An Integrated Framework for Composable, Physical Computing Systems Supporting Pervasive and Social Interactions (PI: Dr. Ngai Grace; 2011/12)

Physical computing creates digital computing systems that are equipped with sensing and actuating functionality to respond and interact with the analog physical world. It helps us to make more interesting connections between the physical and computer worlds. In particular, it supports human creativity by using computers to "capture and support a person's expression", and, most provocatively, to change it. In this project, we propose the design and development of an integrated framework for customizable physical computing systems that are designed for social interactions. We envision user-composable systems digitally enhanced with computational, communication, sensing and actuating capabilities and functionalities that people can use to interact with other systems and people who may not be in the same physical space. Of especial interest to us are systems that are pervasive, integrated into the environment via everyday objects and activities and wearable, that interact with the full body of the user. The system supports and encourages social interaction and collaboration. An example of such a system could be a set of coupled virtual rooms in which people may interact with objects around them to create art or music. Another example could be a wearable system that collects emotions signalled by the wearer, and conveys them in various formats to a friend in another location. There has been much work in the area of physical computing, but much of it from the infrastructural/technological aspect, some of it from the interaction standpoint. However, very little attention has been focused on social interaction, which is known to involve issues different from that of generic human-computer interaction. The majority of these systems are also specialized-purpose, and there has been very little

focus on systems that can be composed or constructed by non-experts. Our objective is to bring together concepts from human-computer interaction (specifically: tangible interaction), social computing and pervasive computing into the design of this framework. Specifically, we wish to design a coherent, consistent platform that will relate the functional, computational and social concepts in a manner that is understandable and learnable by novices and lay people. We believe that our framework has application potential in a number of areas, including creative design, digital toys and education. In this project, we will study two diverse application areas for our platform: computational education for children, and tangible social interaction for the elderly. We will prove our platform via theoretical and empirical evaluation.