Research on Collaboration: Crossing Boundaries

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Research Focus

We engage in research that:

- Investigates collaboration- & information-centric research questions that impact the real world

- Strives to influence the future of collaborative information practices & technology within professions

- Discovers how people, organizations, professions and society can shape information technology design, development & use

- Identifies the impact of novel information technology on people, organizations, professions & society

- Helps shape the contexts in which information & technology are used

Our Research Approach

(Stokes, 1997)

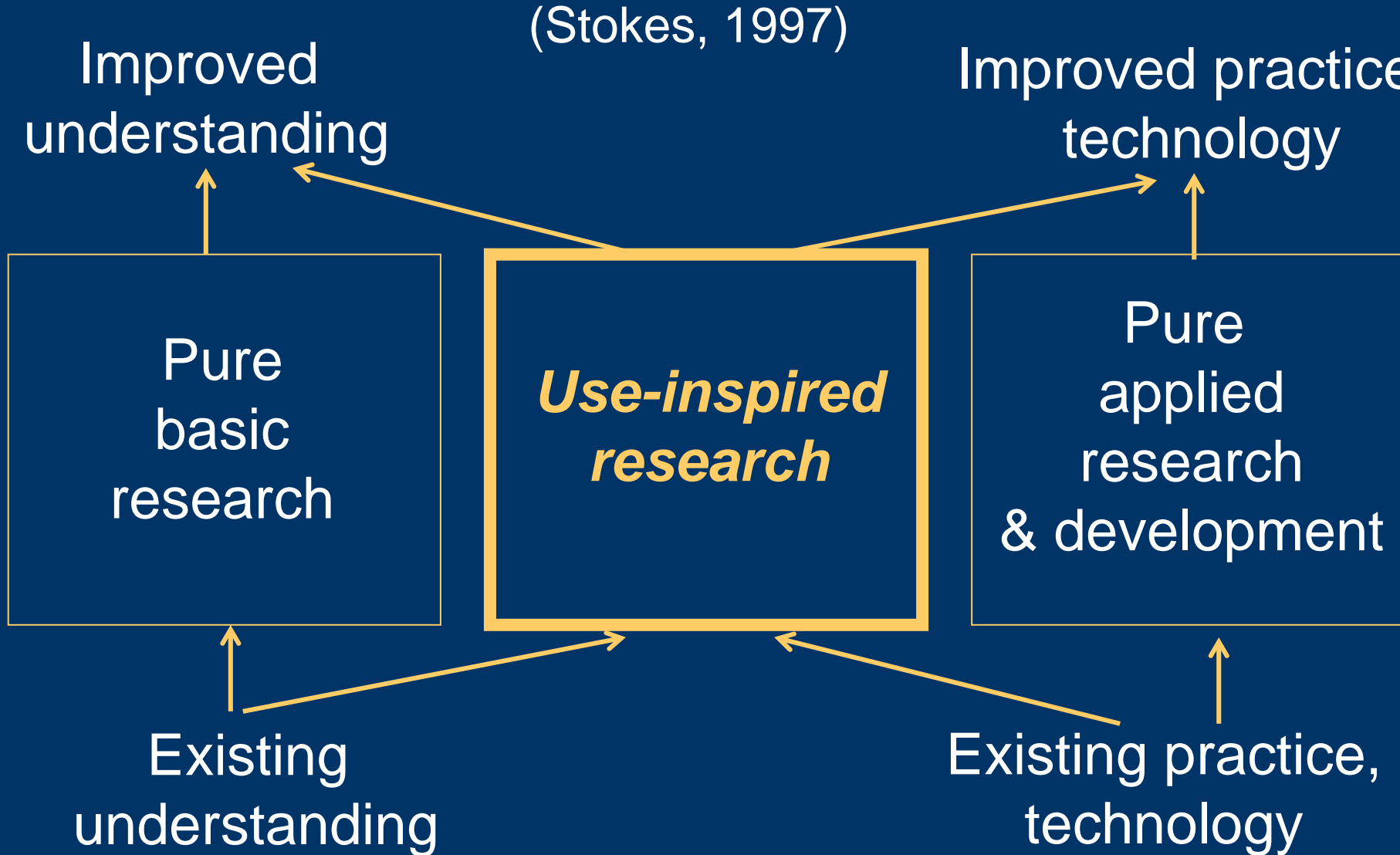Improved understanding

Improved practice technology

Pure basic research

Use-inspired research

Pure applied research & development

Existing understanding

Existing practice, technology

Recent & Ongoing Projects

- Understanding collaboration in command & control

- Designing & evaluating the nanoManipulator Scientific Collaboratory System

- Facilitating collaboration in a distributed science center

- Exploring the potential of 3D telepresence technology for collaboration in emergency medical care

