BUILDING COLLECTIVE CREATIVE IT EFFORTS

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Creative IT workshop
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INTRODUCTION

and some prior work

- Successful (interdisciplinary) collaboration can promote emergence of creativity and transformational research in IT [BP]
- COLLABORATION REMAINS CHALLENGING
- WHY?
- HOW TO OVERCOME THE CHALLENGE
  - Guidelines for effective team work with lowered collaboration costs
  - Based on previous and current work and our own experiences at AME

INTRODUCTION

and some prior work

Strong quantitative evidence that:

- TEAMS DO IT BETTER [Wuchty]
- DIVERSE TEAMS DO IT EVEN BETTER [Guimera]
- DIVERSE TEAMS OUTPERFORM INDIVIDUALS UNDER CERTAIN CONDITIONS [Page]

INTRODUCTION
and some more prior work

- LONG STANDING BIAS IN OUR SOCIETY TOWARDS INDIVIDUAL ACHIEVEMENT
  - overemphasizes individual achievement
  - underemphasizes the effect of collective discovery and of the social interdependencies that lead to innovation

WHY?

produces

- intellectual simplification [Gardner, Hutchins]
- emotional simplification [Davis]
- logistical simplification [Page]

- INCREASING ACCEPTANCE OF COLLECTIVE EFFECT ON KNOWLEDGE

- Complex world leads us away from trivialized distinctions between individual and collective [Davis]

- INCREASING ACCEPTANCE OF COLLECTIVE EFFECT ON KNOWLEDGE
  - Institutions and units built around complex problems (Sustainability, Biodesign) not single disciplines
  - Diverse collaboration the only way to solve these problems
  - Team authorship growing
  - Team awards growing
  - My own experience during my education
    - with Olivier Messiaen in France
    - Brad Garton at Columbia University

SOME GUIDELINES

for successful collaborations in creative IT

- Based on previous and current work, projects and institutions
- Based on our own experiences at AME
  - Examples from
    - One large collaborative research group: mediated rehabilitation for stroke patients
    - The full AME program

- Presented as a list but they are a network
- Highly interdependent
- Most have to be fulfilled for any one of them to have an effect
- many of them have already been mentioned in this workshop thus confirming our own experiences

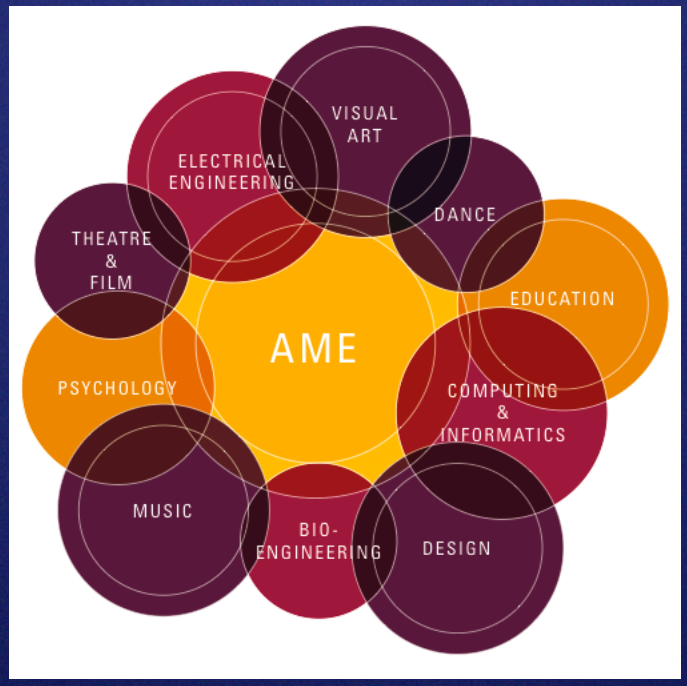
1. A FOCUSED, COMMON GOAL

- General goals do not promote strong integration
- Produce misunderstandings

- Mediated rehabilitation of stroke patients research group has 20 diverse members working on one problem:
  - three bioengineers, three computer scientists, four electrical engineers, two animators, two music composers, an interactive media expert, a fabrication expert, two physical therapists and three medical doctors.

