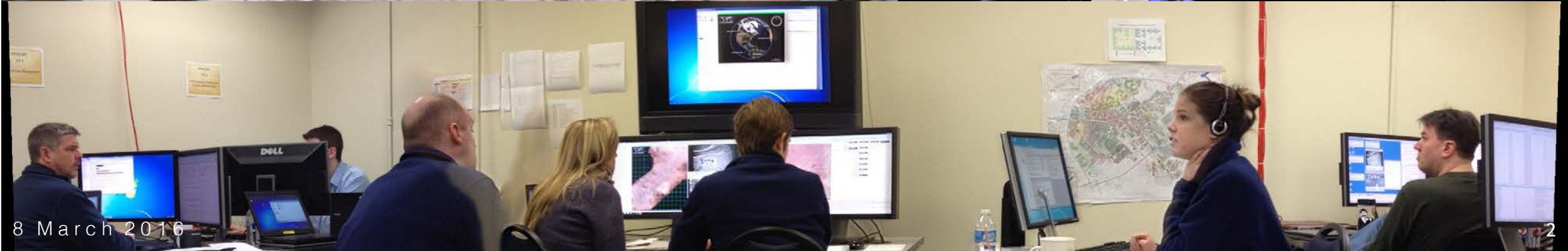


Interface Design Patterns in Cognitive Work and Coordinated Activity for Effective Human-System Integration

2016 NDIA Human Systems Conference
February 9-10, 2016

Dr. Martin Voshell
Charles River Analytics, Inc.

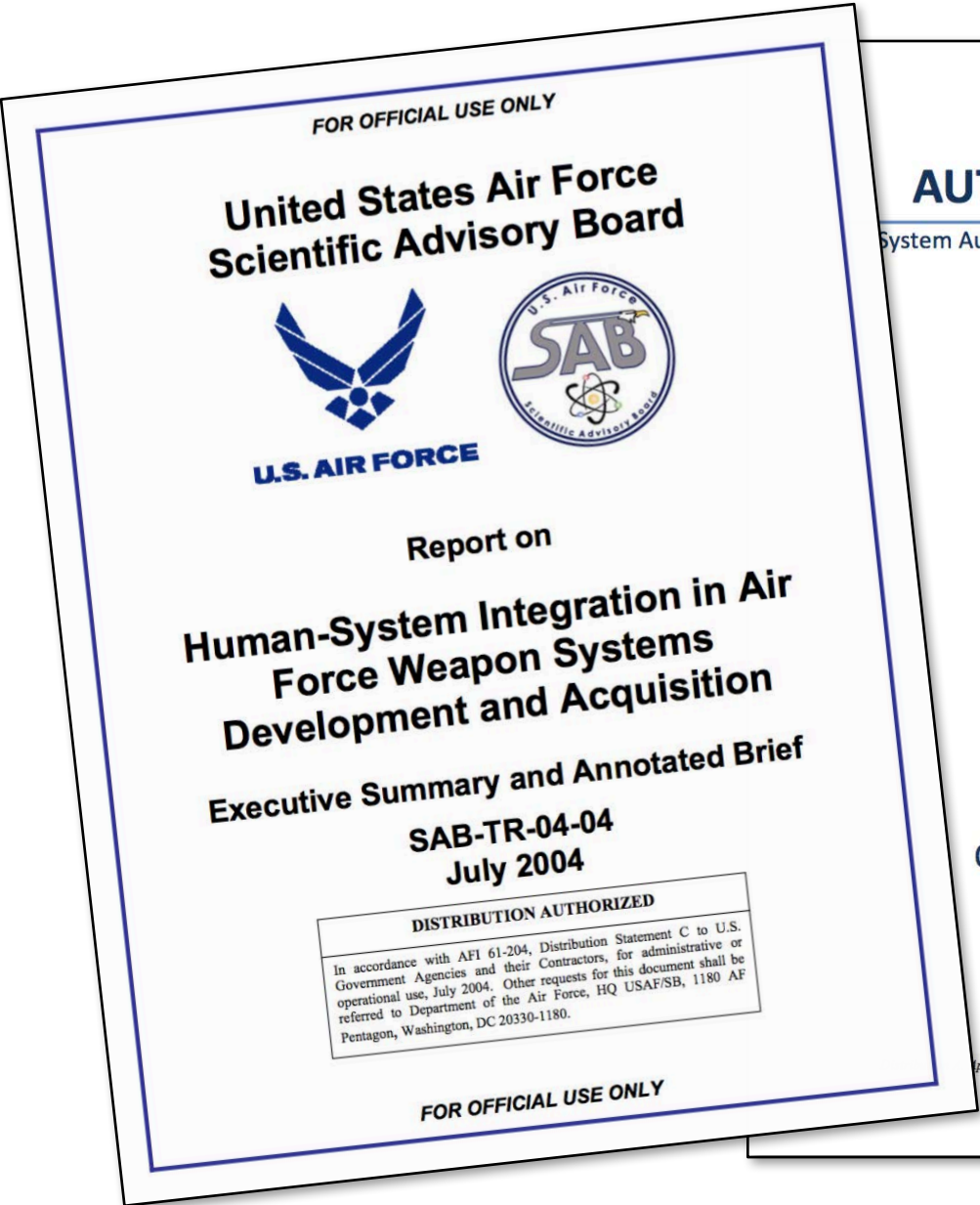
Human Systems are Complex Systems



interface *n* An arbitrary line of demarcation set up in order to apportion the blame for malfunctions.
Kelly-Bootle, 1995

agent n a computer program whose user interface is so obscure that the user must think of it as a quirky, but powerful, person

