
Multi-Modal Gesture Elicitation Methodology for Children

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Abstract

This course will prepare students to both analyze and conduct gesture and multi-modal elicitation studies. These skill sets are critical as emerging technologies continue to shift how we interact with systems. The course will have several sections: Introduction, Objective, and Motivation (30 minutes), Gestures (30 minutes), Gesture Taxonomies (30 minutes), Elicitation Techniques and Current Practices (60 minutes), Hands-on Elicitation Study (45 minutes) which will be done during a break out session, Discuss use-case scenario IDC/Elicitation related (45 minutes). Writing an Elicitation Paper (30 minutes), Challenges and Solutions Discussion (30 minutes), The Future of Elicitation (30 minutes).

Author Keywords

Elicitations; gestures; multi-modal interaction; user studies

Introduction

Elicitation is a type of participatory study design that can help us map inputs to actions for emerging technologies. More importantly, elicitation studies allow us to better understand user behavior. Studies have found that people will use larger motions for larger objects than they would with small objects when attempting the same action [4]. Other studies have shown that there is a preference for upper-body gestures even a whole-body system is avail-

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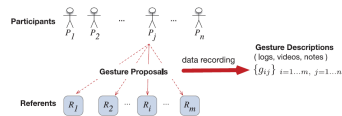
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able [2]. Elicitation studies have most commonly been conducted using Wobbrock et al.'s methods [8], later refined by Vatavu and Wobbrock [7]. The latest method for categorizing gestures was proposed by Vatavu [6]. The evolution of these methods and their importance to interaction design are covered in this course. This will be a synchronous online course conducted over Zoom. The breakout sessions will be held using Mozilla Hubs. Asking and voting on questions will be done over Slido. Course materials, and links to the aforementioned services can be found at <https://cs.colostate.edu/ElicitationCourse>.



Elicitation study example, from [5]

Benefits

Students will learn how to interpret existing elicitation studies, learn from current practices, understand the benefit of different elicitation techniques, and discuss alternative user-centric study designs, such as guessability studies and preference studies. Students will get hands-on practice on how to conduct a study and analyze the results. Finally, we will provide information about children elicitation studies and our experiences gained from work done in collaboration with the early childhood center at Colorado State University.

Intended Audience

This course will be accessible to existing researchers who have not conducted elicitation studies, people who would like to understand the methodology better, practitioners that want to improve their interaction systems, and students interested in human-computer interaction (HCI). While general HCI knowledge is always helpful, this course will be self-contained and welcomes participation from any field. The course can have up to 40 students. The hands-on practice exercises will use active learning techniques with groups of 3-5 members. The instructors will provide all the material needed for the class used for the hands-on elicitation study.

Content and Practical Work

The course will be divided into multiple parts: Introduction, Objective, and Motivation (30 minutes), Gestures (30 minutes), Gesture Taxonomies (30 minutes), Elicitation Techniques and Current Practices (60 minutes), Hands-on Elicitation Study (45 minutes) which will be done during a breakout session, Discuss use-case scenario IDC/Elicitation related (45 minutes). Writing an Elicitation Paper (30 minutes), Challenges and Solutions Discussion (30 minutes), The Future of Elicitation (30 minutes). This adds to a total of 6 hours leaving time for lunch and break. More than half of each of mini-sessions include discussion and/or activities.

Introduction, Objectives, and Motivation

The course motivates why conducting elicitation studies is critical in our field. The course also provides a list of objectives to be accomplished. The course introduction will familiarize students with common-terms and definitions required for the course: User Studies (independent and dependent variables, repeated-measures versus between-subject, etc.) and Wizard-Of-Oz studies.

Gestures

Students are introduced to concepts and theories of gestures, the primary modality used in elicitation studies.

