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Design Concept

A design concept is a collection of embodiments that completely cover all the requirements of a design situation.

What is a design concept?

A *design concept* is a combination of embodiments that have been integrated into a coherent whole such that every system is contributing to the fulfillment of the requirements.

- Embodiments are like building blocks used to construct a variety of different overall concepts for interventions, only one of which will eventually be *the* team's concept.
- Embodiments cover only *some* of the requirements; a concept must cover *all* the requirements.

By definition, concepts are quite vague.

- You will not know the *precise* shape, mass, behaviour, colour, etc. of a design when it is still in the conceptual stage.
- But you will know the principles and technologies that are needed to eventually implement a suitable design intervention.

Design concepts are often described graphically with a sketch. Here are some sample design concept sketches.

Notice how different they are from one another.

- Some are much more polished than others, but they're all equally valid as design concepts.
- The sketches themselves are relatively meaningless on their own.
- They become significant when all the other information about the design (the PRS, PAS, etc.) is available; the design concept stitches all this information together setting a direction for a final design intervention.

Just because many design concepts are rendered as having shape doesn't mean the final intervention's shape must be the same. Even at this stage, the structure of the design must submit to the needs of

behaviour and function, and will change to ensure behaviours and functions are available in the best possible ways.

Design of complex interventions is a process of gradually seeking out the best of very many possible design interventions.

- It is easier, faster, and cheaper to develop and evaluate design concepts than it is to develop and evaluate many different fully detailed designs.
- Even though concepts are vague, it is possible to distinguish between those that are likely to be suitable and those that are likely to be unsuitable.
- The number of unsuitable designs is almost always much, much larger than the number of suitable designs, so even a qualitative assessment - based on concepts rather than fully detailed designs - is more effective and efficient at zeroing in on the "best" designs in the long run.

How do we develop design concepts?

A morphological chart implies a large number of overall concepts. We call the set of all these concepts a *design space*.

Our job at this point in the design roadmap is to try to find the best concept in the whole space. This is usually an intractable task.

There are many ways to manage the complexity of exploring a design space. To keep things simple in this course, we will follow only one process, described below.

> **Remember:** As you work on your concepts, you may find there are unanswered questions about the design brief or your goals that require doing further research.
>
> If this happens, it's vital that you document that research in your situation scan.

Step 1: Select preliminary concepts

The goal of this step is to identify a few concepts from the morphological chart (MC) that a team believes are likely to be reasonable places to begin developing a full intervention.

Each team member will:

- Review the Persona and SUC for which they are responsible.
- Select from the MC embodiments that are "best" for their Persona situated in the SUC.
  - You can only pick **one** embodiment from each row of the MC.
- Combine those embodiments into a single overall concept.
- Document the preliminary concept and the justification for the selection of embodiments.

Step 2: Refine preliminary concepts

Refining you concept involves two tasks: *identifying interaction errors*, and *updating the concept* to correct the interaction errors.

This step must be performed at least twice. That is, each team member with identify some interaction errors, then update their concept, then search for more interaction errors, then update their concept again.

Identify interaction errors

Given a concept per team member (from Step 1, above), then next step is to refine that concept by thinking about how the product will be used by a given Persona in a given SUC, and looking for interaction errors (IEs) between the concept and the users.

This step is done individually, each team member working on their own concept.

Think of watching a movie in which your Persona is using your concept in your SUC. Don't forget to consider the setup and put-away stages that precede and follow the actual use of the concept.

- Watch every single thing your Persona is doing.
- Think also of any co-users or other people in the SUC who may distract or otherwise influence your Persona.
- Consider each interaction the Persona has with the concept.
- What kind of mismatch might occur in that interaction?

The mismatches you identify are IEs. Document each one. Identify at least two or three distinct IEs *throughout* the "movie" of your concept's usage. Read more about interaction errors.

- You should be able to find *many* IEs for a preliminary product.
- We do **not** expect you to find **all** of them.
- We **do** expect you to find significant ones throughout the entire usage.
- By showing you can find varied, representative, and significant IEs, you are demonstrating sufficient mastery for scholastic purposes. Finding IEs that are not sufficiently varied, not representative of all steps of usage, or not significant is indicative of insufficient mastery.

Update the concept

Now, given the interaction errors, modify your concept to address those errors. Remember, an IE is *always* an error on the product's side of an HMIL.

IEs will arise from mismatches between what one or more of your embodiments can do, and what users expect.

- You cannot change humans, so you cannot change your target users or expect them to behave differently than they otherwise would.

- Instead, you must change how embodiments work to interact better with the users.

This can be done in two ways.

Option A: Adjust an embodiment

You can change position, orientation, general size, general shape, weight, texture, or any other attribute of the embodiment.

Example 1: Designing a way to dispense food and drink, including coffee, on aircraft.

- Your original concept places a coffee maker, including a rather large tank of hot water, at the top of a cart. You did this to prevent the flight attendants from having to bend repeatedly to reach a coffee maker positioned low on the cart.
- You subsequently identify an IE: the most ergonomic location of handles to push the cart is such that the resulting forces may cause the cart to tip over because of the heavy water tank at the top of the cart.
- You revise the *coffee system* so that the hot water tank is located at the bottom of the cart while the coffee dispensing subsystem remains at the top of the cart. This changes the weight distribution and improves stability without adversely affecting the ability of flight attendants to reach for coffee easily.

