ANOVA, Interaction, and Research

CS3106 - Human Computer Interaction

Question 1

All data points are given to 5 significant figures. Find lowest sig.level to reject H_0.

Results	**Table 1 (Keyboard)**	**Table 2 (Mouse)**	**Table 3 (Eye Tracking)**
SS_{error}	39.2	234.75	354
SS_{total}	92.1	259.75	646.95
SS_{effect}	52.9	25	292.95
n Participants	10	16	21
m Groups	2	2	3
df_{error}	8	14	18
df_{effect}	1	1	2
MS_{error}	4.9	16.768	19.667
MS_{effect}	52.9	25	146.475
α Confidence Level	0.05	0.05	0.05
F-Ratio	10.796	1.4909	7.4479
Critical Value	5.3177	4.6001	3.5546
Significant?	TRUE	FALSE	TRUE
Keyboards Report	Keyboard A resulted in fewer average errors than keyboard B (23.4 vs 28 respectively). We assumed these errors were normally distributed. Analysis of variance at a significance level of $\alpha = 0.05$ showed that this difference was statistically significant ($F_{1,8} = 10.796, p < 0.05$).		
Mice Report	Mouse C resulted in fewer average errors than mouse B (7.625 vs 10.125 respectively). We assumed these errors were normally distributed. Analysis of variance at a significance level of $\alpha = 0.05$ showed that this difference was statistically insignificant ($F_{1,14} = 1.4909, p > 0.05$).		
Eye Trackers Report	Eye tracking F had fewer average errors than eye tracking G which, in turn, had less average errors than E (32.714 vs 37.571 vs 41.857 respectively). We assumed these errors were normally distributed. Analysis of variance at a significance level of $\alpha = 0.05$ showed that the difference between mean errors was statistically significant ($F_{2,18} = 7.4479, p < 0.05$).		

Question 2

ABSTRACT

I will be evaluating and outlining a field study for Itchy Nose: discreet gesture interaction using EOG sensors in smart eye-wear. The experiment is designed to test the core goal of the project; discreet public computer interaction.

ISSUES

Today's world poses new challenges unforeseen at the time the paper was published (2017). Amidst the Covid-19 pandemic all potential users of the Itchy Nose interaction technique would have to wear a face mask in public settings. This drastically changes the input to the classification algorithm leading to reduced accuracy. Another issue Itchy Nose faces is that it is limited to three input gestures which restricts the user to ternary decision making. The complexity of today's computer systems demand precise and comprehensive input systems; neither are properties of the proposed interaction technique.

After reading the research paper I tried flicking, pushing, and rubbing my nose to further understand the usability. After only one minute I became very irritated as exerting these types of nose movements is unnatural and uncomfortable. The last issue I propose attacks the primary goal of the study. Consistent nose touching would raise concern in a social setting. The paper references a health study claiming mouth/nose touches to average 3.6 per hour. This statistic is used to show that the input gestures are "commonplace" but it is extremely unreasonable to assume a user will average as little as 3.6 inputs per hour.

OVERVIEW

To measure Itchy Nose's effectiveness in being a discreet interaction technique, I propose a social experiment in which one member of an in-person meeting will complete tasks on a computer while trying to remain undetected. After the meeting there will be a vote on who completed the tasks during the meeting; detection is defined as when the modal vote is uniquely the participant using the Itchy Nose.

SETUP

The experiment is between-subjects as the participants have different roles.

Arrange a meeting with five participants all of whom are strangers to the rest of the group.

Brief one of the participants on the interaction technique and the tasks they are required to complete during the meeting.

Ensure that the the EOG electrodes are working as expected and are connected to the relevant participant's device.

Calibrate the classification algorithm for the Itchy Nose user seated.

INDEPENDENT VARIABLES

Meeting participants.

Participant using the Itchy Nose interaction technique.

Tasks to be carried out during meeting.

Number of tasks to be carried out during the meeting.

DEPENDENT VARIABLES

Number of tasks successfully completed.

Modal participant vote.

Discreetness score.

Disruptiveness score.

PARTICIPANTS

Five participants will be randomly selected from a mailing list to more comprehensively represent the population. Additionally, the participant who will use the Itchy Nose will be randomly selected.

Assert that no two participants know each other to avoid tainting results.

TASK

All five participants are invited to a face-to-face meeting, one of which is also invited to a briefing first. The subject of the meeting isn't relevant to the experiment.

The task of the Itchy Nose user is to complete a number of tasks without being detected.

The task of the rest of the participants is to figure out who was completing these tasks.

These participants will not know that this is their task during the meeting.

At the end of the meeting their task is to vote for who they thought was replying to the text messages.

APPARATUS

Itchy Nose glasses (J!ns Meme with EOG sensors).

Action classification software.

Device connected to the glasses.

MATERIAL

After the experiment, the participants will be told about the Itchy Nose (and who was secretly using it) before being asked to score how discreet it was and then how disruptive it was on a scale of one to ten.

PROCEDURE

Participants are asked to come to a meeting, the subject of which is irrelevant for this study but can be used to collect data on what wearable input devices people would use and why.

One participant is chosen to complete tasks during the meeting using the proposed Itchy Nose. The experiment will be repeated with varying tasks with different groups of people.

The meeting will run and the number of correctly completed tasks will be recorded.