1. A FOCUSED, COMMON GOAL

- AME focuses on research and education in experiential media
  - 5 integrated research areas
  - 5 application areas of societal significance for its research
  - All strategic planning and research and education components built around that goal



2. GOAL MUST BE COMPLEX

- Diverse collaboration a real need
  - No one person has all necessary knowledge for mediated rehabilitation
  - No one person can run all components in real-time
  - Holds true for all AME research projects

3. GOAL MUST HAVE DIVERSE COMPONENTS

- Integrate diverse intelligences
- Allow each member to find their niche - offer their optimum
- Not get stuck on local optima
- Achieve major breakthroughs - beyond abilities of homogeneous groups
- Diversity must be a real need of goal

- Mediated rehabilitation has a long list of components; new members extend existing or add new components

- AME integrates multiple types of knowledge and related intelligences

4. GOAL MUST BE USEFUL - APPLIED- OF SOCIETAL SIGNIFICANCE

- Justifies effort and resources
- Real world frustrates “neat” solutions

- Patients’ effort and determination strong influence on rehab team
- Complexity of helping patient regain knowledge of arm, effect of details on goal, and complexity of team dynamics key in the development of team and its members
- All AME research is geared to produce results of societal significance. All projects are embedded in real world situations.

5. PERSONAL CONVICTION BY EACH PARTICIPANT FOR INTERDEPENDENCIES, DIVERSITY AND COMPLEXITY

- participants should (ahead of entering):
  - believe that success in their research lies beyond their ability
  - be seeking the other types of knowledge of the team
  - have or develop intuitions for distant concepts
  - be seeking complex research experiences
  - not have ownership issues
- participants can not be persuaded to collaborate

- AME faculty and students that integrated best had reached those convictions

6. COLLECTIVE OWNERSHIP OF GOAL
   - Equal stake and belief
- Avoids uneven work structures - not sustainable;
   - overworked and underperforming membership
- Increases positive effects of diversity - improvement on each-others' optima
- Discussions about realization, not about goal
- Highly sensitive to the other guidelines mentioned

- AME experience shows:
   - positive correlation between ownership of goal, amount of effort and amount of innovation
   - Members driven by ownership of goal and members "just doing their job" not a good mix

7. NO SINGULAR LEADERSHIP MODELS

- Innovation constrained by the abilities, knowledge and imagination of the lead person
- thwarts optimal performance/contribution of each member
- diverse intelligences of different agents not put to full use

- Collaborative processes not for:
  - Control freaks
  - Researchers with narrow definitions

7. NO SINGULAR LEADERSHIP MODELS

- So what about the masterpiece resulting out of control of aesthetics?
  - Goal of singular aesthetics on same as collective aesthetics
- Not a free-for-all; coordination useful
- Director's experience at AME
  - Evolution of membership reduces need for leadership

8. AGENCY IN REALIZATION

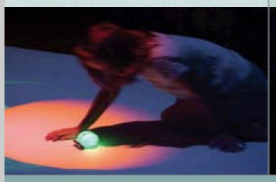
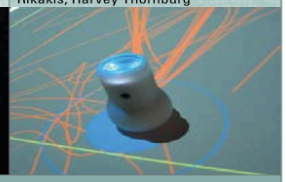
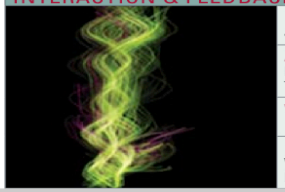
- Common ownership and agency in realization key integrated aspects
  - All working towards one direction
  - Each bringing full scope of abilities
  - Continuum between individual and collective
- Structures for
  - Every member to influence direction of work
  - Individual and collective responsibility
  - Collective decision making
  - Dynamic operation of teams

- The evolution of AME's research model
  - From a fixed matrix defining boxes for each person
  - To matrix as a reference space for dynamic human networks
  - To a dynamic, self organizing network

