom required. Perfect behavior will happen if there is sufficient knowledge to distinguish the correct choice from the others.

3 Natural constraints are present: the world restricts the allowed behavior. The physical properties of objects constrain possible operations (manipulate objects). Each object has a set of physical features that limit its relationship to others objects the operations that can be done on it, etc.

4 Cultural constraints are present. Society has evolved numerous artificial conventions that govern acceptable social behavior. These cultural conventions must be learned, but once learned apply to a wide variety of circumstances.

These four reasons reduce the number of alternatives and reduce the amount of information required to be stored in memory to successfully complete the task.

**Approximate Models: Memory in the Real World**

Conscious thinking takes time and mental resources. Well learned skills bypass the need for conscious oversight and control. Conscious control is only required for initial learning and for dealing with unexpected situations.

**EXAMPLE 1: CONVERTING TEMPERATURES BETWEEN FAHRENHEIT AND CELSIUS**

In book we see the temperature and Fahrenheit example. There is 55°F outside one home in California. So, we have to calculate is it in Celsius? So, use your brain and try to find out in Celsius without help of technology. What is the answer? I am sure all of you remember the conversion equation formula:

°C = (°F–32) × 5 / 9

Plug in 55 for °F, and oC = (55–32) × 5 / 9 = 12.8°. But most people can’t do this without pencil and paper because there are too many intermediate numbers to maintain in STM.

There is easy way? It is Try this approximation you can do it in your head, there is no need for paper or pencil: °C = (°F–30) / 2

Plug in 55 for °F, and oC = (55–30) / 2 = 12.5o. Is the equation an exact conversion? No, but the approximate answer of 12.5 is close enough to the correct value of 12.8. After all, I simply wanted to know whether I should wear a sweater.

**Memory in interface design**

As designers we should learn to design for the short time memory. The memory load is lighter, and interaction is faster and more error-free. If a user has to recognize or recall something from long term memory that takes time, cognitive load and increases error occurrence probability. Distinguish visited page or website with different colors. Don’t put so many sections in one page so user does not get burden where to click. If you need to use a lot of information, divide the journey into more steps. Create a set of standards throughout the product. Adopt widely applied and tested design patterns. Once you do that user won’t have to constantly learn and remember new patterns, but they can use the knowledge they already have. Emotional interaction with your website put some emoji or reactions like high fives raise hand. Always put strong authentication so user must set password creation standards too high might seem an effective measures to increase the security of the system.

Everything we discussed here about in the past; people had to use command lines as the interface to get to their goals. This is an example of design that creates a big load on LTM and high error occurrence probability.

3c. How do effective mappings relate knowledge in the head to knowledge in the world and why would we want to do this? Understanding this, how should we design system or device controls that reflect effective mappings (hint: think about conceptual models!)?

Ans:

**Natural Mapping**

A good example of the power of combining knowledge in the world with that in the head. Did you ever turn the wrong burner of a stove on or off? You would think that doing it correctly would be an easy task. A simple control turns the burner on controls the temperature and allows the burner to be turned off.

In fact, the task appears to be so simple that when people do it wrong which appears more frequently that you might have through, they blame themselves: “How could I be so stupid as to do this simple task wrong?” they think to themselves. Well, it isn’t so simple, and it is not their fault: even as simple a device as the everyday kitchen stove is frequently badly designed, in a way that guarantees the errors.

Reminders are used to put knowledge into the world. They are made up of two components. Signal and message. Many products have only one of the two satisfied that why it is difficult to understand at first time to user. Reminders combined with the power of natural mappings reduce the need for information in memory. Take the stove and its arrangement of controls for example. The row one has many possible combinations and its therefore confusing.

Shape, circle

Description automatically generated

If a design depends upon labels, it may be faulty. Labels are important and often necessary, but the appropriate use of natural mapping can minimize the need for them. Whenever labels seem necessary consider another design which can helps user to understand properly what to do with the product correctly.

There is one more example for this is car seat controls the placement of controls on left side picture shows adjusting the positioning of a car seat is extremely unintuitive. The intension behind the vertical and horizontal shaped controls are to reflect the movement of the seat.

