

User Testing and Predictive Models

Interaction Design Studio (DECO I200)

Overview

User Testing

A brief outline of how to conduct user testing

Predictive Modelling

Using models to estimate user performance

User Testing

User testing involves the use of experiments on intended users of a product to determine whether it is usable for some given tasks

User testing is often used to discover how long it takes a user to perform a typical task as well as the number and types of errors that users make

Typically 5-12 users are involved in user testing but fewer can be used in a “quick and dirty” user test to get feedback on a design

User Testing

Goals and Questions

User testing typically has a well-defined goal or a set of questions that need answering, e.g. Is a new web site's design easier to use than the old one?

Selection of Participants

It is important that the participants of any user testing be a representative sample of the intended users, i.e. it is no good just asking web designers to participate in user testing if the web site is intended for the general public.

Development of Tasks

Tasks for the participants to perform need to be specific and reflect the typical sorts of tasks that people need to accomplish, e.g. find a piece of information on a web site.

The Test Procedure

Tests need to be conducted carefully to ensure that the results from different participants can be compared, e.g. preparing a set of written instructions for participants so that they all get the same information before they start.

Data Collection

Data collected during a session will include a record of the time taken to accomplish tasks and notes on the number and types of errors made. In addition, users may be given a questionnaire at the end of a session to get additional feedback on the user experience.

Data Analysis

Data gathered should be analysed to try to answer the initial questions before any conclusions can be drawn about the success of a design.

Participant	Time to nearest minute	Reason for task termination	MEDLINEplus Pages	External sites accessed	MEDLINEplus searches	MEDLINE publication searches
A	12	Successful completion	5	2	0	2
B	12	Participant requested termination	3	2	3	0
C	14	Successful completion	2	1	0	0
D	13	Participant requested termination	5	2	1	0
E	10	Successful completion	5	3	1	0
F	9	Participant requested termination	3	1	0	0
G	5	Successful completion	2	1	0	0
H	12	Successful completion	3	1	0	6
I	6	Successful completion	3	1	0	0
M	10		3	2	1	1
SD	3		1	1	1	2

Predictive Models

Predictive models provide measures of user performance without the need to test users

Predictive models provide qualitative and quantitative predictions of average user performance based on data gathered from many studies of user performance

Predictive models are especially useful when it is difficult to do user testing

e.g. when many options need to be tested but there are only a limited number of users on which to do the tests, using predictive models can be used to greatly reduce the number of tests that need to be done with users

The GOMS Model

GOMS is the most well-known predictive modelling technique in studies of human-computer interaction, GOMS stands for:

Goals: particular states that a user wants to achieve
e.g. find a website on interaction design

Operators: cognitive and physical actions performed
e.g. decide on which search engine to use

Methods: learned procedures for achieving goals
e.g. type in keywords, press “Search” button

Selection Rules: rules to choose between methods
e.g. choosing between using mouse or keyboard

Goal to delete a word in a sentence

Method for deleting a word using menu

Step 1. Recall that word has to be highlighted

Step 2. Recall that command is “cut”

Step 3. Recall that “cut” is in the edit menu

Step 4. Select word and execute “cut” command

Step 5. Return with goal accomplished

Method for deleting word using delete key

Step 1. Recall that cursor must be placed after word

Step 2. Recall which key is the “delete” key

Step 3. Press “delete” key to delete each letter

Step 4. Return with goal accomplished

Operators to use in above methods

Click mouse

Drag cursor over text

Select menu item

Move cursor to command

Press keyboard key

Select Rules

1. If large amount of text use menu

2. If small amount of text use keyboard

Keystroke Level Model

The keystroke level model is related to GOMS but provides numerical predictions

Using the keystroke level model, predicted user performance can be compared in terms of the time taken to complete tasks using different methods

The keystroke level model was from the findings of many empirical studies

The keystroke level model uses a standard set of approximate times for commonly used operators

Operator name	Description	Time (sec)
K	Pressing a single key or button	0.35 (average)
	Skilled typist (55 wpm)	0.22
	Average typist (40 wpm)	0.28
	User unfamiliar with the keyboard	1.20
	Pressing shift or control key	0.08
P	Pointing with a mouse or other device to a target on a display	1.10
P ₁	Clicking the mouse or similar device	0.20
H	Homing hands on the keyboard or other device	0.40
D	Draw a line using a mouse	Variable depending on the length of line
M	Mentally prepare to do something (e.g., make a decision)	1.35
R(t)	System response time—counted only if it causes the user to wait when carrying out their task	<i>t</i>

Keystroke Level Model

Using the keystroke level model, estimate how long would it take to insert the word *not* into the following sentence?

Running through the streets naked is normal

So that it becomes:

Running through the streets naked is not normal

Mentally prepare (M)	1.35
Reach for the mouse (H)	0.40
Position mouse before the word “normal” (P)	1.10
Click mouse (P ₁)	0.20
Move hands to home position on keys (H)	0.40
Mentally prepare (M)	1.35
Type “n” (good typist) (K)	0.22
Type “o” (K)	0.22
Type “r” (K)	0.22
Type “space” (K)	0.22
Total predicted time:	5.68 seconds

Does this seem like a reasonable estimate?

Keystroke Level Model

Using the keystroke level model, compare how long it will take to delete *not* from the following sentence:

I do not like using the keystroke level method.

Using the following methods:

1. Positioning the cursor at the end of the word and deleting each letter of the word using the delete key
2. Highlighting the word using the mouse and deleting the whole word in one go using the delete key

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(a) Our analysis for method 1 is:

Mentally prepare	M	1.35
Reach for mouse	H	0.40
Move cursor one space after the word "not"	P	1.10
Click mouse	P ₁	0.20
Home in on delete key	H	0.40
Press delete key 4 times to remove word plus a space (using value for good typist value)	4(K)	0.88
Total predicted time = 4.33 seconds		

(b) Our analysis for method 2 is:

Mentally prepare	M	1.35
Reach for mouse	H	0.40
Move cursor to just before the word "not"	P	1.10
Click and hold mouse button down (half a P_1)	P_1	0.10
Drag the mouse across "not" and one space	P	1.10
Release the mouse button (half a P_1)	P_1	0.10
Home in on delete key	H	0.40
Press delete key	K	0.22
(Using value for good typist rate)		
Total predicted time = 4.77 seconds		

Benefits and Limitations of GOMS

The main benefit of GOMS is that it allows user interfaces to be compared easily

GOMS has been used to compare software systems and help advise companies on large purchasing decisions

The main limitation of GOMS is that it has a very limited scope, i.e. computer-based tasks

GOMS can only really help analyse a small set of highly routine data-entry type tasks

Fitts' Law

Fitt's Law predicts the time it takes to reach a target using a pointing device

Fitt's Law can be used by designers to help them decide on where to place buttons on screen, what size they should be and how close together they should be.

Fitt's Law states that:

$$T = k \log_2(D/S + 0.5), k \sim 100 \text{ msec.}$$

where

T = time to move the hand to a target

D = distance between hand and target

S = size of target

Fitt's Law

Fitt's Law predicts that the bigger the target the easier and quicker it is to reach it

i.e. interfaces with big buttons are easier to use!

Fitt's Law also predicts that the most quickly accessed targets on a computer screen are the corners because the sides of the screen prevent users from missing the target

This is why Apple allows the corners to be used to activate frequently required functions, e.g. Exposé

Summary

User Testing

Goals, participants, tasks, procedures, collection, analysis

Predictive Modelling

GOMS, Keystroke Level Model, Fitts' Law