Wisdom is not the product of schooling but the lifelong attempt to acquire it.
- Albert Einstein

Beyond Binary Choices: Understanding and Exploiting Trade-Offs to Enhance Creativity

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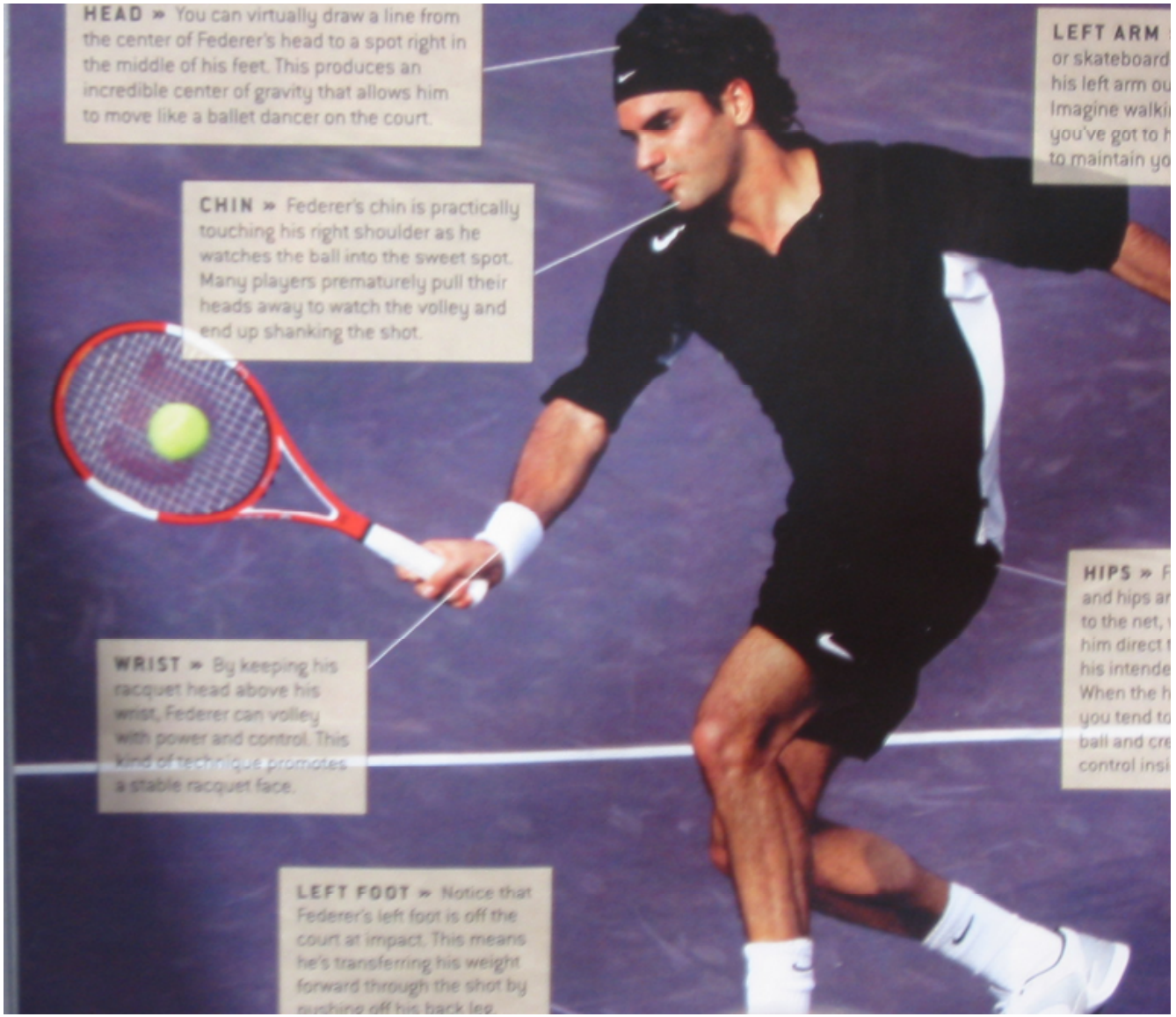
Basic Message