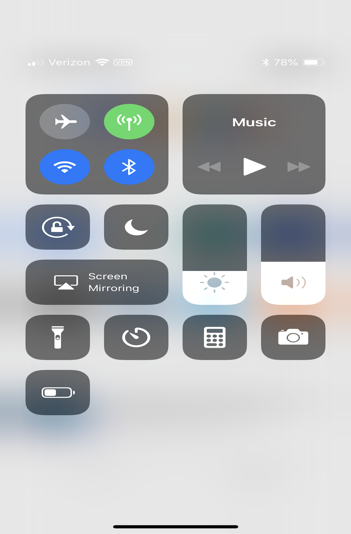
In right side picture you can see the placement of controls for adjusting the positioning of a car seat is more intuitive and easier to use because the arrangement of controls directly mirrors the shape of a real car seat.

Ideally, the design model and user model are the same. The designer must ensure that the system image is consistent with and operates according to the proper conceptual model.

**Culture and Design: Natural Mappings Can Vary with Culture**

Some designs take advantage of a commonly accepted metaphor and use that as the basis for design decisions. When done well these metaphorical mapping can serve to make the system’s functions more transparent. Consider the brightness control in the iOS control center. Swiping up within the control increases the screen brightness and swiping down on the control makes the screen darker. This arrangement works because of the strong culture metaphor “up is more”, which conceptually maps the “higher [brightness]” to the higher conceptually maps to the level of brightness (imagine if the fill were reversed; that is if a black fill indicated greater screen brightness. It wouldn’t feel natural). Or consider color, which can have associations with specific actions for example, in the western world, “green is go” and “red is stop.” Designers can take advantage of such metaphors to create natural mappings. Be aware that the effectiveness of mapping is largely dependent on culture and social conventions.



Everything we discussed in this question is for a system to be easy to learn, people need to quickly understand how it works, that actions are possible, and how to accomplish their goals.

**Chapter 3 References**

<https://uxdesign.cc/knowledge-in-the-head-knowledge-in-the-world-performance-a-basic-idea-for-an-intuitive-38e4c148b55f>

<https://medium.com/ux-planet/designing-for-human-memory-a2cdc0b6a75a>

**Chapter 4: Knowing What to Do: Constraints, 123 Discoverability, and Feedback**

Knowledge in the world includes perceived affordances and signifiers, the mappings between the parts that appear to be controls or places to manipulate and the resulting actions and the physical constraints that limit what can be done. Knowledge in the head includes conceptual models; cultural, semantic and logical constraints on behavior and analogies between the current situations and previous experiences with other situations.

4a. How do *physical, semantic, cultural*, and *logical***constraints** guide our actions and simplify what we need to remember? Discuss each type separately. What category do conventions fall into – and ***why*** would anyone care about this, when designing systems and devices. Also see an elaboration of this discussion, in the section titled “CONSTRAINTS AND CONVENTIONS” in Norman’s article [*Affordance, Conventions and Design*](https://nam10.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.jnd.org%2Fdn.mss%2Faffordance_conv.html&data=04%7C01%7Cmbr63%40drexel.edu%7C54f2bff4d9bd4b7b3bb108d9d78f6e4a%7C3664e6fa47bd45a696708c4f080f8ca6%7C0%7C0%7C637777833303064537%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000&sdata=7DM3bj0IbqCoZIVicQB1JfTlDANRWMpzQDG6AOLhuX0%3D&reserved=0)(Norman, 2018)?

Ans.

**Physical Constraints** - A large battery cell cannot fit into small battery cell remote. Small bulb or tube fits in same size sockets only. The value of physical constraints is that they rely upon properties of the physical world for their operations, no special training is required. With the proper use of physical constraints, there should be only a limited number of possible actions or desired actions can be made obvious usually by being salient. So, we should first check the battery size of remote then but the batteries for remote.

**Semantic constraints** – semantics is the study of meaning. Semantic constraints are those that rely upon the meaning of the situation to control the set of possible actions. In case of motorcycle, there is only one meaningful location for the rider, who must sit facing forward. The purpose of the windshield is to protect the rider’s face, so it must be in front of the rider. Semantic constraints rely upon our knowledge of the situation and of the world. Such knowledge can be a powerful and important clue. If we are driving front side, we should face the windshield front only.

**Cultural Constraints** - We talk in 3c about iOS example that swiping up is more brightness and down makes screen darker. This is the great example of cultural constraints. Each culture has a set of allowable actions for social situations. Thus, in our own culture we know how to behave in a restaurant. Limitations based on accepted cultural conventions. Signs are meant to be read; thus, the police sign be right side up. The red light goes on the rear, because red is culturally defined to mean ‘stop’, etc. If red is signal, we must have to stop and on green we should go.