Lanir, 1995



AUTONOMOUS HORIZONTAL

System Autonomy in the Air Force – A Path to

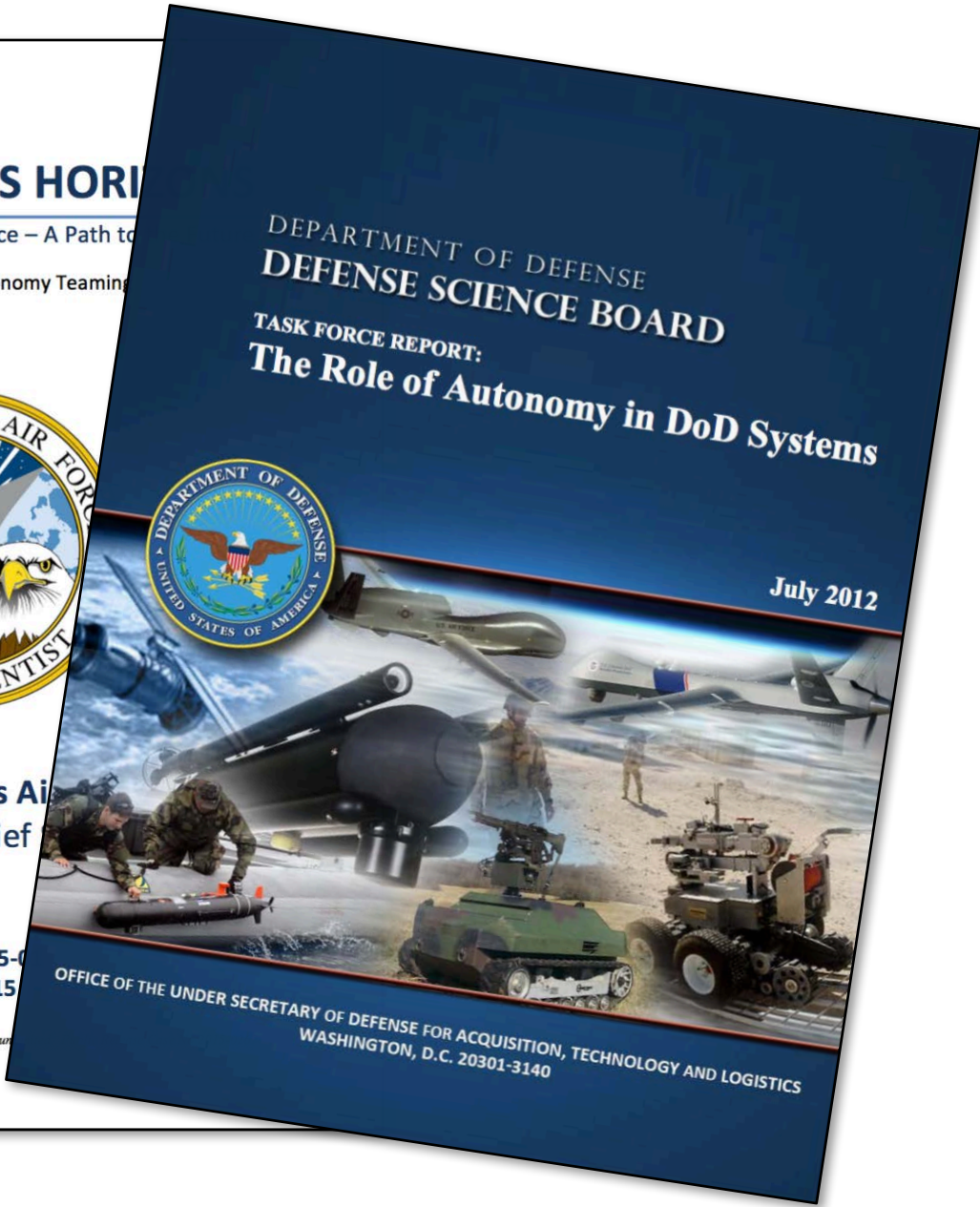
Volume I: Human-Autonomy Teaming



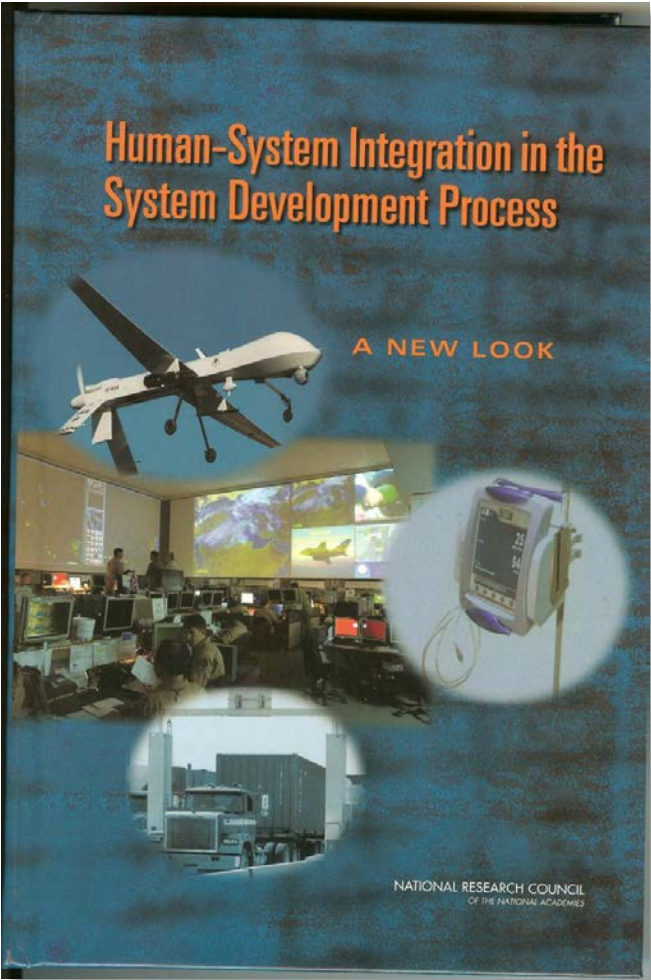
United States Air Force
Office of the Chief Scientist

