

Arthur S. Iberall Distinguished Lecture on Life and the Sciences of Complexity

December 2, 2005 ☿ University of Connecticut ☿ 4:00 p.m.

Alvin M. Liberman Room, Bousfield Psychology Building

Understanding the Mind

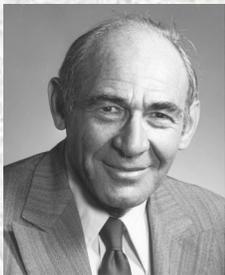
J. A. Scott Kelso

Abstract

In a classic paper written with Warren McCulloch, Arthur Iberall characterized the living system in terms of its “marginal instability” as a result of which the motor system is “plunged into intermittent search modes.” The function of the nervous system in Iberall’s view—with all its memory, communication, computational and learning capabilities—is to modulate the system into behavioral modes, “orbital constellations of all its oscillators”. How, nearly 40 years on, might we build upon Iberall’s vision?

The central thesis to be explored in this lecture is that mind, brain and body and their relationship to the world share a common underlying dynamics—equations of motion for key coordination or pattern variables. What kind of dynamics captures patterns of mind, brain and behavior? Experiments and theory from the brain, behavioral and social sciences—some of which I’ll present-- point to metastable dynamics (meta = beyond) as essential. Metastability is characterized by partially coordinated *tendencies* (not states) in which individual coordinating elements are neither completely independent of each other (“locally segregated”) nor fully linked in a fixed mutual relationship (“globally integrated”). In experimental brain recordings, for example, metastability is revealed by brief epochs of phase-locking synchrony interspersed in time with phase wandering. Theoretical modeling demonstrates that metastability arises as a result of changes in the dynamic balance between the coupling among neural ensembles (mediated, typically by reciprocal pathways in the brain) and the expression of each individual neural ensemble's intrinsic properties (typically heterogeneous in nature).

Broadly speaking, metastable coordination dynamics may be envisioned as a scientific counterpart to William James (1890) beautiful metaphor of the stream of consciousness as the flight of a bird whose life journey consists of ‘perchings’ (phase gathering, integrative tendencies) and ‘flights’ (phase scattering, segregative tendencies). Both tendencies may be crucial: the former to summon and create thoughts; the latter to release individual brain areas to participate in other acts of cognition, emotion and action. More generally still, coexisting tendencies for functional integration and segregation on many levels may attest to the brain~mind’s inherently complementary nature (Kelso & Engström, The MIT Press, 2006).



ARTHUR S. IBERALL DISTINGUISHED LECTURE SERIES

Dedicated to the exploration of connections between physical processes and their manifestations in nature, life, humankind, mind, and society. The series honors the physicist, Arthur S. Iberall (1918-2002), whose intellectual legacy includes homeokinetics, a method of applying the laws of thermodynamics to all self-organizing systems. His applied research contributed significantly to the development of the first space suit, the high-speed dental drill, stove surface burners, the fancy-stitch sewing machine, and the electric knife.

J. A. Scott Kelso, Professor of Complex Systems and Brain Sciences, holds the Glenwood and Martha Creech Chair in Science at Florida Atlantic University. His research is centered on the problem of coordination in living things. The work uses principles and mechanisms of coordination dynamics in connecting levels of brain and behavior through theory and experiment (e.g., in sensorimotor integration, learning, perception, language, and development). He is the Founder and Director of the Center for Complex Systems and Brain Sciences.