- creativity is a **multi-faceted, complex phenomenon**
- the different dimension can be characterized as **trade-offs** and the end-points represent **binary choices**
- **claim**: exploring the middle ground between endpoints will help
  - to gain a deeper understanding of what stifles and hinders versus stimulates and enhances creativity
  - to identify **"sweet spots"** as a combination of factors allowing for a particular suitable solution in a specific context and synergizing the best of the different approaches

Sweet Spots


HEAD » You can virtually draw a line from the center of Federer's head to a spot right in the middle of his feet. This produces an incredible center of gravity that allows him to move like a ballet dancer on the court.
CHIN » Federer's chin is practically touching his right shoulder as he watches the ball into the sweet spot. Many players prematurely pull their heads away to watch the volley and end up shanking the shot.
WRIST » By keeping his racquet head above his wrist, Federer can volley with power and control. This kind of technique promotes a stable racquet face.
LEFT FOOT » Notice that Federer's left foot is off the court at impact. This means he's transferring his weight forward through the shot by
LEFT ARM
HIPS »

Creativity — a Complex Phenomenon

- Csikszentmihalyi discusses personality characteristics of creative people who *"definitely know both extremes and experience both with equal intensity and without inner conflict."* — in "*Creativity — Flow and the Psychology of Discovery and Invention* ", 1996

- **examples:**
  - being smart ←→ naïve
  - playfulness ←→ discipline
  - responsibility ←→ irresponsibility
  - imagination ←→ rooted sense of reality
  - rebellious/independent ←→ internalized a domain of culture

Integrating Binary Choices and Finding Partial Resolutions

Choice-1	CHOICE-2	Choice-3 (Partial Resolution)
individual	social	integration of individual *and* social
creativity in the head	distributed intelligence	spatial, temporal, conceptual, and technological
rigor	relevance	fundamentally new assessment methods

Individual versus Social Creativity

"The strength of the wolf is in the pack,
and the strength of the pack is in the wolf."— Rudyard Kipling

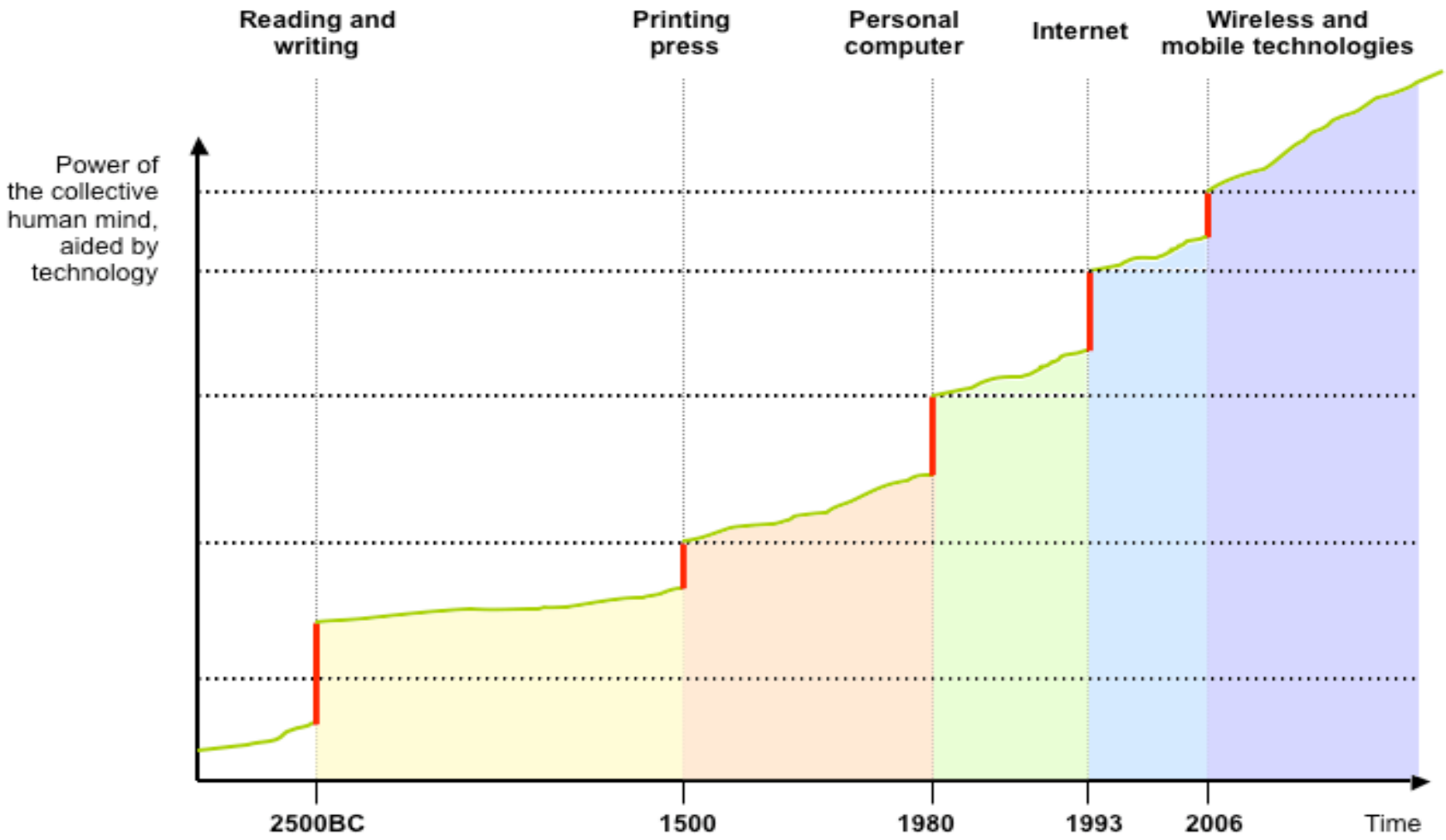
- **creative individuals**, such as movie directors, leaders of sports teams, and leading scientists and politicians, can make a huge difference