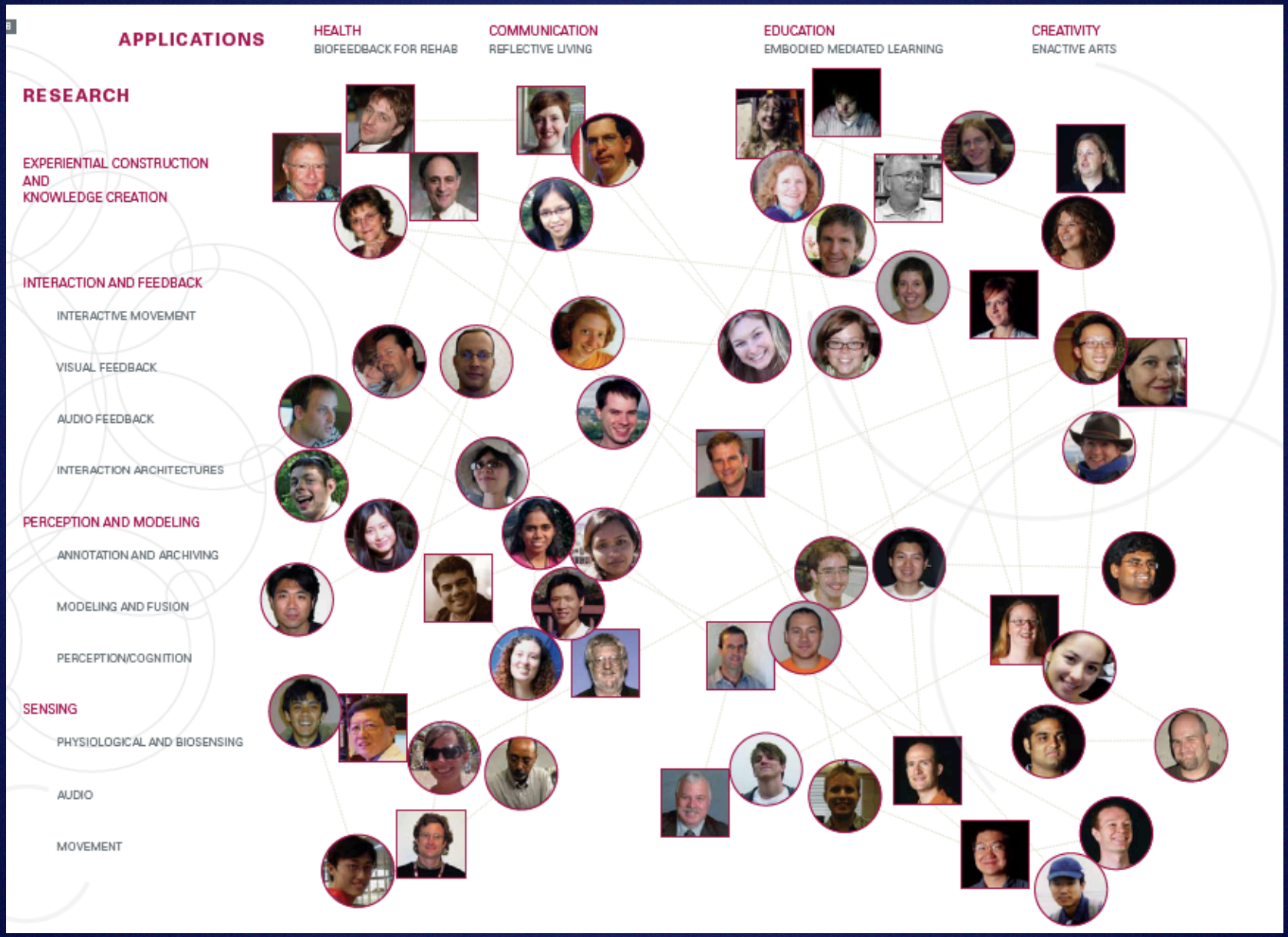
integrated research and applications in experiential media at AME

