University of Cape Town
Department of Computer Science

CSC4000W: Visual Thinking for Design
Final Exam May 2013

Marks: 50

Time: 2 hours

- Approximate marks per question are shown in brackets
- The use of calculators is permitted

Question 1. [9 marks]

Give an definition of each of the terms below and then explain why the concept is important to take into consideration when designing a visual interface.

a) change blindness [3] *Solution: [2 marks for definition/explanation of term]. Because we can rapidly sample the world around us, we have the illusion that we have it all in our heads. However, this is not true. Under high cognitive load, we will be insensitive to change in things we are not concentrating on, because we have a limited capacity for attention. Our working memory is limited and we discard unnecessary information. [1 mark for why it is important] For a visual interface, you cannot expect people to be aware of all changes that occur. You need to reduce cognitive load as much as possible: people can't apprehend an entire data set, but rather focus on specific queries, ignoring the rest. [or other valid point]*

b) chromatic contrast [3] *Solution: [2 marks for definition/explanation of term]. In our visual cortex, we transform cone signals into 3 colour-opponent channels: black-white (luminance), red-green and yellow-blue. We are highly sensitive to contrasts on these channels. Chromatic contrast applies to the red-green and yellow-blue channels and refers to the distortion of a colour on a contrasting background so as to increase the contrast between the colour and the background. This occurs because our visual system is better and determining differences between colours than absolute values. For example, a patch of yellow on a blue background will appear yellow than the same patch on a yellowish background. [1 mark for why it is important] It is important because designers must be aware that the colour of the background can distort the colours in the foreground.*

c) pictorial depth [3] *Solution: [2 marks for definition/explanation of term]. Pictorial depth cues can be reproduced in a photograph or painting and require only one eye to see them. They include occlusion, perspective, cast shadows etc. [1 mark for why it is important - any one below] It is a useful technique for designers to use to differentiate objects for visual searches. Can be used as a ranking metaphor (the closer object is more important). Does not have to be applied in an all-or-ntohing fashion, but can be used as needed.*

Question 2. Examine the graphic in Figure 1 and answer the questions below. [17 marks]

a) A good graphic enables visual queries to be processed rapidly. **For Figure 1**, list two distinct visual queries that are likely to be processed rapidly by our visual cortex and two that are likely to be processed more slowly. Justify your answers. [5]

b) E. R. Tufte said: *There are right ways and wrong ways to show data; there are displays that reveal the truth and displays that do not.* In your opinion, does **Figure 1** show the data a right way or a wrong way? Justify your answer. [3] *Solution: [This question is about "truth" , not design or presentation. I gave marks for good points that addressed the question asked.]. Basically, the strongest case can be made for the graphic displaying the data the right way. The graphic does not attempt to distort the data by odd scales or rather tricks. The one negative is perhaps that the unclear separation of the data for women and men may lead to invalid conclusions being drawn.*

c) Now your task is to improve this graphic: try to make at least 3 improvements to the design. For each design decision, explain why the original was imperfect and justifying your improvement in terms of your knowledge of the way our visual system works and what makes graphical objects distinct. You may use diagrams in your answer. [9]

Solution: [3 marks for each improvement: In each case, 1 for the change, 1 for explanation of why the original was imperfect, 1 for justification. Changes that were not great improvements (like shifting the key) received lower marks. No marks for a change that does not improve the graphic.]

- *Obvious improvements were to arrange the data into one graph (no duplication of x-axis), the use of texture for the country classifications and the blue/pink for the sexes, grid lines or numerical values to enable easy read of the actual values, highlighting or grouping to separate the cancers occurring in each sex from those that don't. the use of symbols (or a body key) to identify the types of cancer and enable easy searching. Justifications needed to explain why the changes would make visual queries easier.*

Question 3. Analyse each of the four graphics listed in Figure 2. [24 marks]

For each of the four graphics listed in Figure 2, explain why they are (or are not) effective, according to our current understanding of the processes of perception in the human visual system. Your (fairly detailed) analysis of each image should consider the goal of the graphic and both the bottom-up and top-down (attention) processes of perception involved. In this question, you should apply all the relevant theory that you learnt in the course about what makes graphics effective. [24]
Solution:

- *The goal of the graphic must be identified. [2]*
- *The discussions of efficacy need to, obviously, make reference to the processes of perception: bottom-up features (colour, shape, texture, size, depth) [2 for 2 good points] and top-down (gist, learning, narrative, humour, gist-object conflict) [2] that gain attention.*
- *Reasoned and justified arguments gain marks.*