**AF/ST TR 15-01
June 2015**

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HSI | Work Centered Design



Pew & Mavor (2007)

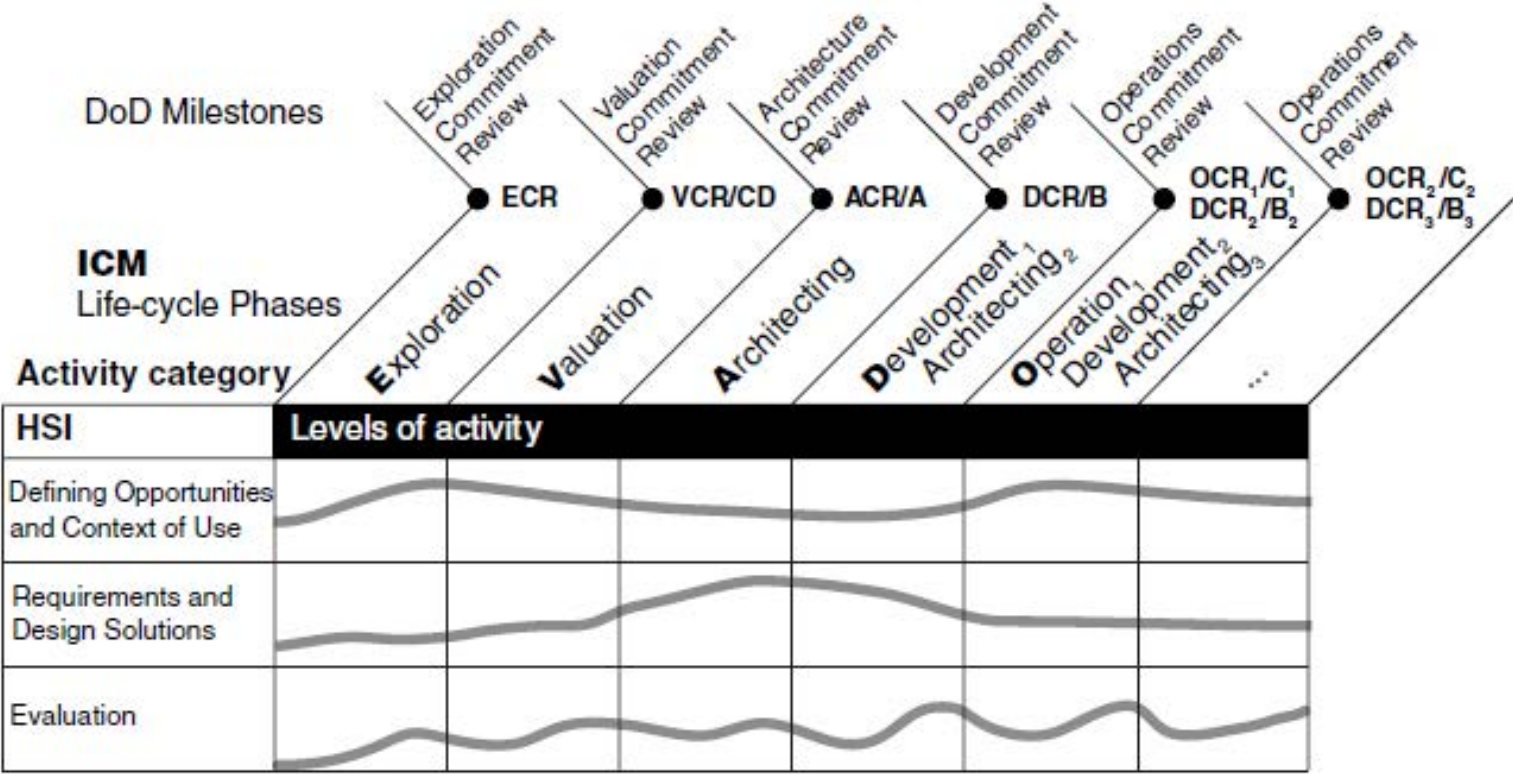
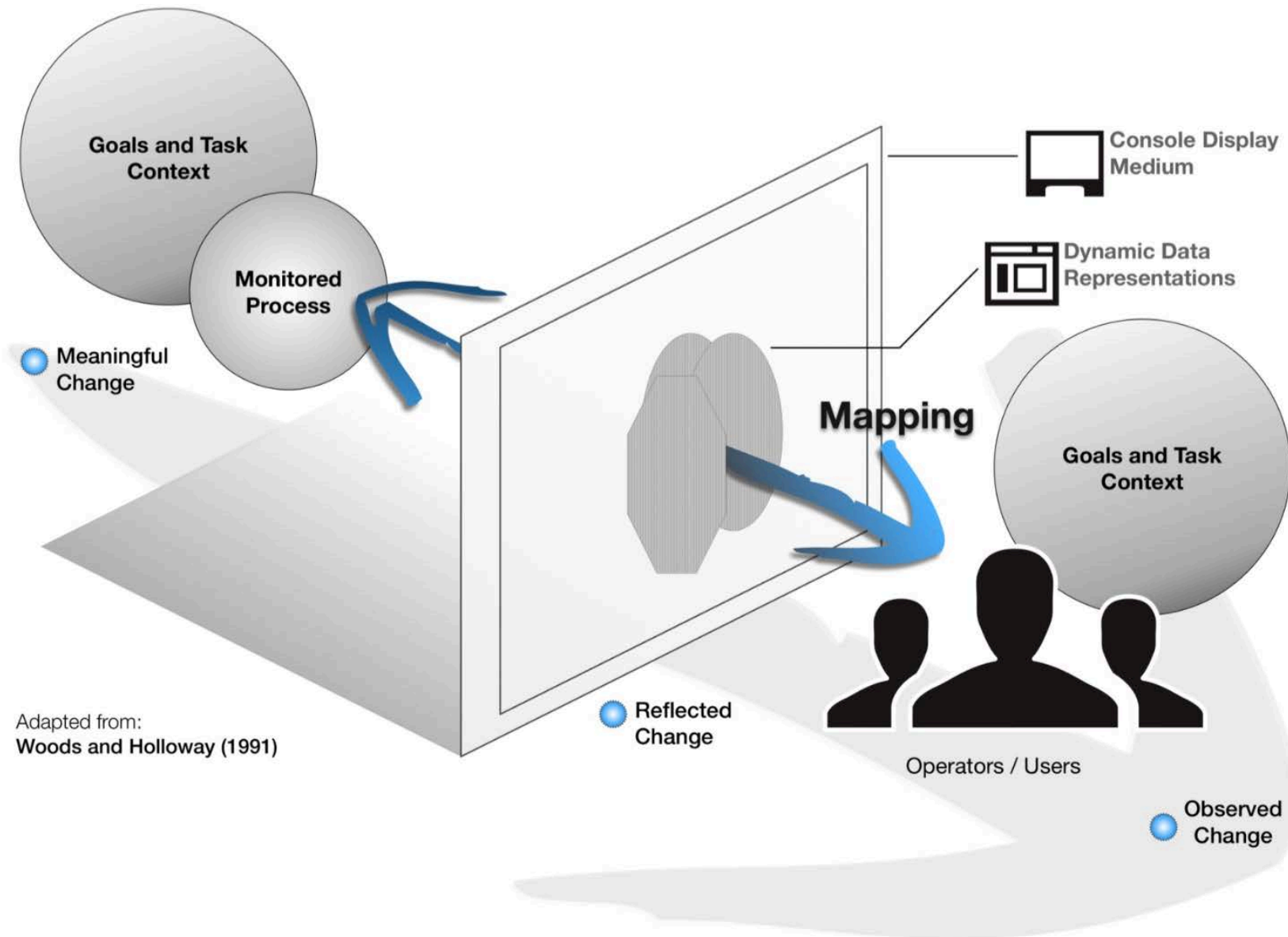