- **individual creativity**
  - grounded in the unique perspective that an individual brings to bear in a specific problem
  - results from the life experience, culture, education, and background knowledge of an individual

- individual creativity has **limits** → in today's society, the **Leonardesque aspiration** to have people who are competent in all of science fails because the individual human mind is limited ("*symmetry of ignorance*")

- **social creativity**
  - from reflective practitioners to reflective communities
  - fish-scale model (Campbell): "achieve collective comprehensiveness through overlapping patterns of unique narrowness"

Distributed Intelligence: Extending the Power of the Unaided, Individual Human Mind



Distributed Intelligence

- ***claim:*** *human cognition* has been seen as existing solely "inside" a person's head
  - studies on cognition have often disregarded the physical and social surroundings in which cognition takes place
  - *"psychologists tend to see creativity exclusively as a mental process"* — Csikszentmihalyi in Sternberg (1999)

- **distribution among people:**
  - all of us are knowledgeable in some domains and not in others ("symmetry of ignorance")
  - division of labor + specialization
  - collaborative learning and working (CSCL and CSCW)

- **distribution between humans minds and artifacts**
  - changing tasks and intelligence augmentation
  - external representations

Multi-Dimensional Distances

- **spatial** (co-located and geographically distributed)
- **temporal** (synchronous, asynchronous, long-term)
- **conceptual**
  - communities of practice (homogeneous → limitation: "group think")
  - communities of interest (heterogeneous → limitation: "shared understanding" and "common ground")
- **technological**
  - human problem domain interaction
  - not more information → but: "the 'right' information at the 'right' time in the 'right' way for the 'right' person"