- Investigating new forms of collaboration in library and information science

  - Among practitioners

  - Among practitioners & researchers

Exploring the Potential of 3D Telepresence Technology in Emergency Medical Care

- Investigators

  - Diane Sonnenwald, Hanna Söderholm
    Swedish School of Library & Information Science

  - Bruce Cairns, James E. Manning
    Medical School, University of North Carolina

  - Greg Welch, Henry Fuchs
    Computer Science Dept., University of North Carolina

- Funding
  - U.S. National Library of Medicine

THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

UNIVERSITY COLLEGE OF BO

The Problem

- Trauma – serious physical injury
  - Responsible for more productive years lost than heart disease, cancer & stroke combined worldwide (Meyer, 1998; Coates & Goode, 2001)
  - Paramedics, not physicians, provide emergency health care to trauma victims at accident scenes
  - Complex, dynamic health care situations
  - Today paramedics receive advice from physicians via cell phone or radio

- State-of-the-art 2D video-conferencing use in telemedicine
  - Difficulty in obtaining the desired camera views
  - Lack of depth perception
  - Mun, 2000; Tachakra, 2001; Hauber et al., 2006

Vision for 3D Telepresence Technology

Large medical center

Remote accident

Need to evaluate the potential of the 3D technology in this context before large investments are made

# *What is the potential of 3D telepresence?*

Research Approach

- Experimental evaluation
  - Can emergency health care services be improved via 3D telepresence technology?
  - Comparison of health care in 3 situations
    - (1) Paramedics **working alone**
    - (2) Paramedics collaborating with a physician via: **2D video-conferencing**
    - (3) Paramedics collaborating with a physician via a **3D proxy**
  - Comparison between situation today, near-term vision & long-term vision

- Context study
  - What might facilitate and/or impede the adoption & use of 3D telepresence in the U.S. health care system?

Experimental Evaluation: Hypotheses

Comparison between Conditions

	Alone	2D	3D proxy
H1: Quality of medical care		<	<
H2: Paramedics' self-efficacy		<	<
H3: Usefulness of information			<
H4: Quality of interaction			<
H5: Trust			<

Post-Test, Between-Subjects Design

Alone

PARAMEDIC		EMERGENCY
	2D Video-Conferencing ↔	PHYSICIAN
TRAUMA SCENARIO	3D proxy ↔	
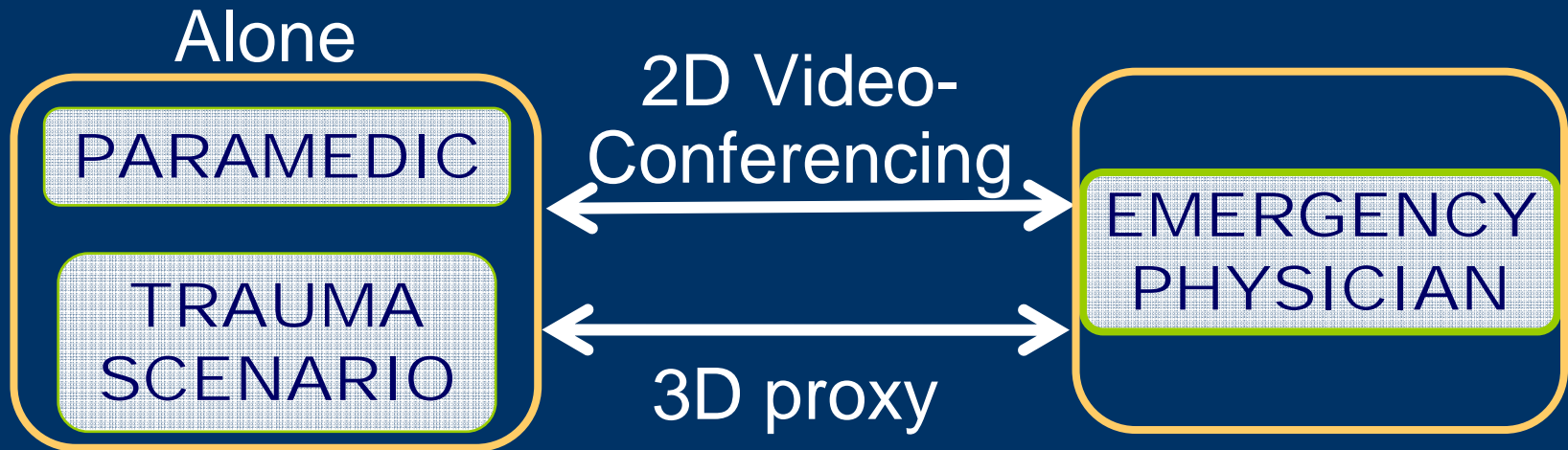
- Simulated trauma scenario
- 2D video-conferencing: 4 cameras, view of physician
- 3D proxy: Physician co-located with paramedic
- Paramedics
  - 20 per condition, 60 total
  - Average 7 years of professional experience
- 2 Emergency physicians with a common collaboration style
- Research observer and mannequin operator