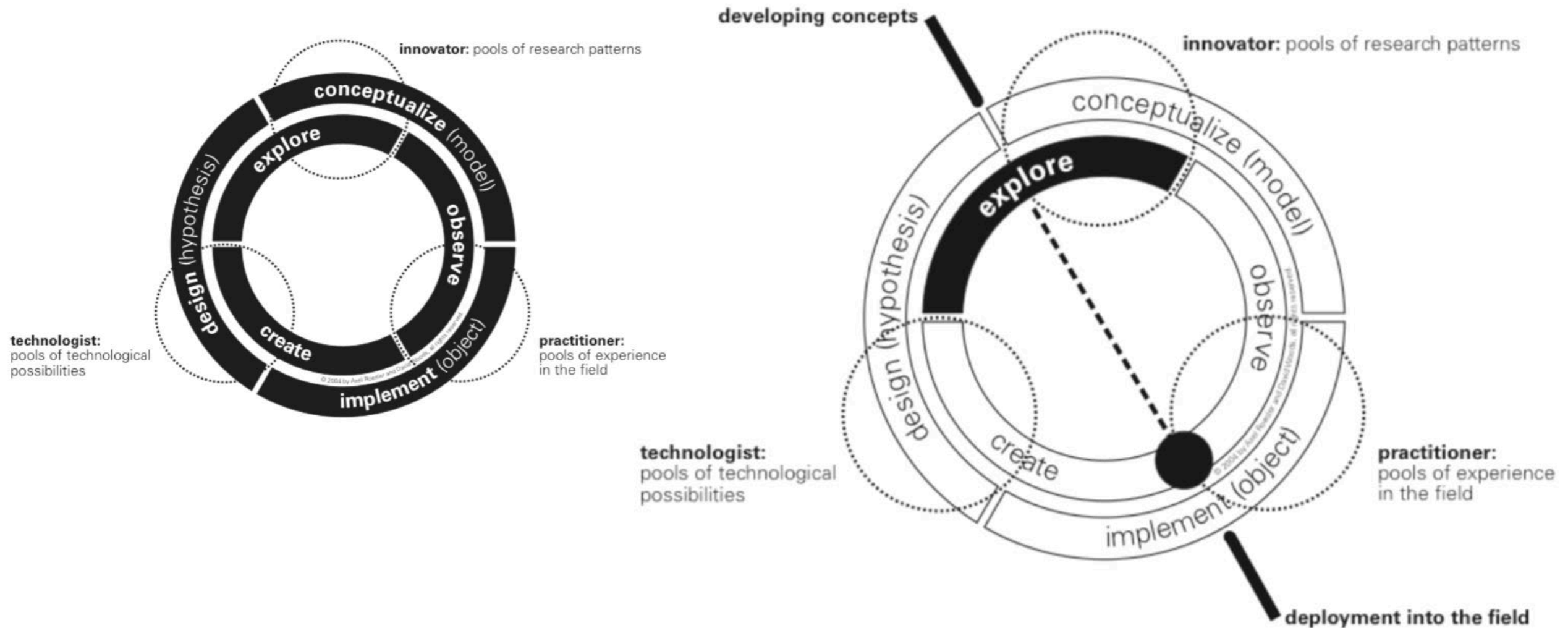
FIGURE 3-1 Activity level of HSI methods across system life-cycle phases.

