INSTITUTIONAL REVIEW BOARD (IRB)
REVIEW FORM
FOR PROJECTS USING HUMAN SUBJECTS

Investigators are responsible for ensuring that the rights and welfare of human subjects participating in research activities are protected, and that methods used and information provided to gain subject consent are appropriate to the research. The IRB will review only those assignments, activities, or investigations that are defined as research.

“Research” as defined by federal administrative bodies is “a systematic investigation designed to develop or contribute to generalizable knowledge” (45 CFR 46.102). Course projects whose primary intent and design are pedagogical, and are not originally intended to contribute to the general body of knowledge, are not normally subject to IRB review. However, it is the position of the IRB that the individual faculty member retains ethical responsibility for the proper conduct of such instructional studies.

All the research activities involving the use of human beings as research subjects (participants) must be reviewed and approved by the Elon University Institutional Review Board (IRB), unless the IRB chair determines that the research falls into one or more of the categories of exemption established by federal regulation. These categories include research conducted in commonly accepted educational settings involving normal educational practices such as research on regular and special education instructional strategies, research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods. Also exempt is research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior. However, each category of exemption contains specific exceptions. Please note that only the IRB may make the determination if the research qualifies for exemption under Title 45 CFR 46.101.

Investigators may not solicit subject participation or begin data collection until they have received approval or written concurrence that research has been determined to be exempt from the Institutional Review Board.

Students may not serve as Principal Investigator on an IRB study and should work with their faculty mentor, instructor, etc as a Co-Investigator when submitting an IRB application.

Application forms are available on the Internet at www.elon.edu/IRB. The form may be downloaded and completed but must be submitted in both electronic and hard copy due to signature requirements. If you have questions about the IRB application form or about the review process, contact:

Stephen Bailey
Chair, IRB
Phone: 278 6346 /E-mail: baileys@elon.edu

The Institutional Review Board generally meets on an ad hoc basis as proposals are submitted for review. Applicants must allow a minimum of 2 weeks for the review process. Allow for extra time if proposal is submitted during the summer or winter term. Proposals describing research that involves more than minimal risk to participants (any harm anticipated in the proposed research that is more probable or of greater magnitude than that ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests) will require a full review, which will occur during the monthly standing IRB meeting. Contact the IRB Chair for meeting times.
A notice of the IRB’s action will be sent to the researcher(s). It is the responsibility of the researcher(s) to see that the form is given to any agency which may require it.

**INSTRUCTIONS:**

Your responses to the 20 questions in the summary sheets that follow are basic to the Institutional Review Board’s determination about the protection of the rights and welfare of human subjects in your research. Your responses should be clear, complete, and easy to understand.

Place your typewritten response immediately under each question (not on a separate sheet). It is important that you answer every question. If you believe that a question does not apply to your research, enter a response such as “N/A” or “does not apply.”

Copies of the following must be included with this form:

1. The letter/script that will be used to inform participants of the nature of the research.
2. The informed consent template the subject(s) will sign (samples appropriate to behavioral and biomedical research are available at www.elon.edu/IRB).
3. Copies of surveys, instruments or measures, questionnaires, interview schedules, focus group questions and/or other materials used to collect data.

Submit one complete hard copy and one digital copy (as a .docx or .pdf file, via e-mail or disk) to:

Stephen Bailey  
Chair, IRB  
2085 CB  
(baileys@elon.edu)

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<table>
<thead>
<tr>
<th>Research Project Title</th>
<th>An investigation of a visual password-entry system for mobile devices</th>
</tr>
</thead>
</table>

**Principal Investigator**

- **Name (first, middle initial, last):** Dugald, R, Hutchings
- **Department:** Computing Sciences
- **Signature:** Click here to enter text.
- **Date:** Oct 1, 2009
- **Campus Box/Phone:** 2320/x6291
- **E-mail:** dhutchings
- **Fax:** x6245

**University Relationship:**
- Assistant Professor
- (“Other” categories may require prior approval.)

**Co-Investigator**

- **Name (first, middle initial, last):** Jonathan, C, Citty
- **Department:** Computing Sciences
- **Signature:** Click here to enter text.
- **Date:** Oct 1, 2009
- **Campus Box/Phone:** 3774/336-613-9698
- **E-mail:** jcitty
- **Fax:** n/a

**University Relationship:**
- Undergraduate Student
INTRODUCTION TO THE PROPOSED RESEARCH

1. Provide the date when you propose to begin research and the date when you anticipate that research will be completed.

   Proposed start date: upon approval (Oct 1, 2009)  Anticipated completion date: Dec 31, 2009

2. Indicate any source(s) of funding for the proposed research i.e., department funds or grants.

   Elon College Fellows provides indirect support to Jonathan Citty through his membership in the program.