Emergency Trauma Scenario

- Car accident scenario

- METI© Human Patient Simulator

- Management of the difficult airway
  - Diagnosis & perform a cricothyrotomy
  - Most common cause of preventable death in prehospital care of injured patients

Evaluation Measures

- H1: Quality of medical care
  - Task execution times
  - Subtask performance
  - Occurrence of harmful interventions
  - Video-recordings of sessions (4 views)

- H2 | Paramedics' self-efficacy |
  - Basic airway management skills
  - Cricothyrotomy skills
  - Post-questionnaire (Bandura, 2001)
  - Post-interview

- H3, H4, H5: Usefulness of info, quality of interaction, trust
  - Post-questionnaire (Levin & Cross, 2004; Butler, 1991)
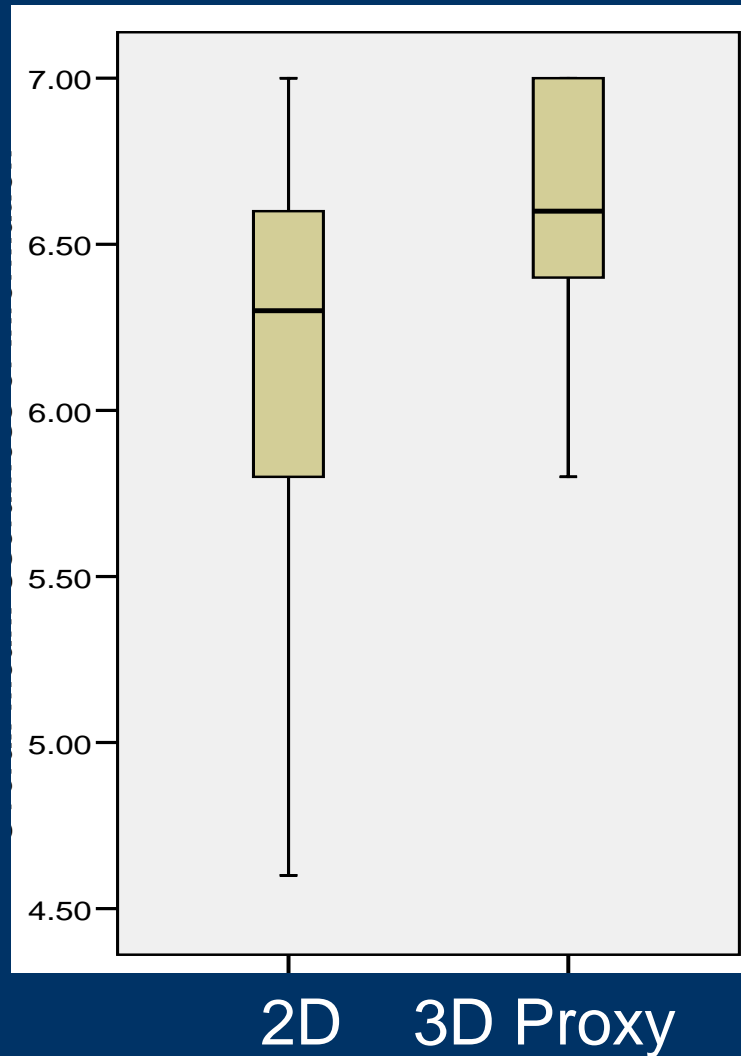 - Post-interview

Usefulness of Information

Did the information you recieved from the physician contribute to:	2D Mean	3D Proxy Mean	ANOVA p
Diagnosing the patient	5.68	6.41	**.032**
Intubating the patient	6.00	6.26	.620
Performing a cricothyrotomy	6.30	6.84	**.013**
Increasing your knowledge about treatment	5.89	6.84	**.002**
Enhancing your future performance	6.35	6.63	**.002**

Scale: 1-7

Usefulness of Information Overall

Mean
(scale 1-7)

2D   3D Proxy

Result statistically significant (p = 0.002)

Usefulness of Information

Post-Interview Data from 3D Proxy Participants

*With [the physician] there we got a better airway…
and increased the patient's chance of survival.*

*Everything [the physician] was telling me was precise.
I knew exactly what to look for.*

*I liked that he was able to point and
tell me what goes where.*

Self-Efficacy: Cricothyrotomy Skills

I can quickly….

