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1) a) i)
1. A guideline document **builds upon good, previous experience**, hence the chances of designing a bad UI is lower.
2. **Continued improvements** on the guidelines allows us to know what works and what does not to design better UIs.

ii) In accordance with the US Rehabilitation Act and WWW Consortium's adopted guidelines, we have the following (a*ny 2 of the following*).
1. **Text alternatives** for non-text elements so that they can be changed to other readable forms
2. For any **time-based multimedia**, provide equivalent synchronized alternatives.
3. **Colour** is not used as the *only* visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.
4. **Title** each frame, facilitating frame identification and navigation

b) Task analysis helps to recognise user's needs by clarifying what tasks are essential for the design and what to leave out to preserve system simplicity and ease of learning.

c) Gulf of evaluation refers to the **mismatch** between **system's representation** and **user's expectations.** An example is when user wants to paint a cat's head orange, but the program instead paints the entire image orange.

d) i) It means to recognise the needs of a **diverse user group** so that the UI can have a large user base.

ii)
1. **Cater to universal usability**. It is often violated as CLIs often only cater to experts and not novices as it requires mastery of the CLI syntax.
2. **Offer simple error handling**. There is a lack of error messages and error correction when using CLIs.

2) a) i)
- *Interview:* Find out from users what they are frustrated with and what design they want to see in the new system.
- *Questionnaire:* Give users a few prototype designs and ask them to select which one they prefer.
- *Observation:* Observe how users use the current software and see whether there are areas which users are frustrated with and can be improved on.

ii) At the start, it may be better to use **paper** to start off the lo-fi prototype, as the main objective is to communicate ideas and concepts. Over time, the prototype can be done on UI software tools as the emphasis is now more on details.

iii) *Editor's note:* As stipulated by the lecturer, it is mandatory to **contextualise** and provide a **specific use case** to illustrate how the measures are obtained. It is insufficient to say like "measure time required to use the software". What kind of use case? How is the time measured?

Two possible answers (other answers are possible):

1. **Rate of errors by users.** Have the accountants to use the accountancy system to update accounts for a month. Have the accountants record the number of errors and what kind of errors were made by the accountancy system.
2. **Time to learn.** Allow several accountants, randomly selected, to learn how to use the software to update accounts. Measure the time needed for each accountant to update accounts using the new software, using a stopwatch.

iv) There are always trade-offs. For example, there is a trade-off between time to learn and speed of performance. To increase speed, there can be more hotkeys and shortcuts to be introduced into the accounting system, which needs to be learnt and memorised by new users thus increasing time to learn.

b) Heuristic evaluation. As it is still low-fidelity, the prototype is largely conceptual and there are not much details. Heuristic evaluation is suitable as here we simply ask experts for their opinion and personal criticism when evaluating the interface. It is also informal, cheaper but still effective. The other 4 expert review methods are unsuitable:

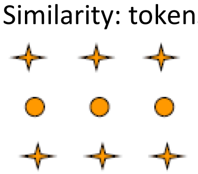
- Guidelines review, consistency checking and formal usability inspection is not to be done during lo-fi stage as the prototype is not focused on the details.
- Cognitive walkthrough is not suitable as we cannot watch experts using the interface when it is just a lo-fi mock-up.

c) Two possible answers (other answers are possible):

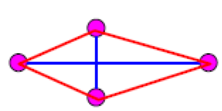
1. **Think aloud**. Participants carry out tasks while saying what they are thinking, and tester records thoughts.
2. **Videotaping**. Participants are videotaped when performing tasks and is valuable for later review and for showing designers or managers the problems users encounter.

3) a)

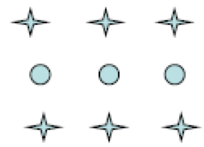
- Similarity: tokens that look alike group together



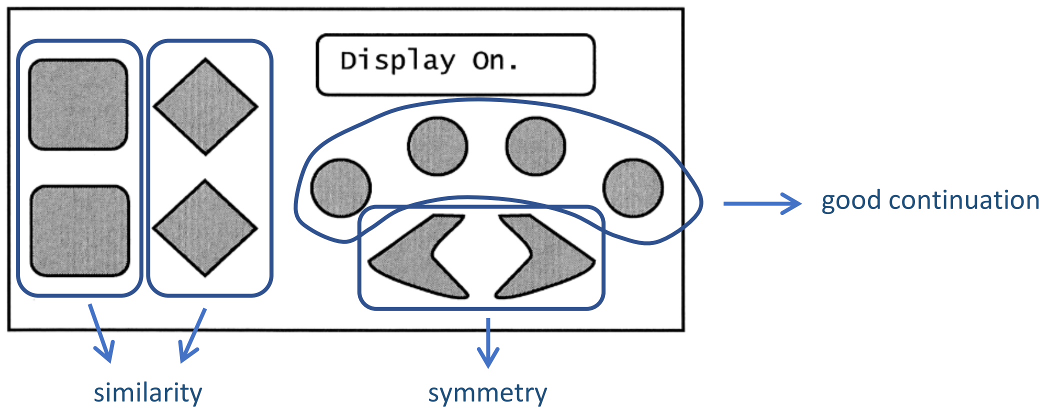
- Closure: tokens than can form a boundary tend to group together



- Common fate: tokens moving in the same way tend to group together



b)



c)
- Body language: to infer the affective state of the person through observations of the body (e.g. head pose, eye gaze, facial expressions, posture, action).
- Vocal paralanguage: to infer emotions such as anger, anxiety and excitement from vocal attributes (e.g. pitch, intonation, loudness).

d)
1. Proprioception (sense of one's body posture)
2. Tactile
3. Vision

4) a) i) Pixel density is the **number of pixels present per inch** on the display. The eye has a physical limit to sense pixel difference and this worsens as distance increases, so when something is viewed further away, a lower pixel density can deliver the same amount of visual detail.

ii) The hint given is rather misleading as similar triangle makes us assume that pixel density is directly proportional to the distance, but part 4(a)(i) clearly tells us this should not be the case. We assume that required pixel density is **inversely proportional** to the distance.

For the outdoor display screen, pixel density = $\frac{25}{20\times 10^2}\times 300 = 3.75$

For the laptop, pixel density = $\frac{25}{60}\times 300 = 125$

iii) Not wasted. Again, the pixel density is valid only for a certain distance. In this case, 6/6 means that it is 6 meters away. The higher pixel density allows for viewing if device is closer to the eye, for example, when used for virtual reality purposes and here the additional pixel density makes a difference.

(b)
- Speaker-dependent speech recognition is trained for specific speakers and thus is relatively accurate. Dragon NaturallySpeaking has a 98% dictation accuracy under low noise conditions. However, this requires large memory space which smartwatch may be unable to accommodate.
- Speaker-independent speech recognition requires less memory space but has very poor accuracy. Especially when it is noisy, the accuracy is very poor. Smartwatches are often used outdoors and the noisiness is an important factor.
- Single-letter handwriting may be useful, but given the limited space of smartwatch and the clumsiness of drawing with a finger, it may be difficult to write accurately. Also, writing one letter at a time may also be frustratingly slow compared to speech recognition.

(c) For example, when searching NTU on Google. If the search is done in Singapore, it will give Nanyang Technological University instead of National Taiwan University due to geographical context. This is useful as the context can help to make searches more accurate for the user.

--End of Answers--