applications

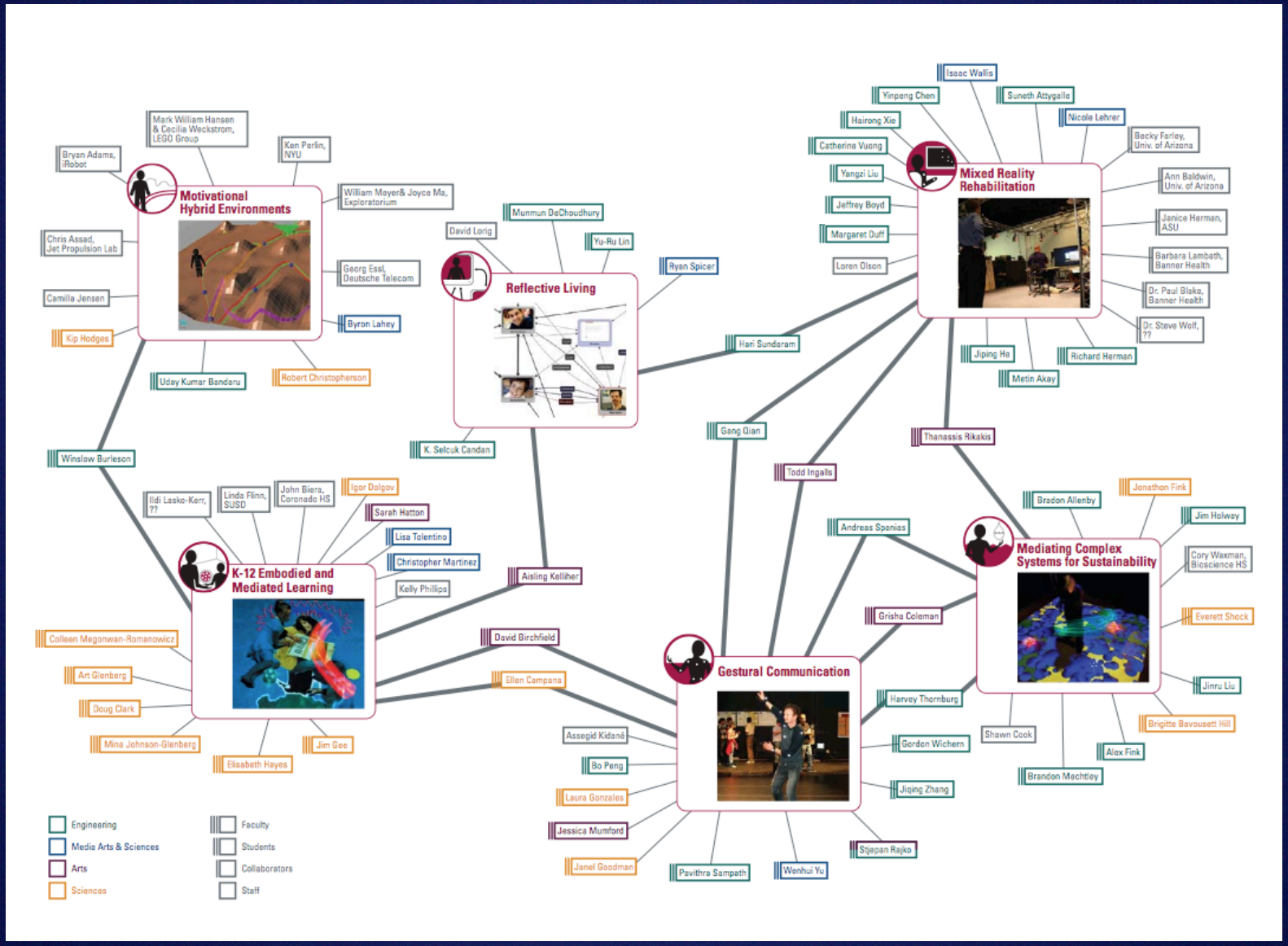
research

	BIOFEEDBACK Lead Faculty: Thanassis Rikakis, Hari Sundaram, Jiping He. Participating AME faculty: Ellen Campana, Todd Ingalls, Loren Olson	EDUCATION Lead faculty: David Birchfield, Harvey Thornburg, Willi Savenye. Participating AME faculty: Win Burleson, Jodi James, Gang Qian	INTERACTIVE ARTS Lead faculty: Todd Ingalls, Gang Qian, Jodi James. Participating AME faculty: Ellen Campana, Harvey Thornburg	SITUATED COMMUNICATIONS Lead Faculty: Aisling Kelliher, Hari Sundaram. Participating AME faculty: David Birchfield, Win Burleson, Thanassis Rikakis, Harvey Thornburg
				