I can quickly….	Alone	2D	3D Proxy
decide when to perform a cric	5.60	5.25*#	5.95*
find the location of the cricothyroid membrane (CTM)	6.05	5.55*#	6.35*
palpate the CTM	6.25	5.80*#	6.50*
secure the opening made in the CTM	6.05	5.63*#	6.35*
I am confident that I can do a cric	5.70	5.35*#	6.16*

Differences are statistically significant at p <= 0.05

#Statistically correlated to years of professional experience

Self-Efficacy: Basic Airway Skills

I can quickly….	Alone	2D	3D Proxy
Diagnose a difficult airway	5.95	5.75	6.15
Manually ventilate a patient	6.80**	6.35**	6.55
Observe problems with manual mask ventilation	6.30	6.00	6.35
Decide on an alternate strategy	6.20	5.75	6.11
Perform initial intubation	6.30	6.00	6.11
Observe intubation problems	6.55*	6.10*	6.35
Decide on alternate strategy	6.30*	5.75*	6.10

**Statistically significant at p <= 0.05
*Statistically significant at p <= 0.08

Self-Efficacy: Post-Interview Data

Phrases reflecting lower levels of self-efficacy

Participants' phrases	*Occurrences per condition*		
	Alone	2D	3D Proxy
Feeling clumsy, scattered, distracted	1	3	5
Frustrated, less confident, insecure	2	3	0
Not reacting as usual	2	3	0
Totals	**5**	**9**	**5**

Remote physician's view

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Additional & less
constructive questions

Summary

H1: Quality of medical care   Alone < 2D < 3D proxy

Partially supported

H2: Paramedics' self-efficacy   Alone **>** 2D < 3D proxy

Supported

H3: Usefulness of information   2D < 3D proxy

Supported

H4: Quality of interaction   2D < 3D proxy

Supported

H5: Trust   2D < 3D proxy

Partially supported

Discussion

- Potential of 3D telepresence technology
  - Some promise to improve emergency health care
  - Positive effect on future job performance vs.
    2D video-conferencing's negative impact
  - Possibility to eliminate any negative impact from a lack
    of previous work experience

- Socio-technical design insights
  - Usefulness of remote pointer
  - Need to dynamically change remote views
  - Paramedics' work visible in new ways:
    New responsibilties & risks
  - Additional requirements emerging from context study

- Approach provides insights regarding technology use
  before billions of dollars are invested in R&D

Recent & Ongoing Projects

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    - Among professionals

    - Among professionals & researchers

Collaboration among LIS Professionals Across Distances: Needs & Challenges

- Challenges in library & information science (LIS)
    - Decreasing resources
    - Increasing complexity due to rapid socio-technical changes
    - Increasing operating costs
    - Increasing demand for new services

- Project goal: To investigate whether new ways of collaborating could help address these challenges

- Project team members: Ann-Sofie Axelsson, Maria Spante, Diane Sonnenwald

- Funding from the Stiftelsen FöreningsSparbanken a charitable foundation

Collaboration Across Distances

- Previous & ongoing collaborative efforts in LIS
    - Sharing catalog entries (e.g., OCLC)
    - Interlibrary loans
    - Open source digital library software (e.g., DSpace)

- New ways of collaborating emerging in other disciplines
    - Remote access to scientific instruments
    - Sharing digital scientific research data
    - Synchronous, interactive collaborative work tools
    - Grid computing

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Collaboratory

Collaboratory

Definition

A network-based facility and organizational entity that:

- Spans distances

- Supports rich and recurring human interaction oriented to a common domain

- Fosters contact between individuals who are both known and unknown to each other, and

- Provides access to data sources, artifacts and tools required to accomplish tasks.

(Science of Collaboratories, 2003)

A LIS Collaboratory

Socio-technical Infrastructure

Actors

Digital Repository

Provide mechanisms for supporting the actors' rights, obligations and activities. Organizational structure, research- & business plans, guidelines for collaborations with other organizations, IP policy, reward mechanisms, visions for sustaining and expanding the collaboratory.