Mapping Principle | Correspondence in Representation



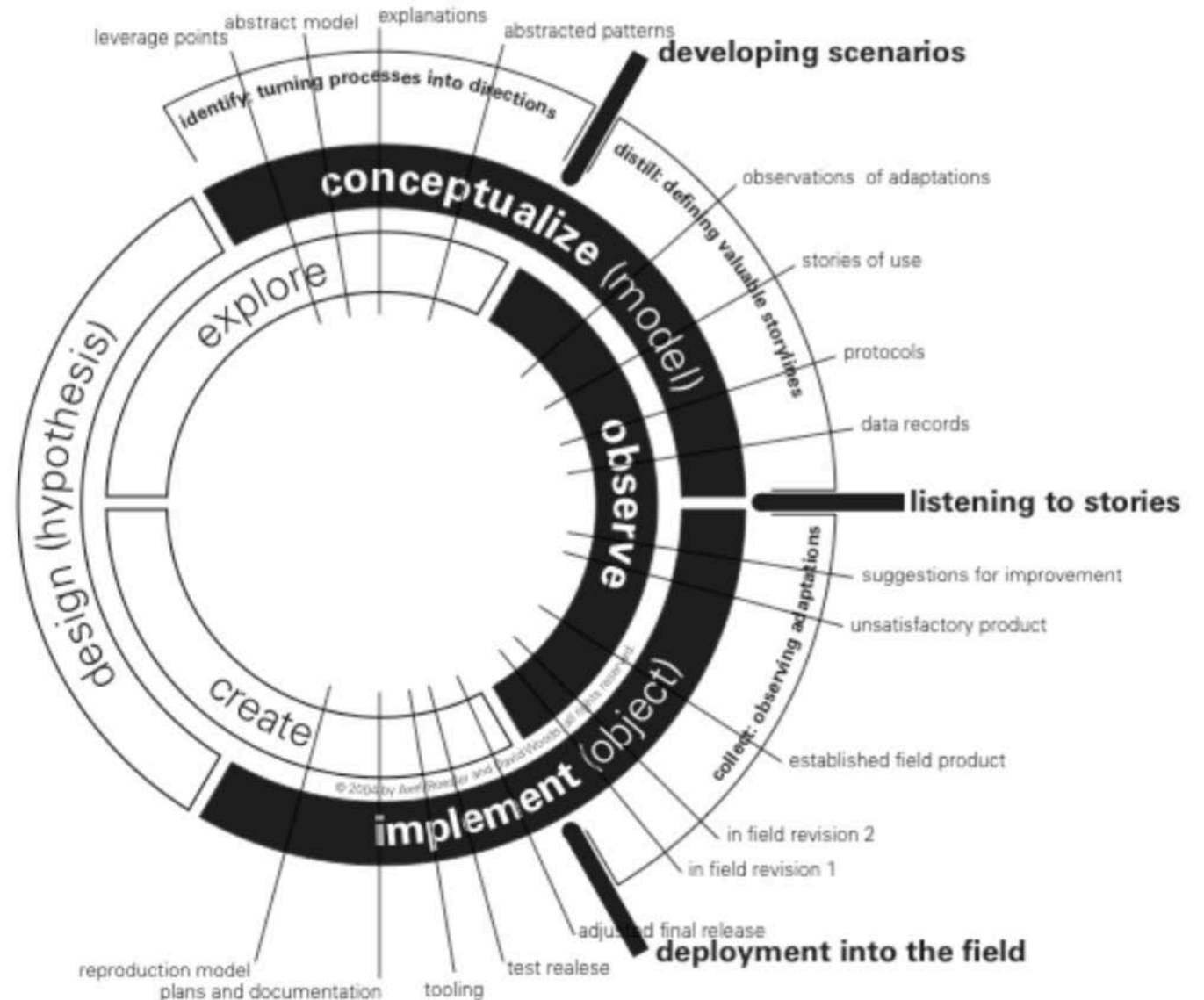
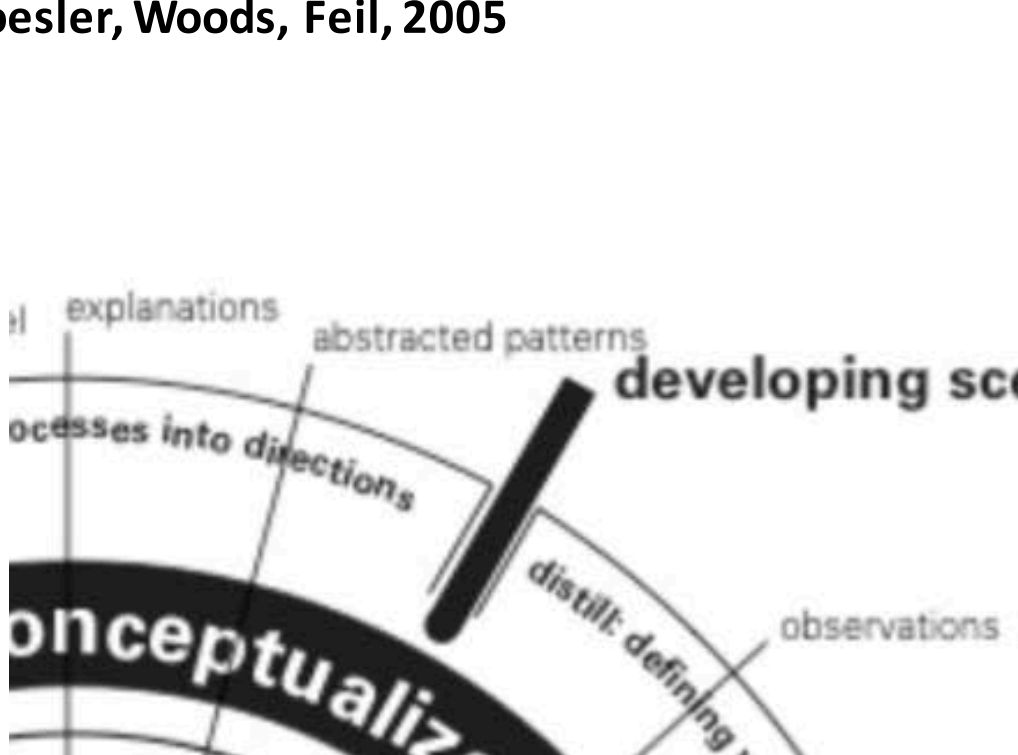
de:cycle | Designing for Technology Driven Applications