  A. Goal: to advertise metro magazine, showing that is is easily shared and has high value of sharing. Low-level: Use of two colours that are clearly branding of Metro News - effective. Small symbols, perhaps less effective, but in keeping with graph metaphor. Symbols have clear outlines, easily differentiated from background and most are easily identified. Text is used to assist in identification, but could be larger. Combination of symbol and graphic is effective. Top-down: familiar graph gist. Use of humour within the graph metaphor - porcupine, germs - effective and holds attention. People are likely to remember this graphic .

  B. Goal: to explain the process involved in data journalism (and the chapters in the handbook) giving quite a lot of detail. Bottom-up: Effective use of colour, with low saturation for the large objects and high saturation for the small ones. Good use of easily-recognised symbols: fishing net, spade, faces, bin. Text is necessary to explain complex concepts, like role of people. Large S-shape feature more

interesting than straight line. Low saturation and hence good (could be lower). Data "dots" for a low-intensity texture that can be focussed on or else filtered out. Font is a weakness: red-on-white writing difficult to read and the font is hard to read. Top-down: use of narrative to step refer through the stages. Familiar water/river metaphor. Not entirely clear at the end what data journalism is, though..

C. Goal: Unclear, likely to surprise or amuse, visual puzzle. Attention-grabbing. Could have a goal in explaining the internal organs and structures of a horse through the car-metaphor (horses were the cars of the old days)provided the viewer recognises the parts (background required). Very effective use of colour, with high saturation and contrast for detail. Familiar outline/contour of horse from obvious angle easily recognised. Use of shading, occlusion to create depth and shading. Gist-object conflict (organic horse filled with industrial machinery) draws attention. Amusing detail (e.g. shock absorbers in legs, battery for heart) holds attention and is informative. Memorable and entertaining.

D. Goal: To send an important message about unwashed vegetables being dangerous. Military theme, carried through in the dog tag. Tag symbol removes possible confusion about death being due to the mushroom being poisonous (the is confusion actually weakens the message). Reversal of usual colour scheme: dark background and light foreground - is also effective. Familiar mushroom outline clearly visible. Good use of pictorial depth cues: shading.Gist-object conflict between mushroom and the atomic bomb metaphor relies on learnt knowledge - less effective/confusing for some. Highly emotional (strong) reaction expected in some - could be seen as inappropriately emotive.

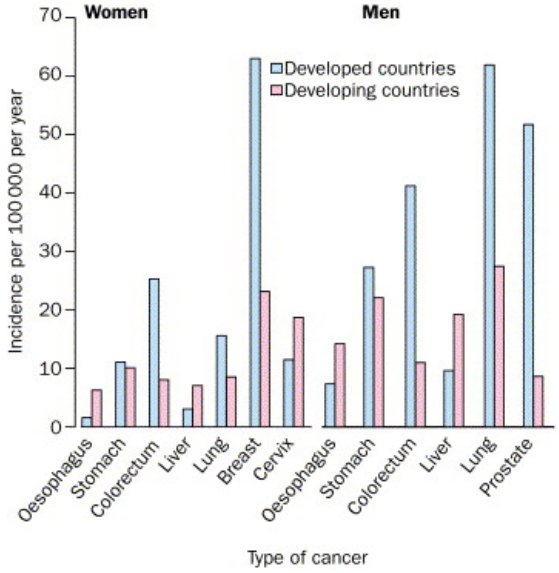
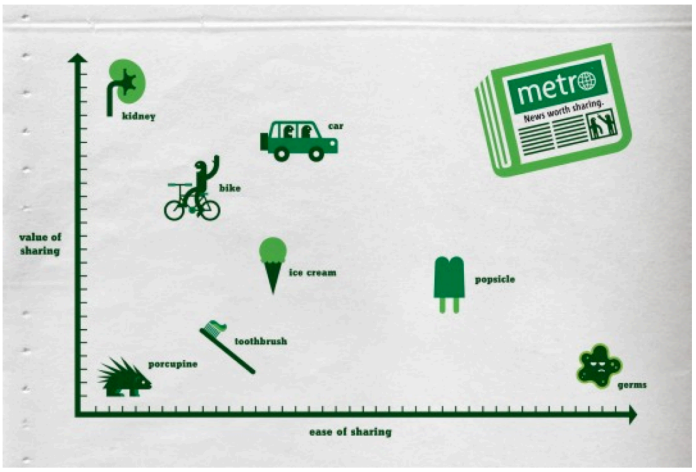
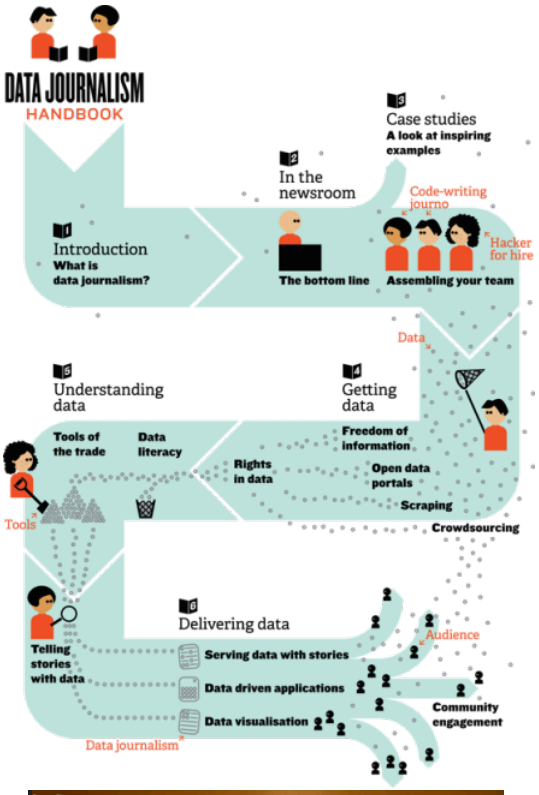


