

Theoretical and Architectural Support for Mobile Group Learning¹

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The PIs explored three fundamental research questions in this project: 1) Why certain emerging mobile applications, such as twitter, foursquare, Farmville, and Instagram, are so “wildly successful” in terms of engaging, motivating, and entertaining users? 2) Can we make it easier for researchers in psychology, education, and learning science to design, deploy, and manage experiments on mobile devices? 3) Can we leverage findings and inventions in 1 & 2 to create effective Intelligent Tutoring Systems (ITS) on mobile devices? We summarize major research activities and findings among these three thrusts.

Design patterns in emerging mobile social applications. PI Wang and Levine, together with graduate student Lanfei Shi, explored the usage of design patterns (Alexander 1977) to capture, understand, and share key insights and emerging knowledge that appear in recent mobile social sharing (MSS) apps. We analyzed 11 MSS apps via card sorting, and identified 23 design patterns on user motivation in 7 categories. We ran a **64-subject** between subject experiment to quantify the effectiveness of the MSS patterns and understand how novice designer and experts use design patterns in a collaborative design process. We have completed a preliminary analysis of the data in metrics such as design quality, idea novelty, idea effectiveness, impact of MSS patterns, and idea serendipity. A technical report [4] on preliminary findings has been filed. Long-term collaborations and additional resources are needed to complete fine-grained coding and analysis of the large amount of video and logs collected.

Infrastructural support for mobile social learning. PI Wang and Schneider, together with graduate student Wencan Luo, undergraduate student Andrew Head, designed **e-Chimera** [3], *a visual end-user programming environment for designing, prototyping and deploying experiments on mobile devices*. The e-Chimera IDE provides a statechart-based, multi-level visual language to create experiments at the workflow, trial, and screen interaction level. The e-Chimera runtime, driven by a Domain-Specific Language (DSL), enables high fidelity, cross-platform application deployment. Through a **12-subject user study**, we found e-Chimera effective and easy to use. This thrust led to the creation of “*an E-Prime system for mobile devices*” and a journal paper in submission [3].

Mobile social learning systems. Based on insights and software system from thrust 1 & 2, PI Wang and undergraduate student Andrew Head, created **ToneWars** [2], a collaborative mobile serious game for learning Chinese as a Second Language (CSL). ToneWars provides a learning experience that combines mastery learning, microlearning, and *group-based interaction between CSL learners and native speakers*. ToneWars explores how unique input modalities, like touch gestures and speech recognition, can improve language acquisition tasks on mobile devices. Through a **24-participant** (12 CSL and native speaker pairs) user study, we found ToneWars provides learning benefits for second-language learners and engages native speakers. We also created **Adaptive MicroTutor** [1], a mobile learning app that enables adaptive microlearning in users’ fragmented times. This thrust led to one full paper publication in ITS 2014 [2] and one short paper publication in ACM CHI 2014 [1].

In summary, this project has led to two paper publications, three major software systems, one journal paper in submission, one technical report, and a rich set of experimental data from **100 subjects in three studies** to date. *We plan to continue research initiated from this project through long-term collaborations*. Funding from this project also trained two graduate students (Lanfei Shi, Wencan Luo) and one undergraduate student (Andrew Head). Andrew has been accepted by top Ph.D. programs in CS (Berkeley, UW, Gatech, UMD, UCSD etc) in part due to his research achievements in this project. PI Wang submitted two external grant proposals to Samsung [5] and Google [6], based on preliminary outcomes in 2013, but neither was supported. We plan to submit more, bigger

¹ This project received a 50% budget cut in 2012, so the scope and depth of proposed research have been significantly reduced.

funding proposals to NSF and other venues in the near future when major publications from this project begin to show up.

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