Roesler, Woods, Feil, 2005



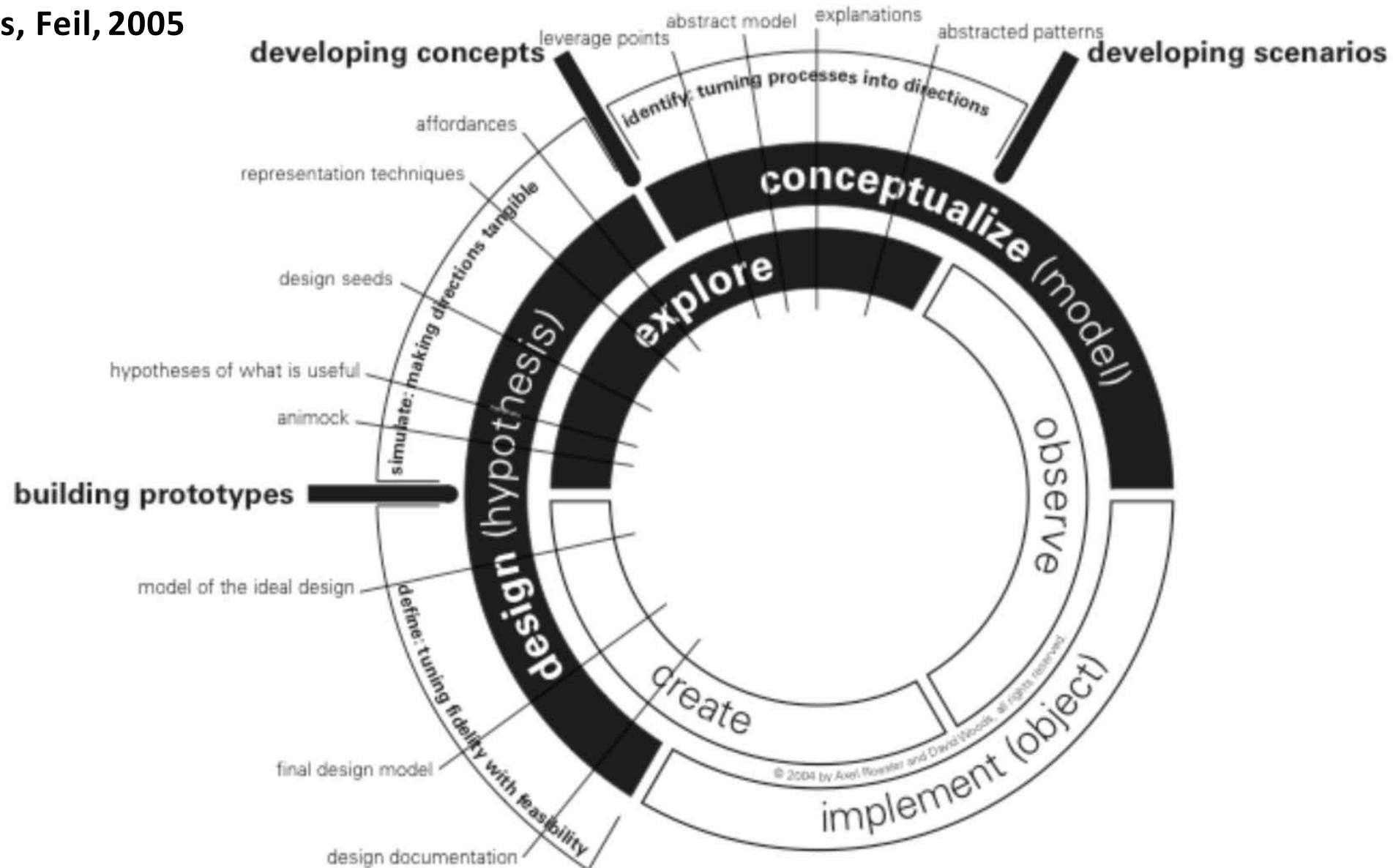
de:cycle | Observation Balances Past and Future