What else might you have done to improve the concept?

Example 2: Designing a food blending system.

- Your original concept includes buttons to select the speed/mode of operation of the device. The buttons are positioned such that an elderly person can easily press the correct button.
- You subsequently identify an IE: an elderly female user is preparing smoothies for their grandchildren (co-users), but the grandchildren are nagging the grandmother, distracting her. You realize you had not considered a *distracted* user when you arranged the buttons.
- You revise the size and separation of the buttons to decrease the chances of a distracted user pushing the wrong button.

What else might you have done to improve the concept?

Option B: Replace an embodiment

You may not find any way to alter an embodiment to correct for an IE. In that case, go back to your team's morphological chart and look through the alternative embodiments for the system in question. Select another embodiment and reconstruct your concept to include the new embodiment that you believe will address the IE in question.

Important notes

You may conceive of a new embodiment that had eluded you during the ideation step. If this happens:

- Review the new embodiment with your team.
- If everyone agrees that it's a good embodiment, add it to the morphological chart and document the addition, paying particular note of the circumstances by which you conceived of it.
    - Documenting "acts of creativity" in real life is important for matters of intellectual property.
    - Adding the new embodiment to the MC makes it available to your teammates as well.

Step 3: Integrate preliminary concepts

For this step, all students are expected to study a 22-minute video of a "Deep Dive" design by IDEO. In particular, pay attention the part of the video about how the individual concepts were combined.

Once all team members have performed two iterations of refinement on their individual concepts, the team will work together to create a single concept embodying the best features of all the individual ones.

The goal is to create a single concept that can satisfy the needs of **all** the Personas in **all** the SUCs.

If you've executed all the steps properly, then *all* the concepts will satisfy the requirements of your project. In that case, combining the concepts should be relatively easy.

- It is generally easier to combine two concepts for, say, small commuter aircraft than it is to combine a concept for a small commuter aircraft with a concept for a 500-person trans-Pacific airliner.

Here's how to execute this step:

1. Hold a meeting with your team.
2. Share all the individual concepts with all team members.
    - Be sure to include which Persona and which SUC are attached to the concept.
3. For each individual concept in turn, collaboratively decide what the key features of the concept are that are most relevant to the Persona in the SUC.
    - The team member who developed the concept under discussion should be considered the "expert" on that concept, and should be expected to respond cogently to questions about why particular embodiments, shapes, sizes, materials, textures, etc. were chosen.
4. Collect the key features into a single list. These are the features that need to appear in your final concept.

- Check the list of features for duplicates or for features that conflict with one another for some reason (e.g., power requirements, size or capacity, etc.). The team needs to remove duplicates and resolve conflicts.
5. Collaboratively formulate a single concept that embodies all the features in the list. This is your final concept.
    - This final concept must (a) satisfy all the requirements, and (b) satisfy the needs of all the Personas in their respective SUCs.

IMPORTANT NOTES

- You may find you are unable to integrate the individual concepts due to some incompatibility that only became evident once individual concepts were compared.
    - In this case, you will have to figure out what embodiments are responsible for the incompatibility and use the techniques in Step 2, above, to fix the incompatibility.
- You may end up with a final concept that looks *nothing* like any of the individual concepts. This is not a problem.
    - Example: modern smartphones emerged from the combination of the PDA and the mobile phone, yet smartphones really don't look like either.

Step 4: Build usage scenarios of final concept

Given a final design concept, each team member will create a usage scenario describing how their Persona would use the concept in their SUC. See the page on usage scenarios for details.

There will thus be as many usage scenarios as there are members in a team.

Step 5: Refine final concept

This step is similar to Step 2, except that now you all work collaboratively in your teams to refine the final concept.

Specifically:

1. Working together, look for several interaction errors in your final concept by analyzing the usage scenarios.
2. Working together, look for ways to address the interaction errors of the final concept to improve the concept.

Remember to document the interaction errors you identify in this step just as you did in Step 2.

Deliverables

The deliverables for this stage include the following.

1. All of the preliminary concepts developed in Step 1.
    - Each concept will fit on one page: half a page for a sketch of the concept, followed by no more than half a page description of its key features. Include in the description only features that are not already evident in the sketch.
2. Descriptions of all the IEs that were addressed during refinement of the preliminary concepts, per Step 2.
3. All the refined preliminary concepts, per Step 2.
    - Each concept will fit on one page: half a page for a sketch of the concept, followed by no more than half a page description of its key features. Include in the description key changes that were made during refinement.
4. Three pages summarizing the final concept, per Step 3. (One page sketch plus up to two pages of description of how the preliminary concepts were combined.)
5. All the usage scenarios developed, per Step 4.
    - Each US must make clear what Persona and SUC were involved.
6. Descriptions of all the IEs that were addressed during refinement of the final concept, per Step 5.
7. A description of the refined final concept, per Step 5.
    - In this case, you may have a full page sketch of your refined final concept, and **up to four pages of explanatory text**.
    - Make sure to describe in detail and in plain language how your team's refined final concept satisfies the requirements and addresses the needs of your Personas, given their HFs.

However

TODO

creativity, method, process, concept

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