DESCRIPTION OF THE PROPOSED RESEARCH

3. Provide a brief (1 page or less) description of the purpose of your research.

   Based on emerging research for standard desktop- or laptop-sized display devices that passwords consisting of a random sequence or set of images (graphical passwords) rather than a user-selected sequence or set of text characters (standard passwords) are as secure but more memorable, we are exploring whether existing techniques for facilitating the entry of graphical passwords will scale to display sizes typical of mobile devices such as phones, iPods, etc. We are proposing a number of alternative display and entry methods and endeavoring to explore which of the methods (if any) is most effective (that is, most memorable) for users. Our goal is to ascertain the memorability of a graphical password under real-world conditions and measure the ease with which participants can actually enter their passwords. The research should provide insight into the generalizability of graphical password systems and schemes and hopefully promote a password system that will help all users of mobile devices keep their devices secure while decreasing the mental burden of securing the data and programs contained on or accessed through the device.

4. Indicate the setting or location(s) where research will be conducted. Attach letters of support or agreement, as necessary, showing that you have permission to conduct research at that location. If you are interacting with human subjects outside of the United States, describe what procedures are required to adhere to the human subjects mandates for the country where data collection will take place.

   The research will take place in room 305 in the Duke Building on the campus of Elon University in Elon, North Carolina, USA. This location is accessible only to majors in computing sciences and as such, we have secured the permission of Computing Sciences Department Chair Dave Powell to use the lab for the research. The letter of support is provided only with the physical copy of this application.

5. Does the proposed research require that you deceive participants in any way?

   ____ Yes  ______ X  No

6. If your response is “yes,” describe the type of deception you will use, indicate why it is necessary for this study, and provide a copy of the debriefing script.

   N/A
7. Describe in detail what will happen to or be required of subjects in your investigation.
   (include a description of any instruments used, sample of questionnaires, focus group questions, etc.)

Participants will greet the examiner outside of the computer lab and be escorted into the lab by the examiner. The examiner will describe the nature of the investigation (see provided script at end of document), present the participant with the informed consent form (see form at end of document), and review key rights held by participants. If the participant does not provide consent, then the participant will be excused. If the participant does provide consent, then the examination will continue. The examiner will record a unique identifier for the participant on the consent form and the forms will be stored in a locked room to help protect the privacy of the participant but also allow the participant to later withdraw their participation in the experiment (in particular, omit their data from any analyses). All other experimental data will be recorded under the unique identifier, not the name of the participant. The participant will then be exposed to a graphical software program on a screen of either a mobile device or standard desktop monitor (or both). The program will illustrate to the participant a pre-selected randomly generated password that consists of images (note: the images are of common objects such as animals, fruits, vehicles, hand tools, etc., and the password is used only for the experiment and does not protect any actual sensitive material). The program will direct the participant to engage in entering the password several times, either through operating a mouse or through direct touch on the screen (or both). Next, the participant will enter the password without assistance to ensure that the participant knows the password. If the participant fails to enter the password, the training session will re-start (if after three attempts the participant cannot learn the password, then the participant will be excused from the session and the results excluded from the analysis). Once the participant successfully enters the password without assistance, the participant will fill out a brief survey to capture key demographic information (see survey at end of document). The examiner will follow-up with the participant to ask about any responses that are unclear. If five minutes has not passed since the beginning of the survey, then the participant will be instructed to sit quietly until the 5-minute period has elapsed. The participant will then re-enter their password correctly to re-confirm that they know the password (or otherwise go back to the training session, as explained above). For participants that successfully enter their password, the examiner will administer a second survey (see survey at end of document) and will schedule a time for the participant to return to the lab (with a goal of returning in 7 days). The examiner will send an email to the participant 24 to 48 hours prior to their scheduled return to the lab as a reminder. For participants that do not return, again email will be used to arrange for an alternate time to return to the lab. When the participant returns, the participant will attempt to enter their password. If the password is entered correctly at any point or if after five attempts the participant cannot correctly enter the password, then the participant will move onto the final survey portion of the experiment (see survey at end of document). Participants who return for the second session will be compensated (but no others will). During all periods of time when participants are interacting with the computer, the software program will be recording their mouse movements and clicks (including a time stamp) for later analysis.