**Logical constraints** – the natural mappings discussed in chapter 3 work by providing logical constraints. Logical constraints are often used by home dwellers who undertake repair jobs. Suppose you take apart a leaking faucet to replace a washer, but when you put the faucet together again, you discover a part left over. Obliviously there was an error the part should have been installed. If two switches control two lights the left switch should work left the right switch should work on right light. If the orientation is wrong, it destroys the natural mapping. We need to fix it properly try left first them right.

**Conventions** are a form of cultural constraints, usually associated with how people behave. Some conventions determine what activities should be done, others prohibit or discourage actions. But in all cases, they provide those knowledgeable of the cultural with powerful constraints on behavior.

Conventions fall into cultural constraints like we see there are some prohibits of activities and encourage others. Every culture has its own conventions like in India we don’t use kiss or shake hands we just take nod or bow our head as gesture of respect when initially meeting an Indian elder.

Or touch their leg and they give blessings. If kissing on which cheek, and how many times, it is an air kiss or an actual one? It is possible to spend a fascinating hour on the internet exploring the different forms of greetings used by different cultures. It is not so amusing to be one of those people: being hugged or kissed while trying to shake hands or bow. Or the other way around. Try kissing someone’s cheek three times (left, right, left) when the person expects only one. Or worse, where he or she expects a handshake. Violation of cultural conventions can completely disrupt an interaction.

Symbols and constraints are not affordances. They are examples of the use of a shared and visible conceptual mode, appropriate feedback, and shared, cultural conventions. This is something that can not be decided by arguments, logic, or theory. Cultural constraints and conventions are about what people believe and do, and the. Only way to find out what people do is to go out and watch them. Not in laboratories, not in the usability testing rooms, but in their normal environment.

We talk about constraints in this question that we should follow all the constraints and conventions which really helps us to improve system and devices.

4b. What are some typical mapping problems that we encounter in the design of system and device controls? How can we reduce these problems, by introducing various types of constraint?

Ans.

**The problem with doors** – Doors comes in amazing variety some open only if button is pushed, and some don’t indicate how to open at all, having neither buttons, not hardware, nor any other sign of their operation. The door might be operated with a foot pedal. Or maybe it is voice operated, and we must speak the magic phrase (open simsim). In addition, some doors have sign on them, to pull, push, slide, lift, ring a bell, insert a card, type a password, smile, rotate, bow, dance, or perhaps, just ask.

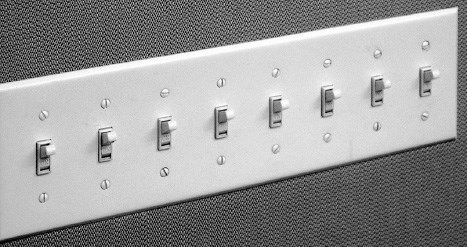
Somehow when a device as simple as a door has to have a sign telling you whether to pull, push, or slide then it is a failure, poorly designed. Consider the hardware for an unlocked door. It need not have any moving parts; it can be a fixed knob, plate, handle, or groove. Not only will the proper hardware operate the door smoothly, but it will also indicate just how the doors is to be operated, it will incorporate clear and unambiguous clues signifiers. Suppose the door opens by being pushed. The easiest way to indicate this is to have a plate at the spot where the pushing should be done.

Some doors have appropriate hardware, well placed. The outside door handles of most modern automobiles are excellent examples of design. Horizontal slits guide the hand into a pulling position, vertical slits signal a sliding motion. The designer has faced a different kind of problem, and the appropriate solution has not yet been found. As result although the outside door handles of cars are often excellent, the inside ones are often difficult to find, hard to figure out how to operate and awkward to use.

**The problem with switches** – The switch problem in an auditorium is annoying, but similar in industry could be dangerous. In many control rooms, row upon row of identical looking switches confront the operators. How do they avoid the occasional error, confusion or accidental bumping against the wrong control? Basic switches and controls should be relatively simple to design well.

But there are two fundamental difficulties. The first is to determine what type of device they control for example flaps or landing gear. The second is the mapping problem as we discussed in last chapter and this one also for example when there are many lights and an array of switches which controls which light?

The switch problem becomes serious only where there are many of them. There is no problem with one switch, and it is only a minor problem where there are two switches.



