1.3 Cognitive ergonomics and human error

Name: _____ Class: _____ Date: _____ **Total: 30 marks**

KEY WORDS cognitive ergonomics • affordance • signifier • mapping • feedback • mental model • information overload

Objective

Build the skills to answer exam questions on **cognitive ergonomics** : affordance, signifiers, mapping, feedback, constraints and consistency, **mental models** , slips and mistakes, and information overload.

You must be able to:

- define affordance, signifier, mapping, feedback, constraint and consistency, with examples
- explain how a mental model helps or misleads a user
- distinguish a slip from a mistake and suggest design changes that reduce each
- explain information overload and how interfaces group and limit information
- evaluate an interface and suggest improvements

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1 Key knowledge and worked examples

Principles for usable products

principle	meaning	good example
affordance	what actions a design allows	a flat plate on a door affords pushing
signifier	a signal of where and how to act	a "push" label, an arrow
mapping	the link between controls and effects	cooker knobs laid out like the burners
feedback	shows that an action has worked	a click, a light, a progress bar
constraint	limits actions to prevent errors	a USB-C plug that fits either way; a keyed connector
consistency	similar things work the same way	standard icons for save and delete

A **mental model** is the user's idea of how a product works. A good design matches it, so users can predict what will happen. A door that people pull when they should push is a **design** failure, not a user failure.

Human error

- **Slip:** the right goal, but the wrong action (pressing the button next to the right one). Reduce with larger, well-spaced controls and a confirmation step for important actions.
- **Mistake:** the wrong goal or plan, often from a poor mental model. Reduce with clear signifiers, feedback and a simple, consistent interface.

Information overload : too much information at once slows people down and causes errors. Short-term memory holds only a few chunks (traditionally about 7 ± 2), and each extra choice makes decisions slower (Hick's law). Good interfaces group information, show only what is needed now and use recognition (menus, icons) rather than recall.

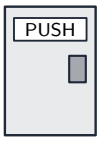
Worked example. A cooker has four burners in a square but four knobs in a row, so users turn on the wrong burner (poor mapping). Fix: place the knobs in a square that matches the burners, or label each knob with a small burner diagram (a signifier).

Answer shapes: name the principle → point to the feature → say what the user does → suggest a change.

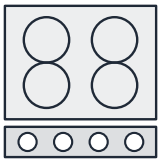
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2 Practice

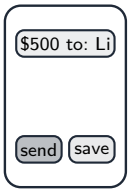
2.1 Define **affordance** and **signifier**. [2]



2.2 A cooker has four burners in a square and four knobs in a row. Explain why users often turn on the wrong burner, and suggest an improvement. [3]



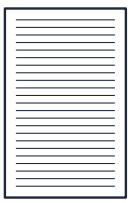
2.3 Distinguish between a **slip** and a **mistake**, with an example of each when using a banking app. [4]



2.4 Explain how **feedback** helps a person using a ticket machine. [2]



2.5 A settings menu shows 24 options in one long list. Using **information overload** and **Hick's law**, explain how it could be redesigned. [3]



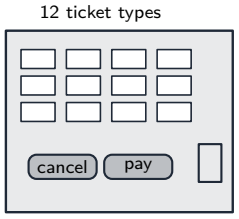
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3 Exam-style questions

3.1 Many passengers buy the wrong ticket from a railway ticket machine, and some press **cancel** by accident when they want to pay.

(a) State what is meant by a **mental model**. [1]

(b) Explain how **one** slip and **one** mistake could happen with this machine. [4]



(c) Suggest **two** design changes that use feedback or constraints to reduce errors. Explain each change. [4]

(d) The redesigned machine will be tested. Evaluate using user trials rather than expert appraisal for this test. [7]

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