As stated in the passage above, the script, consent form, and surveys to be used in the examination are included in-line at the end of this document.
8. Describe any potential physical or psychological risks or problems that a research participant may encounter by participating in this investigation. Also describe how you plan to minimize these risks. Examples of risks and problems include but are not limited to physical injury, painful simulation, deception, coercion, embarrassment, lack of confidentiality, lack of full disclosure, and lack of feedback for subjects. If appropriate, include a description of any special qualification or training by investigators that will be used to minimize risk for the subject (e.g., CPR certification).

Physical risks are minimal and are no greater than those encountered in the everyday operation of a desktop computer, laptop computer, or mobile device such as mobile phone, iPod, etc.

Participants will engage in the experiment in a semi-private lab (that has windows to an outside hallway) so casual observers may be able to ascertain the identities of individuals participating in the study.

9. Describe the potential benefits of conducting this research. List the benefits to the participants themselves, contributions to the field of knowledge, and benefits to society as a whole. If the research participants will not receive any direct benefits from participating in this study, indicate this in your response.

Participants will receive a small amount of monetary compensation for their participation. Some participants will further be offered course credit. Results of this study should further the study and implementation of memorable but secure password systems, which should both contribute to the field of human-computer interaction and also benefit society by making it easier for people to secure their computing devices.

10. Indicate the total number of participants you require, and your sampling procedure.

We expect to enroll approximately 30 participants but may enroll as many as 50 participants. We will use campus media such as e-Net, electronic bulletin boards (such as those found in Moseley and Duke), and physical bulletin boards to recruit participants. We will also ask computing and psychology professors (other than Hutchings) to offer extra credit to their students for participating. Citty will use his social network to attract participants. Our goal is to sample from the Elon University population of faculty, staff, and students.

11. Do you plan to use vulnerable subjects in your investigation?  

   X Yes   ___No

   Examples of vulnerable subjects include students, children, prisoners, pregnant women, mentally disabled persons, or economically disadvantaged persons.

12. Describe the type and source of subjects required (i.e., single parents at Elon, psychology classes, patients at Alamance Regional Medical Center, sixth graders at Turrentine Middle School, etc.).

Elon students will be allowed and encouraged to participate as indicated in item 10.
13. Provide an estimate of the **amount of time** that will be requested from each person who participates in this research study (number of sessions, amount of time per session, and duration of period of time over which the research will take place).

Participants will spend a maximum of 60 total minutes spread over 2 sessions (session 1: 40 min; session 2: 20 min) and a duration of approximately 7 days.

**INFORMED CONSENT PROCEDURES**

14. Describe what you have done to make sure your subjects are **fully informed** about their role in the research, that their confidentiality will be maintained, and that their participation is **voluntary**, and that they can withdraw at any time without penalty. Include a description of how and by whom consent will be sought from subjects.

Recruiting materials will list a Web site that potential participants can visit. The Web site will include detailed information about the study and a link to the informed consent form. The form itself explains the nature of the research, the role of the participant, and the steps being taken to maintain confidentiality. When participants arrive, we will verbally review their key rights and they will review the consent form. The participants will affirm through their signature that they consent to participation and that their participation is voluntary. Participants will be verbally reminded by the examiner that they may withdraw from the study at any time after they sign the form and that they may ask questions at any time during or after the study.

15. Describe any **incentives, inducements, or reimbursements** (e.g. extra credit, research credit, cash payment, raffle, gift) that will be offered to the participants. Indicate whether participants will receive the incentives if they withdraw before the study has been completed.

As indicated in previous items, each participant will receive a small cash award between $5 and $10 (the actual amount is still yet to be determined, but each participant will receive the same amount). Students who were recruited through classroom announcements will also receive extra credit (as provided by the instructor of those classes). Participants must return for the second session in order to receive compensation (both monetary and class extra credit, if applicable), but they do not have to correctly enter their password at the second session in order to receive the compensation.