Figure 1: This may be detached from the exam, for ease of reference.

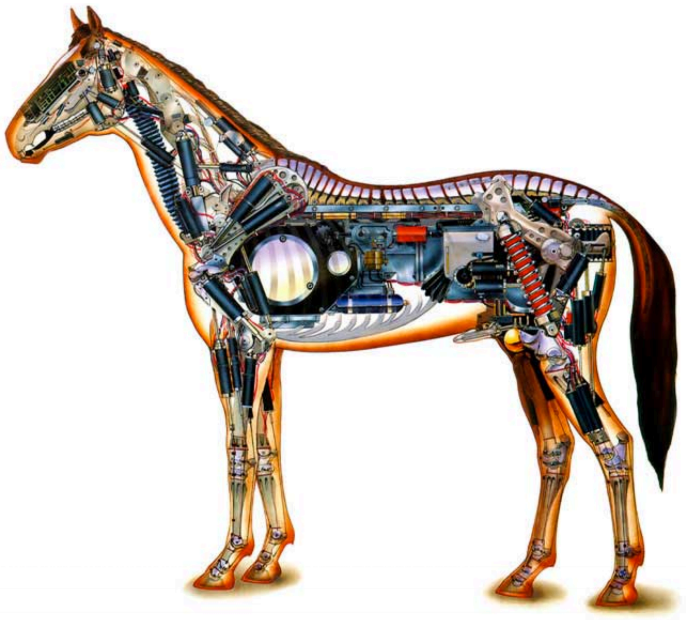
A.



B.



C.



D.

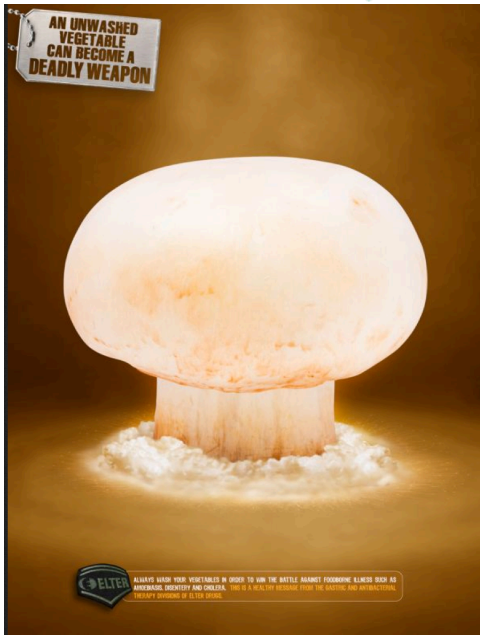


Figure 2: This may be detached from the exam, for ease of reference.