Roesler, Woods, Feil, 2005

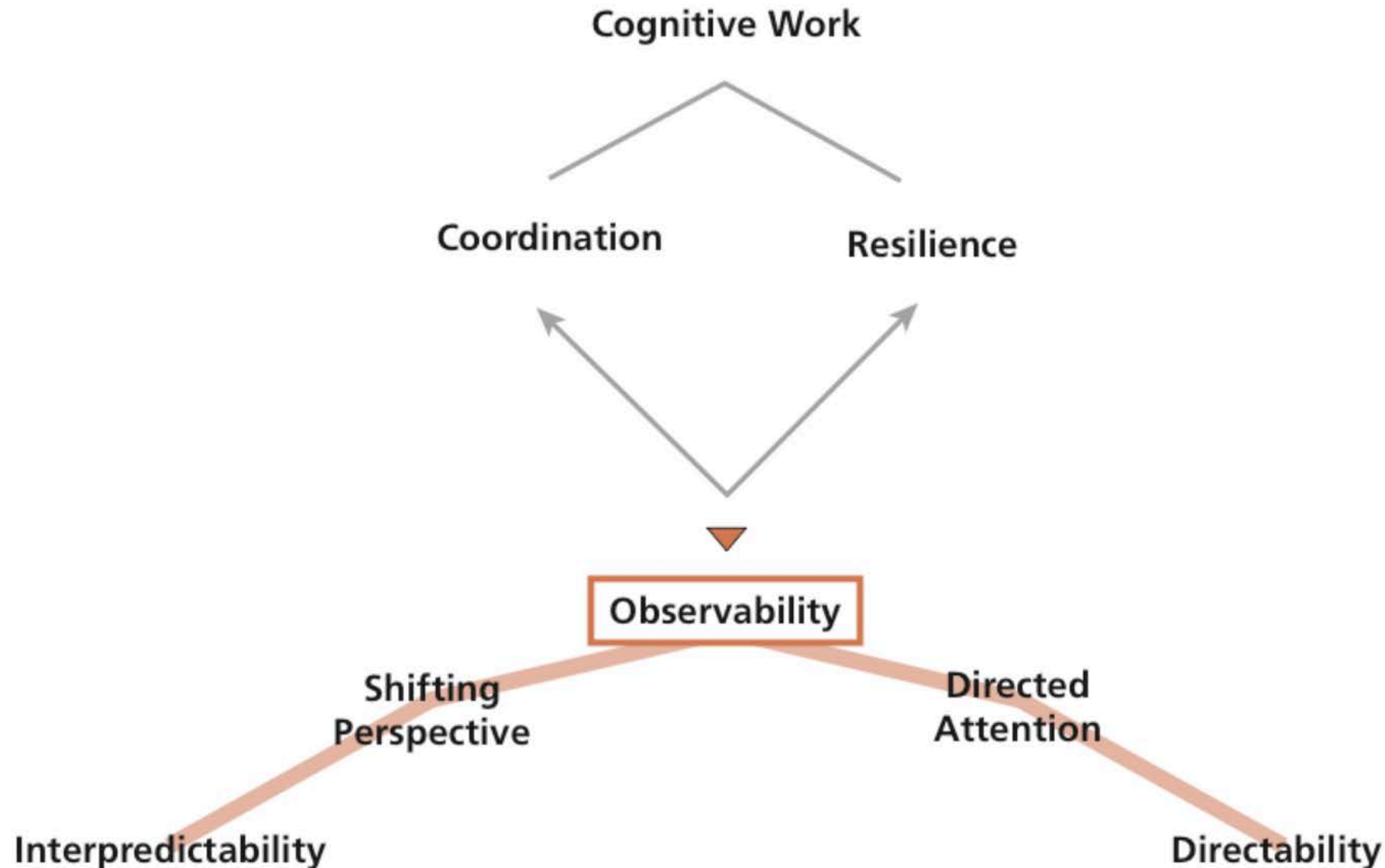


de:cycle | Exploration Drives Design Hypotheses

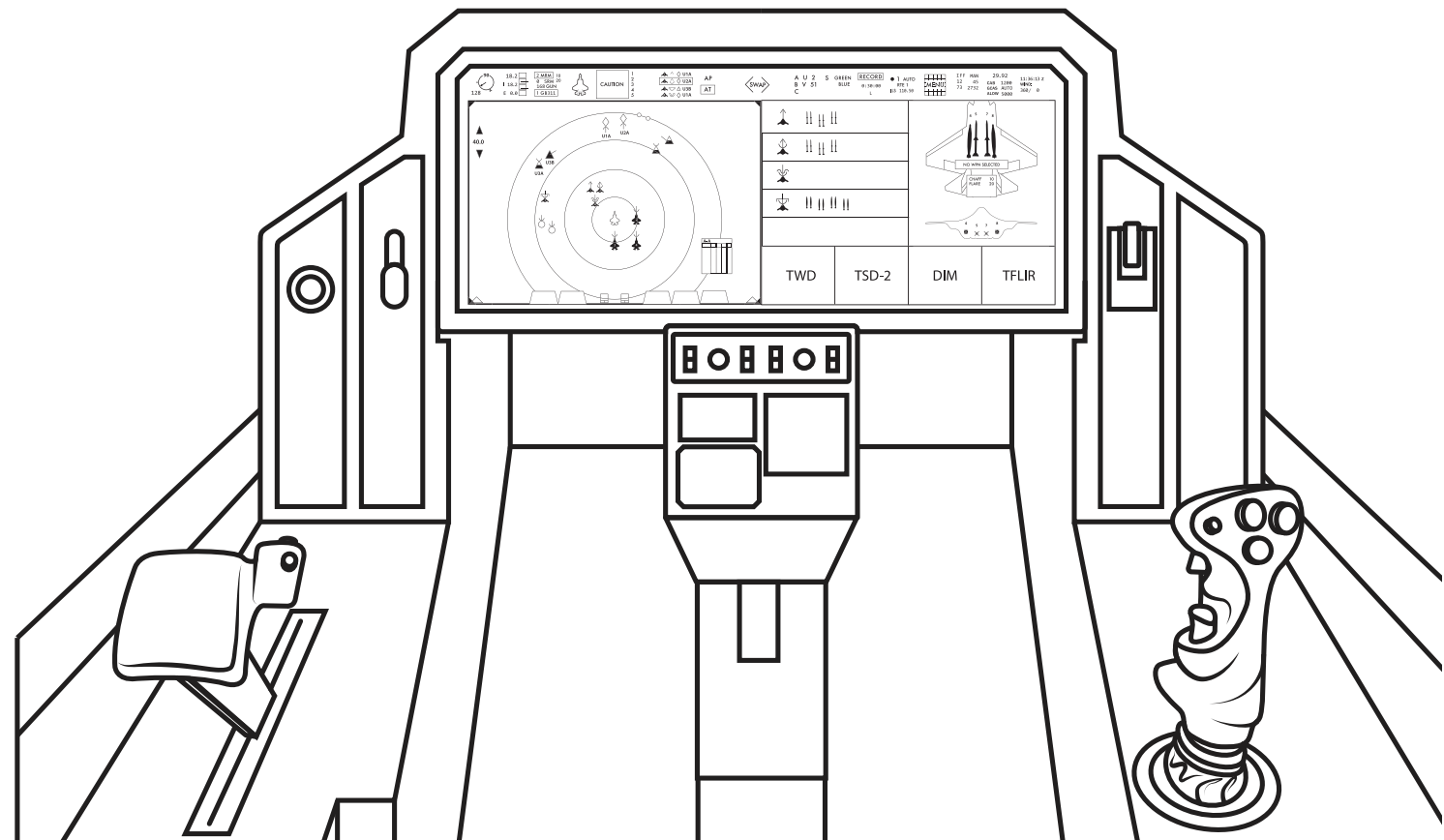
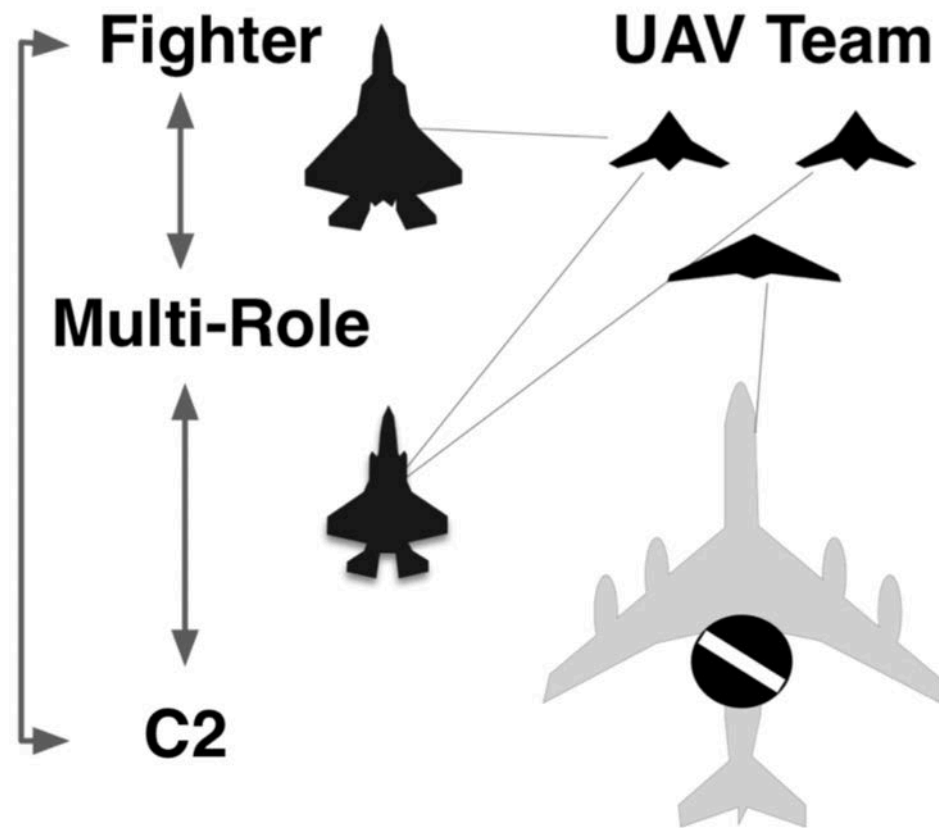
Roesler, Woods, Feil, 2005