Once the meeting has concluded all participants will be told that someone was completing tasks during the meeting using a discreet interaction technique. All participants will then vote for who they thought this was through an anonymous ballot. The vote is counted and then the Itchy Nose user is revealed.

NOTES

Since this is a between-subjects experiment, there are no skill transfer effects.

It follows that there is no balancing or counterbalancing.

THREATS TO EXPERIMENTAL VALIDITY

There are many factors that impact how much attention a person will receive in a social setting such as general engagement and appearance.

The participant who will be using the Itchy Nose will not have used it before and, although it is a very simple interaction technique, a lack of familiarity will likely result in less efficient or incorrect usage.

Question 3

ABSTRACT

I will be evaluating and summarising the paper “Facilitator, Functionary, Friend, or Foe?: Studying the Role of iPads within Learning Activities”. The study explores how the education landscape is changing with the introduction of tablet technology into primary school curricula. The research takes a high-level approach to clearly define the unique roles of iPads in the classroom providing future studies with a framework to work with.

MOTIVATION

The research was conducted to discover the role of the iPad within the context of its use as well as providing ground-work for future studies into tablet integration in education. The goal of this is to clearly define the purpose of iPads in the classroom in order to promote the development of new digital tools and teaching techniques.

ACCOMPLISHMENTS

The paper outlines three categories of interaction with the iPad: facilitator, functionary, and friend. The new classification of iPad uses that the paper proposes provides a robust vocabulary to enable and promote the design and study of tablet devices in formal education. An iPad is considered a “facilitator” if the learning activity is dependent on the existence of the tablet’s technological capabilities. The paper also talks about using an iPad as a “functionary” which is when the iPad is used to facilitate an exercise without being a requirement. An example of this would be reading textbook material from the iPad rather than from the textbook. The final bracket is the iPad as a “friend” which is explained as the interaction between student and tablet which can be likened to companionship. This includes personalising the tablet experience and protecting the device from damages.

The research also shows how current tablet use has impacted students’ learning experience. This brings attention to ways schools can implement tablets into their education programmes in order to build valuable skills for the students that they wouldn’t otherwise be developing. These skills include, but are not limited to, collaboration in a digital environment, research using a search engine, and independent learning.

Through interviews and essays the research shows the students’ opinions about using the iPads to complete various assignments. This qualitative data forms a new perspective critical to the evolution of in-class digital learning. The main point raised by the students was that the excitement of using an iPad in class boosted productivity and motivation substantially, especially for writing tasks.

RESEARCH METHODS

The paper describes an eight month plan to monitor student growth with the iPad at a Scottish primary school in a composite, mixed-ability class of 10 to 12 year olds. The class employed a one-child-per-iPad policy which allows the individual to take ownership of their device and develop familiarity. The study begins when the iPads have just been introduced into the school curriculum so that learning phenomena can be observed.

The iPads were issued with a small set of applications pre-installed to help the students to grasp the basic concepts of tablet technology in the classroom. Over the year this list of applications grew at the teacher's discretion; students were not allowed to install their own apps.

On days that the researchers were in the school observational notes were taken to track fine details about the students' interaction with the iPads. The notes were split into 5 minute segments and transcribed into a spreadsheet to encourage structure. The notes included details about the daily activities in the classroom, the role of the iPad in these activities, and the number of children in each group. The resulting spreadsheet is a comprehensive quantification of tablet interaction.

Cameras were also used to capture entire sessions on video to be reviewed and annotated. The video was analysed alongside the observational notes to identify the context of the iPad use in different subjects, learning activities, and group environments. Video is very data-dense in comparison to other data collection methods and provides a rich source of information allowing subtleties to be studied.

After each session some students and the teacher were interviewed which is also recorded. Gathering responses from the students themselves gives unique insight into the true success of the technology. Their feedback directly highlights the strengths and shortcomings of using tablets in education.

To qualitatively measure how the students' perspective of the iPads changed over the course of the study, the children were asked to write an opinion statement both before and after. 26 short essays were collected describing the students' experience with the iPads so far. They were prompted to discuss what they liked and disliked about it.

CONCLUSIONS

The study achieves it's goal of providing a rich set of language to describe classroom activities using iPads. A classification system is proposed to split tablet interaction in three categories: facilitator, functionary, and friend. By establishing common terms researchers can begin to specialise studies into different aspects of tablet interaction in schools.

Multiple experimental methods are employed to quantify the role of the iPad within the classroom. The data stands to show how iPads have improved the productivity of primary school students. The iPads also built upon social skills by encouraging collaboration between students.

The new child-centred approach of the study brings new perspectives to consider when designing and integrating iPads into school environments.

Students developed self-confidence when given the opportunity to work creatively and at their own pace. Both the more abled and less abled students benefit from the iPads but in different ways. They gave more-abled students a chance to showcase what they have learnt going above and beyond what is expected of them. The less abled students were supported by the technology and could learn in their own time using tools and techniques they are comfortable and familiar with.

NEGATIVE IMPLICATIONS

The authors noted that some students find the iPads to be distracting and there are situations where the technology inhibits learning. An example of this is the barrier to learn spelling when spelling is auto-corrected. Further, one student claimed in an interview that the iPad is distracting at home.

The study did not touch on the socio-economic implications of having iPads at school, especially in a one-tablet-per-child scenario. As the technology matures and the application landscape expands, schools with the financial means to provide tablets will have an ever growing advantage over other schools promoting social inequalities.