Banks of switches like this are not uncommon in homes. There is no obvious mapping between the switches and the lights being controlled. I once had a similar panel in my home, although with only six switches. Even after years of living in the house, I could never remember which to use, so I simply put all the switches either up (on) or down (off).

**Own Experience Example**

From my experience when I was seat in back side of tesla and the car doors are going upside vertical so when I was going to exit from car I did not find the doors button which I get little nervous that I am seating in tesla and I did not know how to open the door so my uncle help me to open show the two button one is for to open and one is for to close.

So in that time I again get confuse which should I press and then I saw the open doors symbol on one button and I press that button and doors open so this thing happen with me where I encounter the design of system and device controls. We can reduce these problems by glowing buttons or easy to see the person who is seating near to door that he can easily see and press that button without any problem.

In physical constraints they should put the button near to person so he/she can easily press it while exit from car. In Logical constraints the door should open properly if I press the button the doors should be open without any problem. In cultural constraints if I press the back side door button it will open only back side door only. In convention they should put some proper symbols on the door button so we can understand which one is for opening and which one for closing. These all things are matter while you should know because it is also a design which in knowledge in the world. But I’m seating in tesla first time it is little difficult and once I learn it is easy for me.

In this question I learn how the mapping problems and their solutions are help me to get good in real life where I explained my tesla car example in it. Constraints and conventions are important role in it.

4c. Why is sound an important signifier? How does it provide visibility and in what circumstances is this important? Extra credit: Give some examples of the use of sound as a signifier, from your own experience of using devices and systems.

Ans.

**Using Sound as Signifiers**

Sometimes everything that is needed cannot be made visible. Enter sound: sound can provide information available in no other way. Sound can tell us that things are working properly or that need maintenance or repair. It can even save us from accidents.

When we open the sliding door at home we click on the bolt and it sound which make sense it is opening if it clearly sounds without any noise its working properly, if there is less sound or any noise while opening means we have to repair or put the maintenance request for that. Sometimes door doesn’t shut properly it makes tinny small sound. When road is not properly plain and there is low high in road car gets roaring sound where car muffler gets a hole. When fire or smoke is there in any building the siren gets loud and put message to get out from that building and call the fire officers to off the siren. When we put water for boiling it makes some sound that shows the water is boiled and off the stove. The click when the toast pops up. The washing machine after finning the washing makes sound it’s done. The Dryer also same.

Many devices simply beep and burp. A beep can assure you that you’ve pressed the button like in lift. But the sound is an annoying as informative. Sound should be generated so as to give knowledge about the source. They should convey something about the actions that are taking place, actions that matter to the user but that would otherwise not be visible. The buzzes, clicks, and hums that we hear while a telephone call is being completed are one good example: If the ring before calling someone is not ring or no sound, we cannot sure that someone is going to pick the call or not. Like we do not understand also if there is any network problem or something in between the telephone.

This all reasons are giving more importance of sound and that’s why sound is the important signifier and it also provide visibility which helps better to find the solution for problem or how it’s going.

Real life experience example

While using homepod mini which is apple intelligent sound device in daily routine I ask so many questions to my intelligent device for example hey Siri how’s the weather today she told me about the details with correct data which is provided by her to the weather channel which she told at end that this information is given by weather.com. So, I have two homepod devices one place at on my study table and the second one place it on my lamp shelf. So, both are connected to WIFI and I’m using college internet connection so sometimes I get connection problem I ask my device the weather condition she told I have problem with connection check the home app. Sometimes I ask the nearest device to answer the question so the distance and my quality of voice that needs to verify the Siri to answer the question. If I ask in low sound or voice she did not answer because there is problem in voice that she did not understand what I ask.

Voice interface must minimize the time required to complete an action in order to be useful, because listening to signifiers takes longer than scanning a menu, and speaking a verbal command takes longer than clicking a button. But skipping important signifiers in order to save time can be counterproductive: it doesn’t matter how quickly a task ended if the task failed. Guessing implicit signifiers, sequential cues and progressive disclosure are all valid strategies for expending voice commands, especially for secondary or easily reversible commands. These methods can sometimes be more efficient and just as effective at bridging the gulf of execution. But they must be carefully designed to ensure they actually reduce the interaction time, instead of extending it by introducing errors.

**References for Chapter 4**

<https://jnd.org/affordance_conventions_and_design_part_2/>

<https://www.nngroup.com/articles/audio-signifiers-voice-interaction/>