Redefining the - 'ilities' Provide Design Leverage



Example | Envisioned Operations



New Stories Create New Patterns for Design

Woods and Branlat, 2011

“Faulty spatial perception, diverted attention, inability to acquire data in the time available, deficient decision-making, perhaps, but not a deficient abstraction!” (Billings 1996)

Decompensation Patterns

System exhausts capacity to adapt; breakdowns occur and cascade faster than responses can be decided on and deployed to effect

- Aviation automation, transfer of control; capacity, and resource bottlenecks

Working at Cross-Purposes

- Role behaviors are locally adaptive but globally mal-adaptive
- Coordination de-synchronization, different echelons as goals interact and could conflict
- Side effects, failures to synchronize, authority/autonomy double-binds

World changes, System does not

- Failure to revise current assessments, automation brittleness

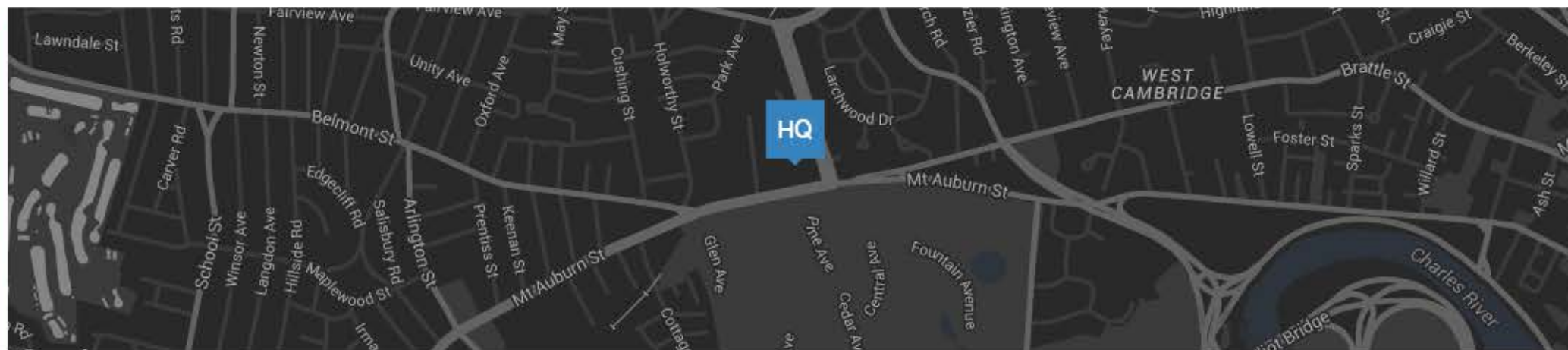
Take Away

Good interface design is about designing good decision support systems

Interface *conceptualization, design, implementation* must be grounded in stories about the future (CONOPs, patterns, models, leverage points)

The most effective interface design efforts will be developed by teams that combine:

- an understanding of the systems challenges of real work in operational domains
- the cognitive and perceptual capabilities of human problem holders and operators
- knowledge of fundamental design principles and patterns of work
- technical skill set to create visualizations that solve specific problems



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