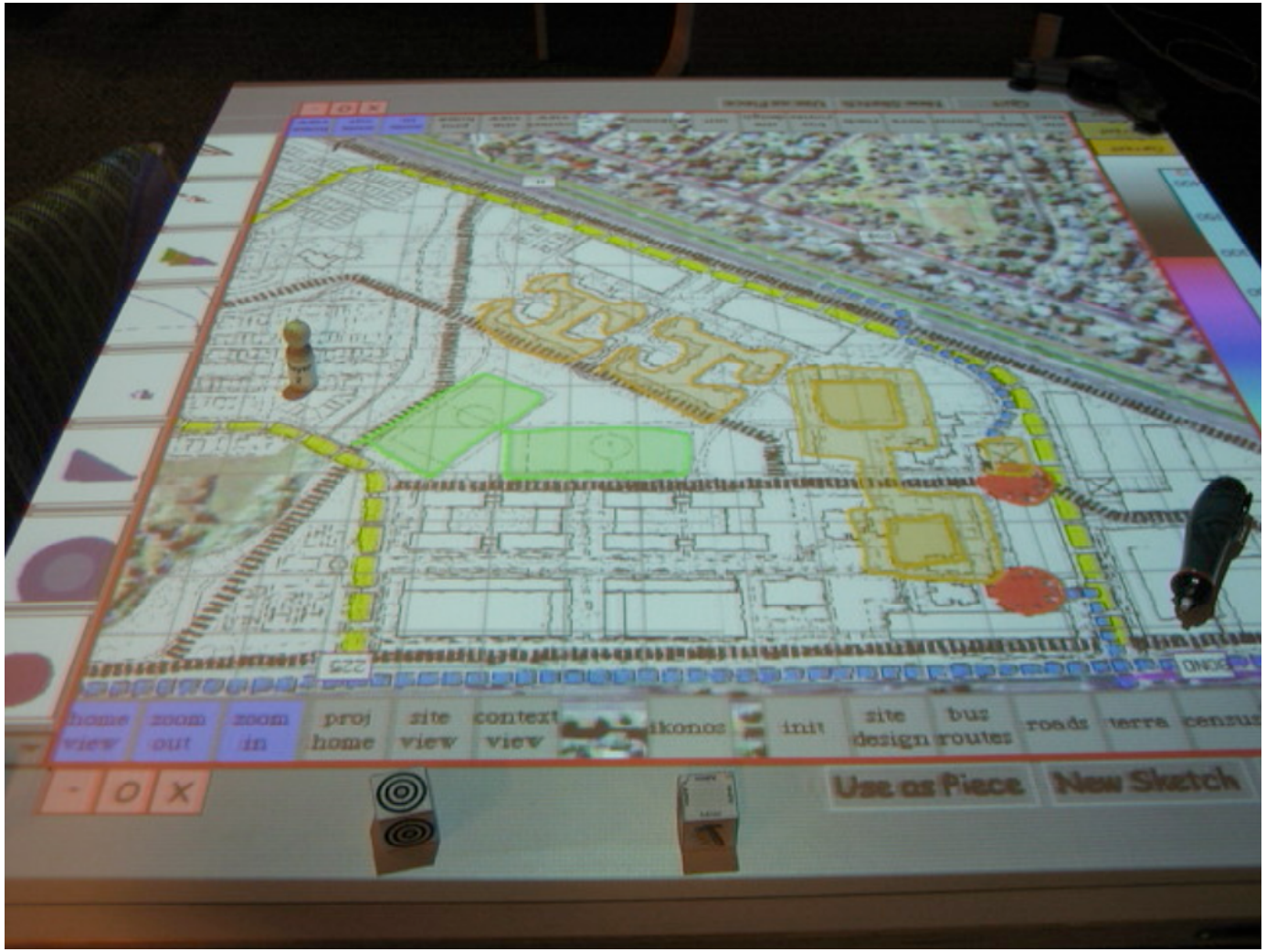
Example: Envisionment and Discovery Collaboratory (EDC)
—
Exploration of Concepts Relevant to Creativity

- **integrate** individual and social creativity
- **support** distributed intelligence → reflective communities, reflection-in-action and reflection-on-action
- **transcend** the limitations of closed systems (EDC = end-user modifiable version of Simcity) → end-user development, meta-design

