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Reflections on the Implications of LENA for Behavioral Science

Keynote Presentation by Steven F. Warren*

I wish to provide a broad context for considering the research and development effort that is the focus of this symposium.

Measuring human behavior in real world contexts has historically been a labor-intensive, tedious, and expensive task that has at best been assisted by various simple technological aids like tape recorders and stop watches. In many ways our standard measurement techniques are analogous to the equally labor-intensive, tedious, and expensive lab techniques involved in “gene hunting” *prior* to technological breakthroughs such as the gene-chip and DNA sequencing methods that led to the human genome project and related revolutions in the biological sciences and medicine. Measurement instruments shape, enable, and constrain the advances of all sciences. Breakthroughs in measurement lead to breakthroughs in knowledge (Abelson, 1986). While the science of human development and disorder has made rapid progress due to technological breakthroughs in molecular genetics and neuroscience, the behavioral sciences have lagged behind because we are stuck with measurement tools that have improved only marginally in 50 years.

I believe this is about to change. We are here today to learn about the results of an extraordinary scientific and technological achievement – one that a short time ago I

believe most people with knowledge of the complexity of this challenge doubted could be achieved during our lifetimes.

Infoture has embarked on a quest to perfect the world's first automatic speech monitoring and analysis system. They have named this measurement break-through LENA. It is a 2-ounce digital recorder that slips into a pocket on a young child's clothing. If LENA achieves its potential, I believe it will represent a transformative technological breakthrough in real world measurement of complex human behavior that is presently without parallel. It may even prove to be, in a sense, equivalent technologically and conceptually to such revolutionary break-through as the gene-chip.

The conceptual inspiration for LENA is Betty Hart and Todd Risley's (1995) seminal research on the early language environment of typical children and its effects. It took Betty Hart and many research assistants at KU's Juniper Gardens Children's Project thousands of hours over many years to code and analyze just a fraction of the data that LENA can process in just a few minutes. This same transformative technology can be used to monitor the richness of language input in the home, in a childcare setting, or even eventually in adult day care settings and beyond. Wonder what kind of "enriched" environment your child experiences when you aren't around? LENA can tell you. Wonder how often staff members are actually interacting with residents? LENA can tell you. Do you want to know if the clinical treatment under way has been implemented as intensively as called for and whether it's generating changes in the target child's language? LENA can tell you. Do you want to know how the richness of environments interacts with various genetic propensities over many years? Perhaps LENA will hold the key to this as well.

Hopefully LENA will be just the first in a line of high tech real world human behavior measurement systems that will fundamentally change the nature of research, care-giving, clinical practices and education. The implications of this new technology for research and practice and beyond are potentially profound. Among these implications is how we may eventually come to understand environment-behavior interaction and ultimately environment-behavior-brain-gene interactions.

Radically improved measurement of behavior will allow a much more precise calculation of the behavioral side of the biology-behavior equation. No longer will it be necessary to just assign the error variance in behavior genetic studies to some ill-defined notion of “the environment”. Now, the tools will exist to understand gene-brain-environment-behavior interactions dynamically, developmentally, and cumulatively.

In conclusion the main point to remember is that the history of science shows that breakthroughs in measurement lead to breakthroughs in knowledge and create the basis for future innovations in research and practice. With this in mind, I invite you to consider what Infoture has accomplished.

References

Abelson, P.H. (1986). Instrumentation and computers. American Scientist, 74, 182-192.

Hart, B., & Risley, T.R. (1995). Meaningful differences in the everyday experience of young American children. Baltimore: Brookes Publishing.

* This keynote address was given at “Symposium on Child Language Development: The Language Environment of American Children Age 2-36 Months”, hosted by the University of Colorado Department of Speech, Language, and Hearing Sciences on October 22, 2007. Dr. Warren is a Professor of Applied Behavior Science and the Director of the Schiefbusch Institute for Life Span Studies at the University of Kansas. He serves as a member of the Infoture Scientific Advisory Board.