Individuals & organisations (practitioners, students, researchers).

Internal & external resources

A Collaboratory for LIS professionals?

Exploratory Study

- Interviews with LIS managers at:
    - Public and university libraries (large & small)
    - Company libraries (large & small)
    - Government R&D organization
    - LIS higher education department
    - NGO (non-governmental organization)

- Interview topics
    - Information seeking behaviour
    - Needs for additional resources, including knowledge
    - Resources in their organization that could be shared
    - Requirements for a collaboratory

Data Analysis & Results

- Interviews analyzed to discover:
  - Factors that motivate and/or hinder collaboration across geographic & organizational boundaries
  - Requirements for a collaboratory

- 4 categories of factors & requirements emerged
  - Organizational
  - Economic
  - Resource
  - Social networking
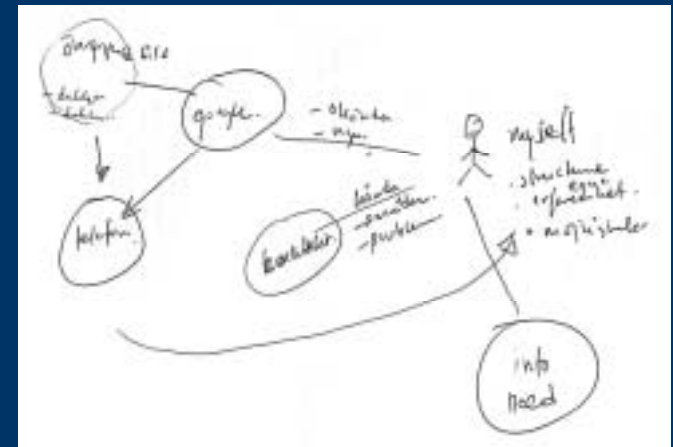
Organizational Factors

- Organizational roles for a collaboratory
    - Increasing employees' professional development
    - Helping the organization solve its problems
    - Bringing new and innovative ideas into the organization
    - Providing expert, personalized advice regarding:
        - (a) Problems that emerge in daily work
        - (b) One-time issues

- Tight integration with current work practices required
  "You need somehow to build it into … the organization."

- In comparison, scientific collaboratories typically introduce new work practices

Economic Factors

- Collaboration should ultimately lead to increased economic resources for the organization
    - E.g., new, profitable services and products
    - *"The absolutely most important thing is that it brings something back to the company."*

- Suspicion that a collaboratory will introduce additional costs
    - Money & time
    - *"If one has the time, there are a lot of great and fun things one could use technology for…it is never too difficult…it is rather the time."*

- Questionable economic benefits from scientific collaboratories – but, many other benefits have emerged

Resource Factors

- Large need for increased access to expensive equipment, software, specialised expertise
  - Need for one or more additional resources mentioned by every interviewee
  - Could be provided through a collaboratory

- Too many online resources that only offer documents

- Not yet another listserv!

- Preference for personal, face-to-face contact with experts

"You can always read. There is plenty around to read… And it may be interesting but you don't get this extra something…No, it must be a human!"

Resource Needs & Availability

An Example

Manager A: *"One recurrent [challenge we face] is copyright law. The legal aspects of library management are very complicated questions."*

Manager B: *"There are a lot of questions about copyright …companies will get into trouble unless they have sorted out the copy-clearing, and this is an area where I have been involved a lot…I think I could contribute quite a lot."*

Social Networking Factors

- Positive attitudes towards a collaboratory expanding social networks

- Need for a balance between focus & breadth

"I will get a super network with branches into all kinds of workplaces and activities…[my company] is very positive towards external networks."

"I think [the collaboratory] needs to be focused and it's quite important that the scope is wide enough to be able to make people contribute, but focused enough to be narrow, so one knows it's of interest."

Future Research

- "Expert on Demand" collaboratory
  - Personalized knowledge sharing for LIS professionals in everyday work practice
  - Experts available for 'free' consultation
  - Organizations donate their experts' time in exchange for consultation with other experts

- Open research issues, e.g.,
  - How can expertise be made visible in multi-disciplinary field?
  - How to encourage/reward participation?
  - How to maintain a collaboratory?
  - How to integrate a collaboratory into organizational work life?

Concluding Comments

- Collaboration
    - Dynamic creation & exchange of information
    - Evolving area of research
    - Multi-disciplinary
    - Inter-organizational
    - A variety of research methods
    - Multiple, integrated methods
    - Use-inspired research

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