APPLICATION EXPERTISE/KNOWLEDGE EVALUATION				
	*Margaret Duff*, Sheng-Min Liu	*Gary Minyard*, Roger Bedard, Mary Erickson, Stephani Etheridge Woodson		*Ben Erlandson*
INTERACTION & FEDBACK				
				
INTERACTIVE MOVEMEMT Jodi James		*Harper Pivar*, Jennifer Tsukayama	*Jessica Mumford*	
AUDIO FEEDBACK David Birchfield, Todd Ingalls, Thanassis Rikakis	*Isaac Wallis*	*Aaron Cuthbertson*	Todd Ingalls	*Jonathan Simon*
VISUAL FEEDBACK	Loren Olson	*Sarah Hatton, Christopher Todd*, Dan Collins	Mary Bates Neubauer	*Xiang-Jun Wang*, Jennifer Brungart
INTERACTION ARCHITECTURES Win Burleson, Aisling Kelliher, David Birchfield				*Adithya Renduchintala, Shreeharsh Kelkar*
PERCEPTION & MODELING				
				
ANNOTATION AND ARCHIVING Hari Sundaram	*Wei-Wei Xu*	*Gordon Wichern*		*Evan Weatherspoon*
MODELING AND FUSION Hari Sundaram, Harvey Thornburg, Gang Qian	*Yinpeng Chen*	*Lei Tu, Matthew Fulmer*	*Dilip Swaminathan*	*Yu-Ru Lin, Ankur Mani*
PERCEPTION/COGNITION Ellen Campana, Michael McBeath, Clark Presson	*Wei Wang*	*Igor Dolgov*	*Kathleya Afanador*	
SENSING				
				
PHYSIOLOGICAL Win Burleson, David Birchfield, Gang Qian			*Sankar Rangarajan*, Assegid Kidané	Dosun Shin
AUDIO Harvey Thornburg, Andreas Spanias		*Gordon Wichern, Brandon Mechtley*		*Alex Fink*
MOVEMENT Gang Qian, Jodi James	*Yufei Liu*, Bing Cheng	*Huan Jin*, Bing Cheng	*Stjepan Rajko*	