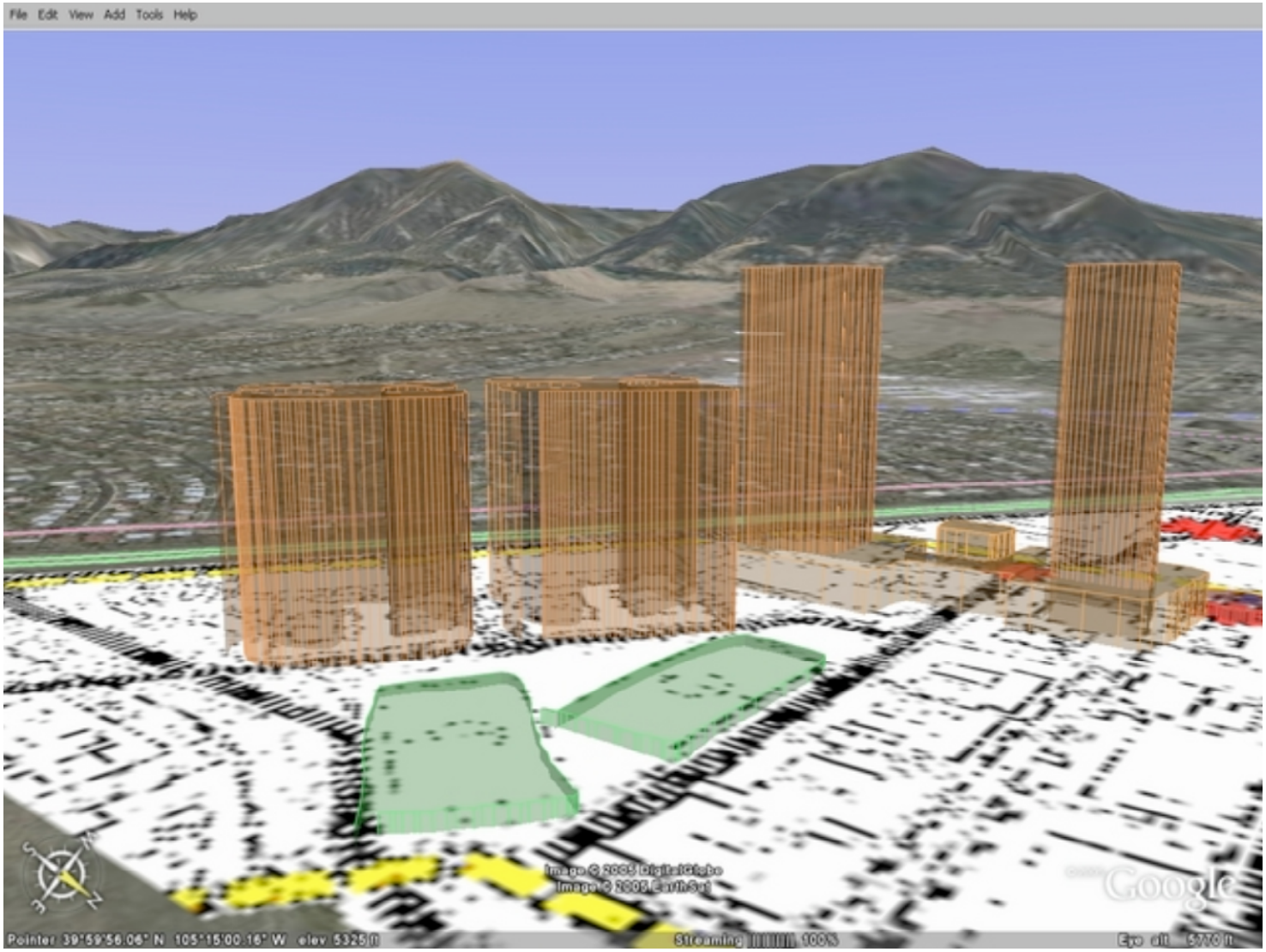
The Envisionment and Discovery Collaboratory (EDC)

