UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE AND ENGINEERING

FINAL EXAMINATION, APRIL 2001
Third Year - Programme 04
MIE 344S - Ergonomic Design of Information Systems

Exam Type: A
Examiner: P. Milgram

The exam will be marked out of 100 and is divided into two parts.
Part A, which is worth 40 marks, consists of relatively shorter questions, each worth **8** marks. You are to answer ***any five (5)*** of these.
Part B, which is worth 60 marks, consists of relatively longer questions, each worth 20 marks. You are to answer ***any three (3)*** of these.
(Given that you have 2.5 hours at your disposal, you should allocate approximately one hour to Part A and 1.5 hours (1/2 hour for each 20 mark question) to Part B.)
Needless to say, you are advised *to read each question carefully* and *answer what is being asked.*

PART A (40%)
Answer ANY FIVE (5) Questions (@ 8 marks each)

1. a) It has been argued that a pilot's understanding of synthesised voice warning messages, such as *"fuel low"*, will be improved if the message is augmented by added
(4) voice context, such as *"attention, your fuel is low"*. What is the basis of that argument? What would be the disadvantage of adding the extra words? How could this case be generalised?

(4) b.) Prior to landing, airline pilots must go through a formal checklist procedure. One of the checklist items for a particular airline is *"Check to see that the landing gear is not still up."* Is this a good way to word such an instruction? If not, what would be a better way? How can this be generalised?

2. Figure 1 is reproduced from the midterm exam, where, as you will recall, the user's goal is to change the thickness of the outer box shown in (i) to that shown in (iii). Ordinarily the user would click on the box, see the result displayed in (ii), select a thicker line and
(8) obtain the image shown in (iii). However, due to a not apparent object grouping (explained in (v), which shows that the label "MIE344S" had previously been grouped with the outer box), the user sees (ii) when she clicks on the box, and instead of (iii) she gets the result shown in (iv).
Sketch a State Transition Network (STN) diagram which describes the dialogue necessary for going from (i) to (iii), while ensuring that (iv) does not result.
Is this a reasonable notation for describing this particular dialogue?

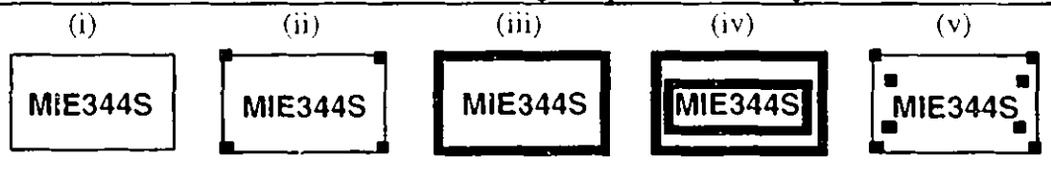


Figure 1

3. Explain the essence of *Software Systems Requirements Engineering* (RE). In other words, explain what the core Requirements Engineering activities are and where the field
(8) draws its theories and techniques from.

4. Figure 3 (Question 10) illustrates the procedure for renaming the label of a Macintosh file. Perform a GOMS analysis to predict the time necessary for changing the label
(8) from "Picture" to "Figure", as shown. (You are not required to recall the parameter values, but you should explain how you would go about obtaining them.) What is the value (positive, neutral or negative) of such an analysis?

5. The fresh food and freezer temperature controls for an ordinary North American refrigerator are illustrated in Figure 2(a). Two possible mental models of how the actual
(8) system works are given in Figure 2(b) (simplified but *incorrect* model) and Figure 2(c) (more complex but *correct* model) respectively. (Source: D. Norman, 1996)
Discuss the compatibility between the system image provided by the controls in Figure 2(a) and the two associated models. Why do issues such as this matter in general?