The Kinematic Chain Model: The framework commonly used in HCI is the “kinematic chain model” which is used to understand bi-manual interactions. The kinematic chain model says that a person’s preferred hand inserts content while their non-preferred hand provides framing assistance. This means that the preferred hand will use high temporal frequency movements with low spatial frequency while the non-preferred hand provides the opposite. Bi-manual commands have been found to be more memorable and more enjoyable than uni-manual commands, particularly in the

$$\mathcal{AR}(r) = \frac{\sum_{P_i \subseteq P} \binom{|P_i|}{2}}{\binom{|P|}{2}} \quad (1)$$

case of abstract commands. Bi-manual interactions are better for both experienced and inexperienced users, with greater gains for inexperienced users.

Gesture Taxonomies

The first step towards understanding gestures is to understand the different taxonomies that they can fit into. Quek elaborated on McNeil's work with an emphasis on creating a gesture interaction language for use with computers [3]. The most recent adaptation of a gestural taxonomy comes from Aigner et al [1]. This is the state-of-the-art in gesture categorization. This taxonomy contains pointing, semaphoric, stroke, pantomimic, iconic, and manipulation.

Elicitation Techniques and Current Practices

Gesture elicitation studies became prominent with the work of Wobbrock et al. [8]. This was an elicitation study conducted using a Wizard-of-Oz (WoZ) design. An elicitation study is when a participant is shown prompts for an interaction (referents). These referents are the effect of the action being requested. An example is showing a user an object in position a moving to position b . The participant is asked to produce an interaction, typically a gesture, that would trigger the objects movement action. These are called proposals. Figure shows how data is collected from a elicitation study: participant p_j generates gesture proposals for referents R_1 to R_m . After a proposal is made the experimenter either covertly or overtly triggers the action to be performed. This is phrased as allowing a "monologue [with the system] in which the user's behavior is always acceptable [8]." The action are triggered by the experimenter and not the participant or a recognition system which makes it a WoZ study.

This part of the course also discusses different techniques in elicitation (e.g., production, priming, and grouping), different approaches (guessability and preference studies), and a small subset of studies for children and adults. In par-

ticular, there will be an emphasis on elicitation studies with children and multimodal interaction techniques and studies.

Hands-on Elicitation Study

This part of the course provides a toy example of an elicitation study. In order to achieve full understanding, the student uses videos or referents in groups of 4-6. Students design the study (along with the help of the instructors), run the study among themselves, and annotate the data. This has been a very useful exercise in Ortega's classes.

Agreement Analysis

A separate but crucial analysis found in elicitation studies is a computation of the agreement among proposals. Agreement can be seen as the number of pairs in agreement over the total number of pairs. For a fixed referent r , the "Agreement Rate" $\mathcal{AR}(r)$ is calculated using equation 1, where P is the set of all proposals for referent r , and P_i are the subsets of equivalent proposals from P [7].

Discuss Use-case scenario IDC/Elicitation related

This session of the course will be an open conversation around experiences that participants have had with elicitation and elicitation use cases within this community.

Writing a Elicitation Paper

The course will cover the process of writing an elicitation paper for a research conference. For example, describing the gesture set, the experiment design, and the observational findings, among others.

Challenges, Solutions Discussion and The Future of Elicitation

Elicitation methods have received criticism in two major areas. It was suggested that Vatavu and Wobbrock's method was incomplete due to the interpretation of agreement rates (gestures were considered valid when they should not have been) [5]. Tsandalis proposed new measures such as us-

ing a Fleiss' kappa to address this [5]. Second, there is a concern that given the exposure to existing devices or gestures, elicitation may be biased (legacy bias). This course will conclude with future directions and open questions.

Instructors

Francisco R. Ortega, Ph.D. is an Assistant Professor at Colorado State University and Director of the natural user interaction lab (NUILAB). His main research area focuses on improving user interaction by (a) designing gesture and multi-modal elicitation, and (b) developing interactive gesture-recognition systems.

Adam Williams is the most senior Ph.D. student at the NUILAB in the department of Computer Science (CS) at Colorado State University (CSU). His research concentration is multimodal inputs for augmented reality environments and human factors input design.

Jason Garcia is a master student at the NUILAB in the department of CS at CSU. He is actively seeking new methods for elicitation studies.

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