**CONFIDENTIALITY OF THE DATA**

16. Indicate the **intended use** of your data. Check all that apply.

- _____ Thesis
- _____ Capstone
- _____ Publication/journal article
- _____ Undergraduate honors project
- _____ Results released to participants/parents
- _____ Results released to employer or school
- _____ Conferences/presentations
- _____ Results released to agency or organization
- _____ Other. Describe below.
17. Describe the steps you will take to insure the **confidentiality** of the data. Indicate how you will safeguard data that includes identifying or potentially identifying information (e.g. coding). Indicate when identifiers will be separated or removed from the data.

As indicated in previous items, participants will be assigned a code under which their data will be stored. This code will be recorded on their informed consent form and the forms will be stored in a locked room. The motivation for recording their code on the form is to be able to remove their data from the analysis should they decide to withdraw their participation at a later time (i.e., in order to maintain participant rights, there must be some recorded link between participant name and participant code). All data will be stored under the participant code, not the name.

18. Indicate where and how you will **store** the data and how long you plan to retain it. (Research proposals that involve any type of use of human subjects must be retained for 3 years.) Describe how you will dispose of it (e.g. erasure of tapes, shredding of data).

Collected data will be first stored on the devices used in the experiment, then later transferred to the computers of the investigators (one computer is an Elon-owned computer and one computer is a personally-owned computer). Each investigator plans to retain the data forever and there is no plan to dispose of the data at any time.

19. Will results of this research be **made available** to the subjects involved?

   X  Yes  ___ No

20. If so, **how and when?**

Participants may request to see the results at any time. Any publications or presentations arising from this work will be made available on the Web site of the primary investigator.
Demographic Survey

Please respond to the following seven questions as accurately as possible.

① Sex  M  F

② Age  ________________

③ Circle all of the activities listed below that you have completed within the past year.

- Checked Email
- Edited Pictures
- Written a computer program
- Facebook
- Created a Video
- Created a Website
- Listened To Music
- Online Banking
- Sent files to a FTP Server

④ For each of the following systems or Web sites, estimate the number of times per week that you complete them by entering a password. Write your estimate in the line provided.

- Blackboard
- Facebook (or other social
- Ontrack
- Online banking
- Campus Email
- Purchase with debit card (PIN number)
- Login to lab computer
- Check voice mail (with
- Personal Email
- Unlock phone or mobile device (with PIN)

⑤ If there are other Web sites or systems that you use on a regular basis (once per week or more) that require a password but that were not listed above, please provide the sites or systems below.

(please turn survey over to other side of sheet)
Circle all of the types of mobile device products listed below that you currently use on a regular basis (once per week or more).

<table>
<thead>
<tr>
<th>Phone</th>
<th>Music Player</th>
<th>Game System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackberry</td>
<td>iPod Touch</td>
<td>Nintendo DS</td>
</tr>
<tr>
<td>iPhone</td>
<td>Other: ___________</td>
<td>Playstation Portable</td>
</tr>
<tr>
<td>Android</td>
<td>Other: ___________</td>
<td></td>
</tr>
<tr>
<td>Palm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows mobile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other: ___________</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If there are other mobile devices that you use on a regular basis (once per week or more) that were not listed above, please provide the name(s) of the devices below.
Password-entry Survey – First Session

Please respond to the following four questions as accurately as possible.

1. Was there any point where you felt confused or lost while entering your password?

2. If so, can you explain what you were lost about? How were you able to resolve this issue?

3. Are there any improvements that you would make to the password system?

4. Do you think that you will remember your password next week?
Password-entry Survey – Second Session

Please respond to the following four questions as accurately as possible.

① Did you have difficulty recalling your password?

② Did you have difficulty entering your password using the software?

③ Did you think about your password or this study at any point in the last week?

④ Overall, is your opinion of this password system positive or negative? Please explain your answer.

⑤ Please provide any additional comments on your experience with this password system.
Script to Inform Participants of Visual Password Study

Thank you for considering participating in my study of visual passwords for mobile devices. I am interested in discovering whether a password that consists of images rather than keyboard characters is memorable and secure. To address this question, I am asking that participants engage in the following sequence of events.

