IGERT: Dynamics of Communication in Context

A. Project Summary

Research themes and intellectual merit: Our ambition for this IGERT training grant is to create a community of scholar-scientists with the conceptual reach and technical expertise to integrate the computational, cognitive and neuroscientific study of communication, be it characterized as human-linguistic, animal or machine. Recent research progress has focused increased attention on two themes, on which we will base our broad interdisciplinary approach to graduate and postgraduate training. The first theme emphasizes communication as inherently a dynamical process, one that unfolds along multiple time scales that vary from milliseconds (as in planning and understanding messages) to centuries (as in the historical development of languages and cultures). The second theme emphasizes communication as a process in context, where contexts range from the physical setting and communicative history of a specific conversation, to the linguistic, social and technological assumptions of social groups. The communicating entities may be of many types, from groups of baboons to expert medical teams interacting with and through networked computing devices.

Fragmentary state of current research: It is difficult to think of a research area that is currently less integrated than the scientific study of communication. Research of this sort takes place at Penn and elsewhere in disciplines that include Anthropology, Biology, Computer Science and Engineering, Economics, Linguistics, Neuroscience, Philosophy, Psychology and Sociology, but lamentably not one of these disciplines is a particularly good fit to the overarching topic of communication. Rather, each discipline tends to ask different basic questions and to employ different tools and formalisms. As a result, researchers at all levels struggle as outsiders to understand or redevelop concepts, methods, and techniques whose natural home is in other disciplines. Not only does this render research needlessly repetitive and difficult, it often leads to initial periods of failure or an inability to see broader implications of a research program. Worst of all, some interesting strands of research are neglected because they are cross-disciplinary in their conceptual foundations, not just in their methods.

Broader impact: For reasons just sketched, some researchers studying communication have, in our opinion, hardly recognized that they share a larger intellectual goal, one whose coherence and scope can be materially enhanced by cross-disciplinary fertilization. It is difficult to negotiate such change and integration within mature scientific communities whose working patterns and research agendas are relatively settled and inflexible. We believe, therefore, that the most efficient and realistic route to cross-fertilization and growth of this field lies in the creation of a community of young scientists who comfortably cross both methodological and topical boundaries. Though the virtues of interdisciplinary training and cooperation are in some cases too casually touted, we believe that the need for professional-level interdisciplinary training is immanent and critical to advances in the communication sciences. This is because of the emergence of several transformative technologies whose applicability is limited to the extent that they are essentially proprietary to disciplinary groups with specialized access and expertise. The first of these is the emerging technologies of brain imaging and recording (such as fMRI, ERP and multi-unit recording). A second is the continuing explosion of computational tools for human-machine interaction (such as head-mounted eyetracking, virtual reality interfaces, artificial agents, and annotated electronic corpora). A third is a set of new mathematical and computational tools for modeling the emergence of shared cognitive structures by intercommunicating entities. The communication scientist we train will impact the field through expertise in, and access to, these technical resources, which they obtain during, rather than after, the formative years of professional research training.

Key education and training features: Enrollees in our IGERT training program will commit in advance of acceptance to a five-year graduate training program, organized under the Penn Communication Consortium, and comprising the following components: (1) Core disciplinary training in the standing program of either Anthropology, Biology, Linguistics, Computer Science, Psychology or Neuroscience which in all ways meets each program’s rigorous standards; (2) One-year cross-disciplinary training (usually during the 3rd graduate year) in a chosen second discipline, including completion of a publishable research project; (3) participation in a weekly interdisciplinary research meeting throughout the 5-year program; (4) completion before the end of the 3rd graduate year of an advanced Mathematical Foundations course specific to the IGERT program; (5) co-advising throughout the 5 graduate years by a 3-member faculty team drawn from at least two of the participating disciplines chosen to reflect the student’s interdisciplinary research trajectory; and (6) completion of the Ph.D. dissertation.