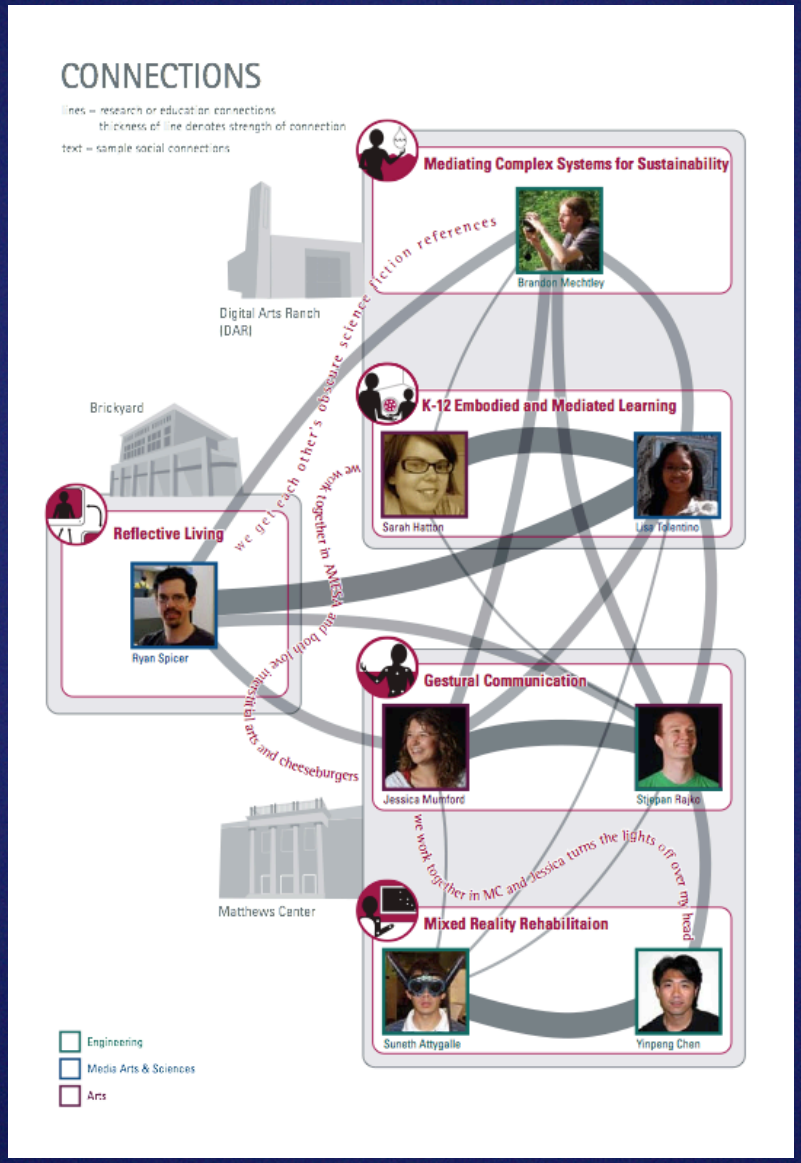
Italic = Students


APPLICATIONS
HEALTH
BIOFEEDBACK FOR REHAB
COMMUNICATION
REFLECTIVE LIVING
EDUCATION
EMBODIED MEDIATED LEARNING
CREATIVITY
ENACTIVE ARTS
RESEARCH
EXPERIENTIAL CONSTRUCTION AND KNOWLEDGE CREATION
INTERACTION AND FEEDBACK
INTERACTIVE MOVEMENT
VISUAL FEEDBACK
AUDIO FEEDBACK
INTERACTION ARCHITECTURES
PERCEPTION AND MODELING
ANNOTATION AND ARCHIVING
MODELING AND FUSION
PERCEPTION/COGNITION
SENSING
PHYSIOLOGICAL AND BIOSENSING
AUDIO
MOVEMENT

Research Modules



A rich student network



9. CONSISTENCY IN FUNCTIONS

- Guidelines should apply to all aspects of the team-work
- Challenging to generalize guidelines beyond controlled contexts

- Examples:
  - Respect for administrative or technical support expertise
  - Dynamic, non-tenured, faculty lines

10. SUPPORTIVE SOCIAL STRUCTURES

- performance of cognitive tasks that exceed individual abilities shaped by a social organization of distributed cognition [Hutchins]

- At AME
  - research space and physical space team structures inadequate
  - emergent, informal social interaction also needed - also a good predictor of collaboration and research success
  - social interaction creates empathy for other perspectives
  - awareness
  - diverse avenues for creation of social space
  - meet and talk - the no e-mail escalation rule
  - reflection strategies crucial

11. REFLECTION STRATEGIES

- to grow, evolve as a team, collective reflection strategies are needed
- influence development of common ownership, distribute cognition

- discussion time not pressured by decision or outcome needs
- different formats and different participants, inclusive
- informed by qualitative and quantitative data
- some physical, some electronic, some hybrid
- informed by technology

11a. HYBRID REFLECTIVE SYSTEMS

- Combine human and computational strengths
- Reveal the complex and hidden connections of a collective effort
- Continuum
  - From the everyday to the long term
  - From private space to common space
- Consider simultaneously
  - the individual, groups, the unit
  - artifacts, events (formal and social)