Boulder City Council and University of Colorado Regents

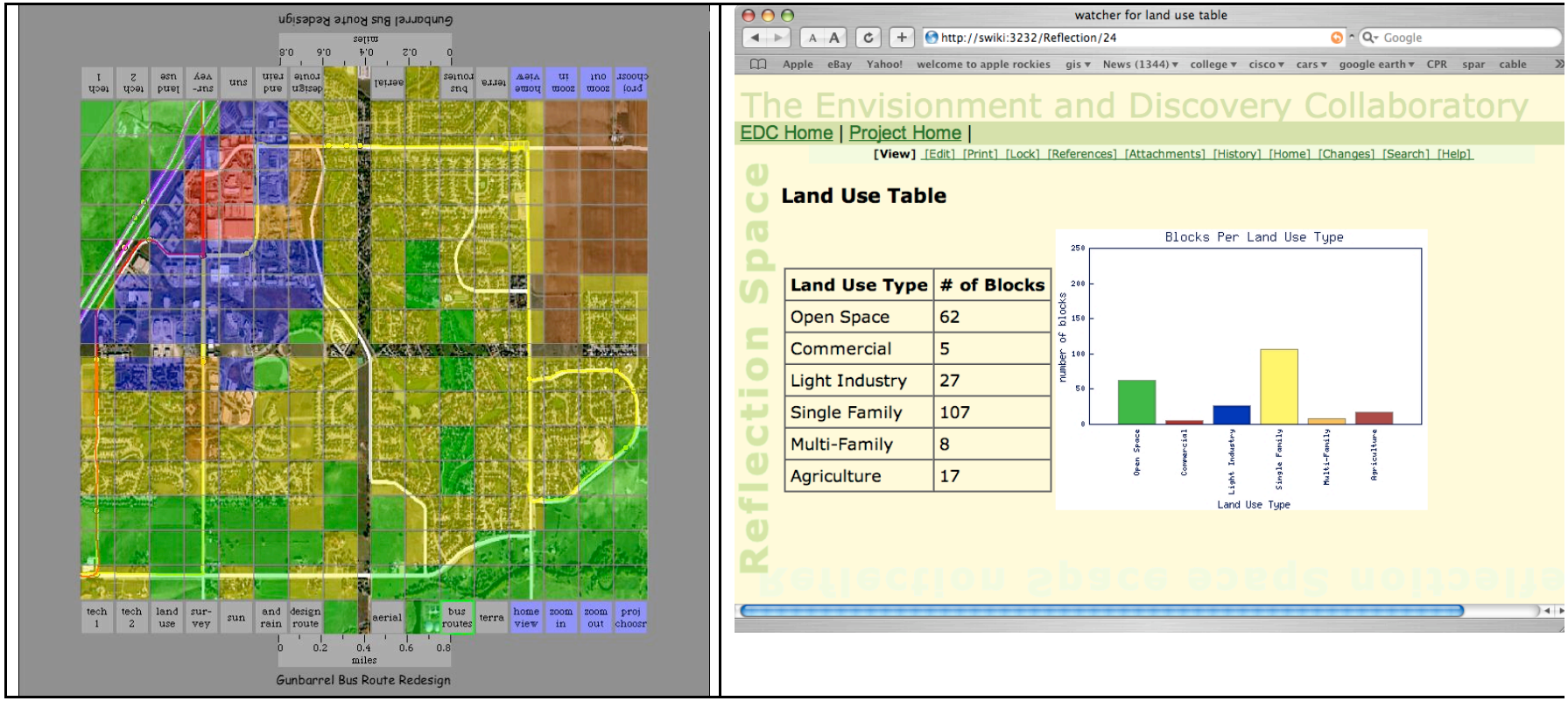
Sketching Support in the EDC



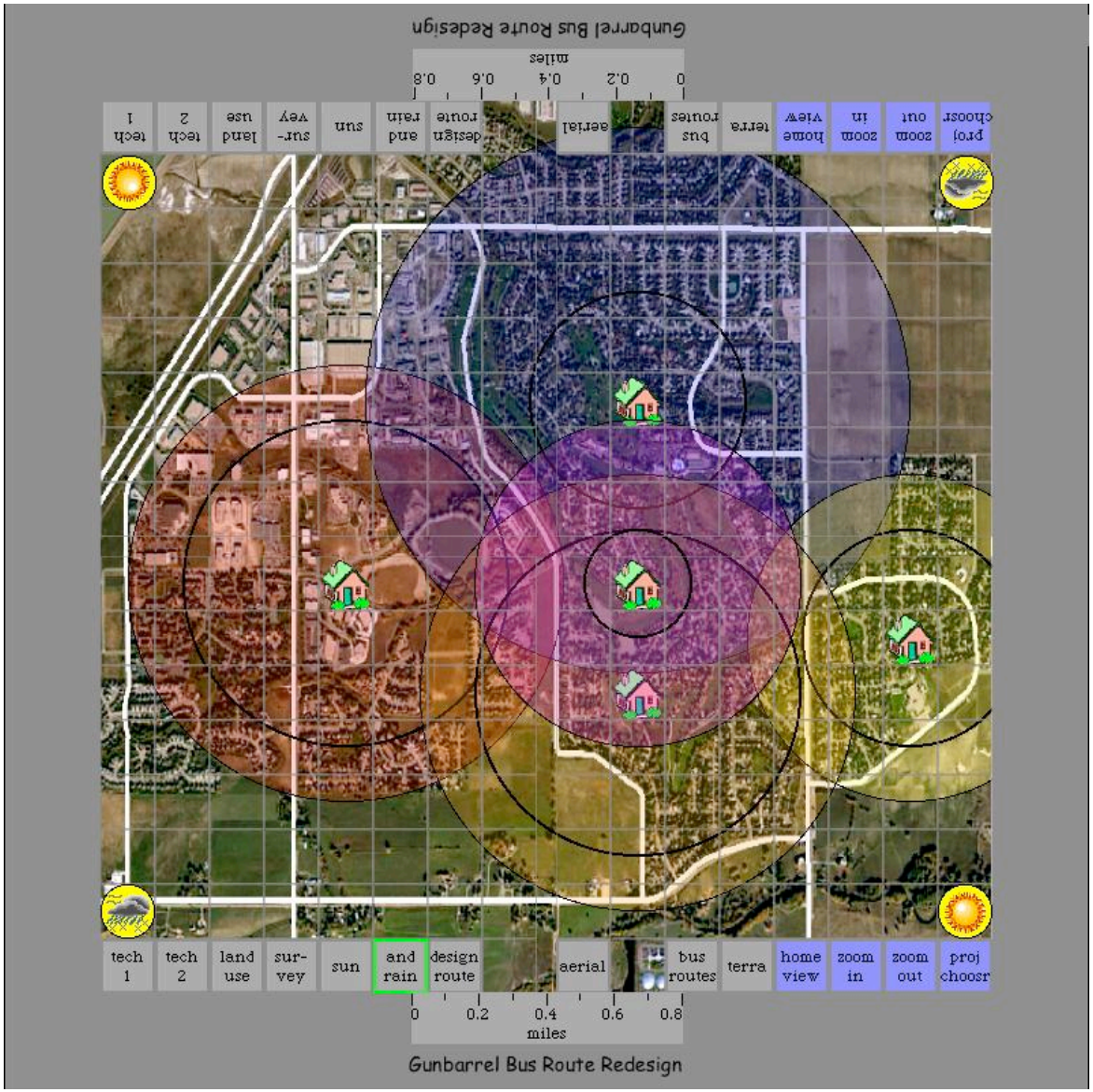
Buildings Sketched into a Google-Earth Client



Linking Action and Reflection



Emerging Insight: Illustrating Multiple Walking Distances



Rigor versus Relevance

- **rigor** ←----------→ **relevance**

lab experiments	contextualized
experimental psychologists	explorations
objectively testable	assessed subjectively

- **question**: how **"rigorous / scientific"** in a conventional sense can / should we be for
  - complex design problems (which are unique)
  - historically creative people which we cannot study in the laboratory

Creativity Research in the Past (and Present)
—
an Orphan, a neglected and marginal Research Topic

- **evidence:**
  - less than 0.2% in Psychological Abstracts focused on creativity (Sternberg and Lubart) → reason: problem with rigor versus relevance
  - no position for academics

- **why now?**
  - **"punctuated equilibrium"** (Stephen Jay Gould): fossil record = long periods of stasis followed by rapid bursts of evolution (instead continuous evolutionary change) brought about by changes in the environment
  - **claim**: the evolution of social systems follows a similar pattern

Creativity — Why Now?

- **American competitiveness** → outsourcing / offshoring
- **complexity** of design problems that are **unique** require some creativity by definition
- **new media/technologies** for every aspect of life → Postman: *"you can do philosophy with smoke signals"*
- **WEB 2.0 technologies** → open source, open content, living memories, from consumers to active contributors
- **relationship to other NSF programs**
  - Science of Design
  - Human-Centered Computing

Why Not

- NSF Education and Human Resources Directorate (EHR) → **testing**
- NSF CISE → **rigorous quantitative goals** (high performance computing, cyberinfrastructure)
- **short-term** objectives

Conclusion

- **hypothesis**: the future is not out there to be discovered — it has to be **invented and designed**

- **objective:** use the collaborative creativity of the people at this meeting to be as innovative as possible to collaborate with NSF to design an exciting research agenda for creativity and IT