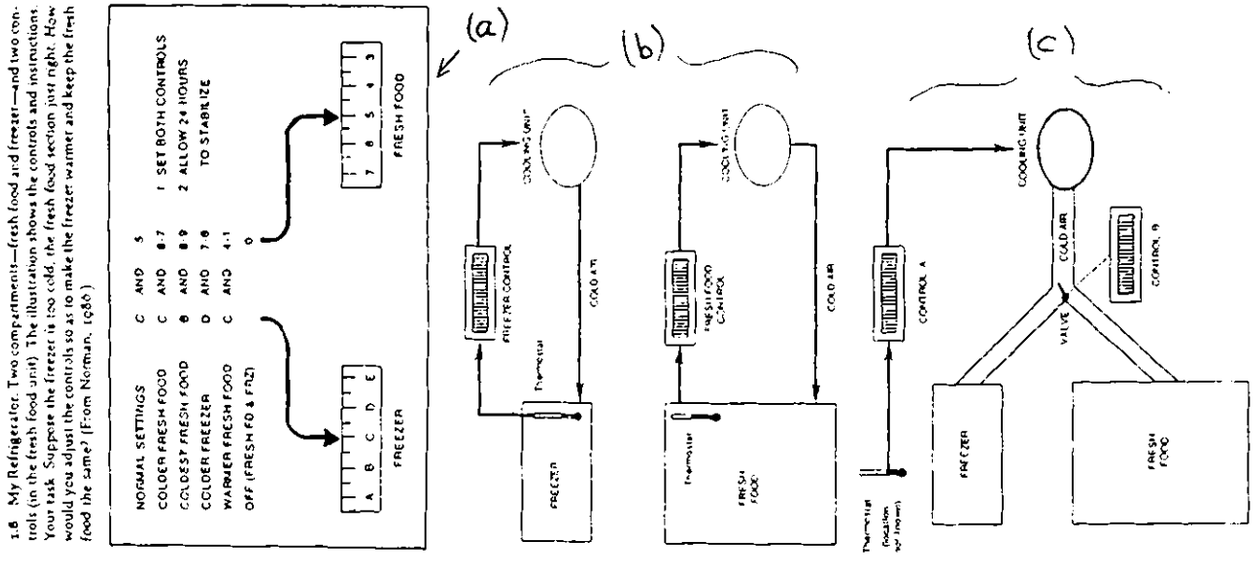


Figure 2: Refrigerator temperature controls (a) and two associated mental models (b&c).

6. You have recently acquired some new technology for producing synthetic speech signals at multiple locations and you wish to incorporate it into the control room that you are designing. One of the factors that concern you is whether or not users will be able easily and unequivocally to determine the direction from which the different sounds emanate.
In testing the new system experimentally, your general protocol is to blindfold subjects, produce sounds at various points in space and have them point, to the best of their ability, at the perceived source of the sounds. By recording their body position and pointing directions, you are able accurately to evaluate how closely they are able to localise the origin of various sound sources.

a) Describe briefly the auditory mechanisms which enable humans to localise such sound
(4) sources.

b) Would it make sense to use Fitts' Law as a paradigm for analysing and describing the
(4) results of such an experiment? (Explain your answer.)

7. For most cases of usability testing, it is usually essential to have some knowledge about prior experience and skill levels of your participants. An example of one such case
(8) involves acquiring some idea about people's experience with interactive computer interfaces, such as those found in popular video games.
Critique the questionnaire shown below, whose aim is to assess such experience.

Questionnaire on Experience with Video Games

This questionnaire is designed to find out how skilled you are with video games.

1. How old are you? _____
2. How often do you play video games? _____
3. How long have you been playing video games? _____
4. Do you consider yourself a good video game player?
Poor Fair Good Very Good Expert
5. Would you play video games more often if they were more challenging, or do you think that this might actually prevent you from playing more? _____
6. Some people say that video games inhibit mental development in children. Do you agree?
7. Do you think that video games could be improved? _____

Thank you for your cooperation in filling out this form.

PART B (60%)
Answer ANY THREE (3) Questions (@20 marks each)

8. The reading and comprehension of textual material is clearly an important aspect of information display systems.

6) a) Explain the co-existence of both bottom-up and top-down perception of text.

6) b) How do these processes affect *reading* performance, either positively or negatively?

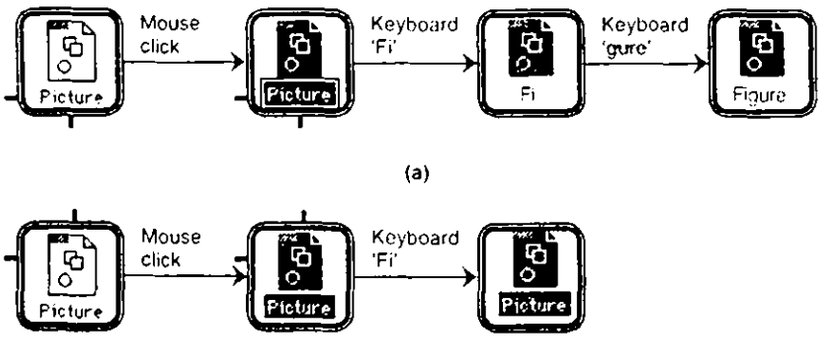
8) c) Theories of perception of text have generated several practical guidelines for the design of textual displays. Give 4 examples of such guidelines, with a justification for each one.