- I will provide you with an overview and demo of our image password system
- I will provide you with a sample password
- I will ask you to use the computerized training to help you remember the password
- I will ask you to fill out a survey of key demographic information
- I will have you enter your password one more time to confirm that you remember it
- I will ask you to fill out a survey concerning your experiences using the password system
- I will set up a time to meet in approximately 7 days
- At that time, I will ask you to enter your password again
- I will conclude the experiment with a final survey about your experiences using the system
- I will provide you with compensation in the amount of $X. If you are also expecting to receive extra credit for this assignment, you will provide us with the name of your professor.

Prior to beginning the experiment, I would like to ensure that you are aware of your rights as a participant. Please read the following document and use as much time as you need. If you have any questions about any of the items in the document, please do not hesitate to ask me. If you are comfortable continuing your participation after reading the document, please sign it.

(Participant reads document)

Thank you for your participation. Before we begin the formal experiment, I want to stress that you may cease your participation in the experiment at any time and you do not have to give a reason for your decision.
Research Consent Form – Elon University

1) Project Title: Assessing Visual Passwords for Mobile Devices

2) Investigators: Dr. Dugald Hutchings & Jonathan Citty

You are being asked to be a volunteer in a research study.

3) Purpose of Research: This study will measure the effectiveness of a new type of password system. All people able to use a mobile device such as a mobile phone or portable music player and understand the English language are eligible for this study. Approximately 30 people will be involved in this study and each will give approximately 60 minutes for the study.

4) Procedures: There are two phases to this study. In Phase I, we will assign you a password consisting of images and ask you to undergo a training procedure to help you remember your password and enter your password in our system. You will also fill out two surveys in this phase and set up a time to return to the lab for Phase II. In Phase II, we will ask you to remember and enter your password (as assigned in Phase I) and fill out a final survey. For all three phases, we will not record audio or video during your participation, but we will be recording the following two things: (1) the times it takes to complete the various tasks and (2) other notes about the way that you interact with the computer as you complete the tasks.

5) Risks/Discomforts: The risks involved are no greater than those involved in daily activities such as using a mobile device.

6) Benefits: Participants will be compensated as described in the next section. We further hope to improve password systems and thus help all everyday users of passwords to more easily remember their passwords while still protecting the data and programs that are accessible only through password entry.

7) Compensation to You: Participants who continue the study into Phase II will be compensated $X, regardless of whether they remember their password. Student participants may also be eligible for extra credit from an instructor of one of their courses (if so, students should inform the investigators of the name of their instructor at the conclusion of Phase II).

8) Costs to You: There are no costs to you for participating in this study other than your time, energy, and effort.

9) Confidentiality: The following procedures will be followed to keep your personal information confidential in this study: The data that is collected about you will be kept private to the extent allowed by law. To protect your privacy, your records will be kept under a code number rather than by name. Your records will be kept in locked files and only study investigators will be allowed to look at them. Your name and any other fact that might point to you will not appear when results of this study are presented or published. The Elon University IRB has the right to review study records. To make sure that this research is being carried out in the proper way, the Elon University IRB may review study records. The Office of Human Research Protections may also look at study records.

10) In Case of Injury/Harm: If you are injured as a result of being in this study, please contact Dr. Dugald Hutchings by telephone: (336) 278-6291. Please note that neither the Principal Investigator nor Elon University have made provision for payment of costs associated with any injury resulting from participation in this study.

11) Subject Rights: Your participation in this study is voluntary. You do not have to be in this study if you don’t want to be. You have the right to change your mind and leave the study at any time without giving any reason, and without penalty. You may withdraw your participation even after Phase II of the study. Any new information that may make you change your mind about being in this study will be given to you. You will be given a copy of this consent form to keep. You do not waive any of your legal rights by agreeing to this consent form.

12) Questions about the Study or Your Rights as a Research Subject: If you have any questions about the study, you may contact Dr. Dugald Hutchings at telephone (336) 278-6291. If you have any questions about your rights as a research subject, you may contact Dr. Stephen Bailey, Elon University at (336) 278-6346.

If you understand your rights and give your consent to participate in this study, then please fill out the following information.

Print Your Name: ____________________________

Sign Your Name: ____________________________

Date: ____________________________

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