

UNIVERSITY OF BRISTOL

January 2024 Examination Period

School of Computer Science

Year 3 Examination for the Degree of Bachelor of Science in
Computer Science

COMS30027

Human-Computer Interaction

TIME ALLOWED:

Two Hours

**There are THREE questions
Answer TWO of the questions**

Total marks: 100

This is an open book exam

TURN OVER ONLY WHEN TOLD TO START WRITING

Question 1

Imagine that you are part of the team that has been asked to develop *StudyBuddy*, a new health and wellbeing smartphone app for university students.

- a) Describe the basic human psychological needs identified by Self-Determination Theory that underlie human wellbeing and a design feature that could be added to *StudyBuddy* to support each of these needs. Justify your choice of design features.

[12 marks]

- Define the three basic psychological needs : autonomy; competence; relatedness
- Describe a feature that could support each of the three needs and justify the choice: autonomy – customisation of the app ; competence - effective feedback or activities with tailored difficulty that provides opportunity to increase competence; relatedness – social forum features

- b) Give a brief description of the two main types of motivation in Self-Determination theory. Then explain how Self-Determination theory can inform the design of *StudyBuddy* so that students are intrinsically motivated to use the app, describing two design features which should be avoided and two design features that should be supported in order to achieve this.

[8 marks]

- Define extrinsic and intrinsic motivation and the relation to controlled and autonomous motivation
- Avoid external pressure/punishment
- Avoid rewards
- Two from the following:
 - Support sense of competence (explain how)
 - Support relatedness (explain how)
 - Support autonomy (explain how)

- c) *StudyBuddy* has a 'to do' list function, which shows users the tasks that they have to complete on different days and enables them to record when they have completed them. The 'to do' list is partly automatically generated from the user's calendar but users can also add items manually. Explain the concepts of *gulf of execution* and *gulf of evaluation* in Donald Norman's model of interaction. How can natural mappings and feedback help reduce the gulfs of execution and evaluation on the 'to do' list functionality?

[10 marks]

- Answer by defining the concepts of: gulf of execution; gulf of evaluation; natural mappings; feedback; the link between these concepts; and propose how these relate to the ‘to do’ list functionality
- d) Some users of StudyBuddy have reported that although they like some elements of the ‘to do’ list interface, they are also frustrated by other parts of the interface. Describe Gaver’s conception of affordances and use it to speculate on what could be working well and not so well with the ‘to do’ list interface.

[10 marks]

- A definition of Gaver’s notion of affordance in terms of separating affordances from the perceptual information available about them leading to four categories of affordances: False, Correct Rejection, Hidden and Perceptible.
- An example of False Affordance, e.g. choosing to click on something that leads to nowhere
- An example of Correct Rejection Affordance, an example of a non-existing function
- An example of a Hidden Affordance, e.g. affordance there but no information about it
- An example of a Perceptible Affordance, e.g. buttons that convey click ability
- e) Choose one of the design features that you proposed in (a) and imagine that it is not working well. Describe how you would re-design the interface to ensure it provides an effective affordance.

[5 marks]

- A description of the re-design of an interface element e.g. a hidden affordance by exposing information about how to act upon it, such as redesigning the visible depth of an interface element to convey click-ability
- Correct identification of the initial affordance state
- Correct re-design strategy to expose information
- Correct identification of the final affordance state
- f) Describe how Norman’s conceptualisation of affordance differs from Gaver’s.

[5 marks]

- A discussion distinguishing between the four dimensions of Gaver’s conceptualisation and Norman’s notions of perceived vs real affordance, including sources of mapping constraints;
 - o Cultural
 - o Physical
 - o Logical

a) Explain the terms ‘subject’, ‘object’ and ‘tool’ as used in Activity Theory. Follow this by describing the main distinctive features of the Activity Theory approach, including the difference between ‘actions’ and ‘operations’ and the concept of ‘contradiction’.

[8 marks]

- Marks for explanations of: subject; object; tool; actions; operations; contradiction; distinctive features of Activity Theory.

b) Your team has developed chatbot functionality in the *StudyBuddy* app, which enables users to discuss any issues that they have related to their health and wellbeing and get advice. Give a brief Activity Theory analysis of a user’s interaction with the chatbot, clearly identifying the elements in your analysis. Give a rationale for carrying out this type of analysis and explain why you have selected each element in your analysis.