9. In the era of free trade, your company has decided to expand its operations around the globe. Furthermore, due to high travel costs, the company has decided to upgrade its
(20) communication and teleconferencing facilities, to enable remote meetings, collaborative design activities, joint report writing, etc. In addition to enhancing standard audio links, some of the options to be considered for the new sysetm include interactive video, shared whiteboards, co-authoring hardware and software, and shared diaries.

Discuss the various human communication related factors which should guide the design of such a system.

10. a) Explain the basic ideas comprising (Polson's & Lewis') theory of *Exploratory*
10) *Learning*, as it relates to the use of interactive systems.

10) b) Figure 3 (below) indicates two ways (one correct and one incorrect) of changing the label of a Macintosh icon. Perform a *cognitive walkthrough analysis* of this procedure.



Changing the label on a Macintosh icon by selecting and retyping: (a) the correct method; (b) an incorrect method – the user selects the body of the icon. Icons

Figure 3

11. Using McGrath's "Strategy Circumplex" as a guide (Figure 4 below), discuss where in the design cycle you would emphasise:

20)

- analytical evaluation techniques
- experimental and query evaluation techniques
- observational evaluation techniques

Explain your reasoning and give examples of evaluation techniques wherever possible.

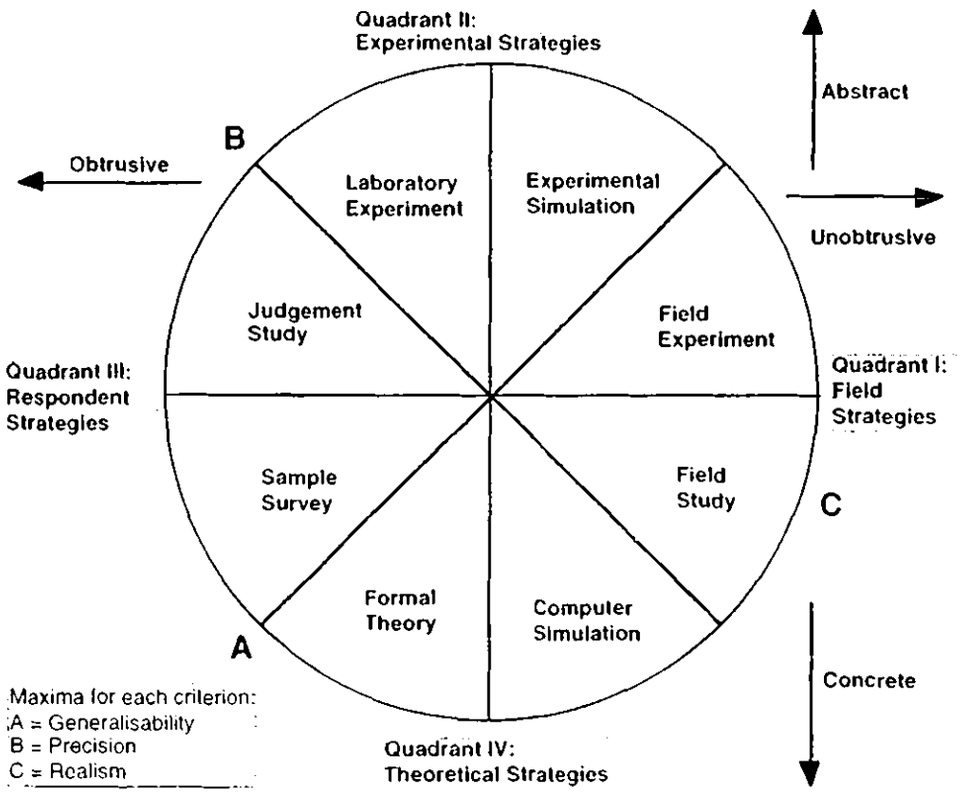


Figure 4: McGrath's Strategy Circumplex