11a. HYBRID REFLECTIVE SYSTEMS

- Components of hybrid reflective architecture at AME:
  - On-line faculty and unit evaluation system
  - Eventory - media database
  - Media interventions
    - LifeSampler
    - Media Jam - Sensor squid
    - Generative storytelling

12. APPROPRIATE EVALUATION AND REWARD STRUCTURES

- Evaluate in integrated manner:
  - Individual, groups, unit
  - Short term and long term
  - Process and product
  - Include all forms of human creation and expression

12. APPROPRIATE EVALUATION AND REWARD STRUCTURES

- AME evaluation
  - Products judged by impact, not type
  - Quantitative and qualitative
  - Connectivity
    - Tracked from products (and soon events)
    - Critical component of evaluation
      - Minimum required connectivity
      - 25% of evaluation weight
  - Interdisciplinary committees
  - Connected individual, group and unit performance indicators

REFERENCES

- Mitchell, W.J., A.S. Inouye, and M.S. Blumenthal, *Beyond Productivity: Information Technology, Innovation, and Creativity*. 2003, Washington, DC: National Academies Press.
- Csikszentmihalyi, M., *Creativity: flow and the psychology of discovery and invention*. 1997: Harper Perennial.
- Csikszentmihalyi, M. and J.W. Getzels, *Discovery-Oriented Behavior and the Originality of Creative Produces: A Study with Artists.* Journal of Personality and Social Psychology, 1971. **19**(1): p. 47-52.
- Davis, B. and D. Sumara, *Complexity and Education*. 2006, Mahwah, NJ: Lawrence Erlbaum Associates.
- Reynolds, R. and S. McAdams, *Form and Method: Composing Music: the Rothschild Essays*. 2002, London, England: Routledge.
- Stravinsky, I., *An Autobiography*. 1998, New York, NY: WW Norton & Company.
- Florida, R., *The Rise of the Creative Class: And how It's Transforming Work, Leisure, Community and Everyday Life*. 2003: Basic Books.
- Gombrich, E.H., *The Story of Art*. 1995: Phaidon London.
- Faure, E., *Learning to be: The World of Education Today and Tomorrow*. 1972: Unesco.
- Guimera, R., et al., *Team Assembly Mechanisms Determine Collaboration Network Structure and Team Performance.* Science, 2005. **308**(29): p. 697-702.
- Page, S.E., *The Difference*. 2007, Princeton, NJ: Princeton University Press.
- Hutchins, E., *Cognition in the Wild*. Vol. 1. 1995, Cambridge, MA: MIT Press.
- Chen, Y., et al. *Media Adaptation Framework in Biofeedback System for Stroke Patient Rehabilitation*. in *ACM Multimedia*. 2007. Augsburg, Germany.
- Wang, X.-J., et al. *Eventory - An Event Based Media Repository*. in *International Conference on Semantic Computing*. 2007. Irvine, CA.
- Sundaram, H. and T. Rikakis, *Experiential Media Systems*, in *Encyclopedia of Multimedia*, B. Furtht, Editor. 2006, Springer Verlag: NY NY. p. 989p.
- Birchfield, D., et al. *SMALLab: a Mediated Platform for Education*. in *ACM SIGGRAPH*. 2006. Boston, MA.
- Jenkins, H., et al., *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century*. 2006, MacArthur Foundation.
- Dyaberi, V.M., et al. *Phrase Structure Detection in Dance*. in *Proc. ACM Multimedia 2004*. 2004. New York, New York.
- Rikakis, T., et al. *An Arts, Sciences and Engineering Education and Research Initiative*. in *IEEE Frontiers in Education*. 2006. San Diego, CA.
- Wang, Y., G. Qian, and T. Rikakis. *Robust Pause Detection Using 3D MotionCapture Data for Interactive Dance*. in *International Conference on Acoustics, Speech, and Signal Processing*. 2005. Philadelphia, PA.
- Whiteley, D., et al. *Real-Time Tracking of Multiple People from Unlabelled Markers and its Application in Interactive Dance*. in *British Machine Vision Conference*. 2005. Oxford, UK.