[14 marks]

- Any reasonable description of a rationale
- Reasonable subject: agent performing activity
- Reasonable object: thing to be transformed
- Reasonable tool: things that mediate the transformation
- Reasonable set of rules
- Reasonable elements of a community
- Reasonable division of labour

c) Explain what primary and secondary contradictions in an activity system are, illustrate these two levels of contradiction with examples from the analysis you produced in (b).

[4 marks]

- Correct definition of primary contradiction and example
- Correct definition of secondary contradiction and example

d) Define the terms *breakdown*, *present-at-hand*, *ready-to-hand* and *unready-to-hand*, illustrating these concepts using examples from the *StudyBuddy* chatbot functionality.

[8 marks]

- Definition of breakdown and example
- Definition of present-at-hand and example
- Definition of unready-to-hand and example
- Definition of ready-to-hand and example

e) Explain how phenomenology can inform interaction design, illustrating your answer with examples from technologies of your choosing

[8 marks]

- Explanation of how we can use breakdown to inform interaction design, in particular:
 - o Breaking down illusion/interaction
 - o Discovering hidden features of interaction
 - o Devising more effective interaction strategies
- One mark for each example related to the three points above

f) Your team have been asked to add game-like functionality to StudyBuddy that will support users to enter a flow state. What principles will inform your design?

[4 marks]

- Provide support for:
 - o Focusing on moment-to-moment engagement
 - o Merging of actions with awareness
 - o Increased sense of control and agency
- Make the game intrinsically rewarding

g) If your flow game is successful then what subjective experiences would you expect users to report?

[4 marks]

- Points are gained for describing any of the experiences associated with flow states, including: feeling in the moment, actions merging, lost of reflective states, and loss track of time

Question 3

a) Your team has developed a social forum for *StudyBuddy* users, where they can anonymously post messages and read and comment on other users' messages and comments. Conduct a brief *Distributed Cognition analysis* of this social forum functionality, paying attention to the different places where processing is carried out, where information is stored and how information flows between components.

[14 marks]

- any analysis that contains a whole system/context as a unit of analysis
- identifying what information/knowledge is necessary/flows in the system
- where this information is stored in terms of: external representation ; actors/agents internal representation ; physical interactions; and social interactions
- any sensible representation of how information flows between these component

b) Describe three insights that a Distributed Cognition analysis can provide into the design of social forums that facilitate collaboration on topics?

[6 marks]

- Two marks for any reasonable insights, including: provide external representations on the forum that show the most popular topics; show links between different but related threads as cognitive processes are distributed; provide an external representation of the topics that different users post about and the links between users, in terms of the topics of their posts, as there is a division of labour

c) What are the key differences between analysing a system using Distributed Cognition and Activity Theory? Illustrate your answer by reference to any technological system.

[8 marks]

- Reasonable examples for each point (up to 4)
- Description of differences between AT and DC in terms of:
 - o What drives the analysis, high level motive vs. Information processing
 - o The nature of design insights gained from each analysis: contradictions and their resolutions identifying representational improvements

d) What are the main differences between a GOMS conceptualisation of interaction compared to Distributed Cognition?

[8 marks]

- One mark for every reasonable contrast, including:
 - o GOMS: expert single users; skilled; no learning; no problem solving; internal representations; restricted tasks.
 - o Distributed Cognition: groups of users; different levels of expertise; internal and external representations; real-world tasks

e). Describe a new feature of *StudyBuddy* and how you could use a KLM analysis to inform its design.

[8 marks]

- Description of an appropriate design feature e.g. deciding on whether to use a drop down menu or radio buttons to select some input values to an interface that is appropriate for a health and wellbeing app for students
- Description of how the KLM analysis would be carried out: up to 4 marks if values for the different actions are provided.
- Up to 2 marks for the working that shows the correct answer.

f) Describe an aspect of the *StudyBuddy* interface where you could use Fitts' Law to help you design the interface. Name two benefits of using Fitts calculations in this setting over more descriptive methods.

[6 marks]

- Description of a situation that involves predicting performance on at least two different mouse tasks in order to determine where to place a widget e.g. a button
- Two of the following:
 - o Quantification allows easy numerical comparison to measure the design.
 - o Communication for the client can be simpler to understand with data to back it up.
 - o Use of the law reduces time and cost in running real-world user tests.

End of Exam.