What is Behavioral Informatics?

SYMPOSIUM
WHAT IS BEHAVIORAL INFORMATICS?

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OBJECTIVES OF THE SYMPOSIUM
Increase Your Understanding of…

1. What is Behavioral Informatics (BI)
2. What BI can/might offer behavioral medicine
3. BI research domains & research questions
4. BI's component disciplines and technologies

OBJECTIVES OF THE SYMPOSIUM
Increase Your Understanding of…

5. Issues facing BI that affect its development as a scientific discipline
6. How behavioral scientists & computer scientists/ informaticians can effectively collaborate in BI research

OUR PRESENTATIONS

Tom Houston (*The SBM BI SIG Perspective*)
History & purpose of the SIG. SIG membership. BI issues discussed at SIG meetings. BI research by SIG members.

Beth Bock (*The Behavioral Science Perspective*)
Published BI research. Definitions and domains of BI. Issues raised in BI research. Likely directions in future BI research.

OUR PRESENTATIONS (CONT.)

Tim Bickmore (*The Informatics Perspective*)
BI research conducted by computational scientists. Computational technologies relevant to BI. Likely future directions in BI research by technologists.

Rob Friedman (*A Summative Perspective*)
Review perspectives on what is BI & its research domain. Place development of BI in context of evolution of other scientific disciplines in health & medicine.

Behavioral Informatics
The Special Interest Group

Tom Houston

What is the SIG?

- Forum for SBM members with an interest in the impact of technology on health behavior outcomes and processes.
- Goal is to promote the appropriate use of technologies to improve health and healthcare.

Working Definition of Behavioral Informatics

- "the study of the use of technologies by patients and health care providers as well as the design, implementation, and evaluation of behavior change interventions delivered through advanced technologies."

Requests of SIG Members

- Have a listserve and website
- Workshops
  - Theory and Function
  - Platforms – benefits/drawbacks
  - Recruitment and "stickiness"
- Compendia of BI projects
- Develop a taxonomy of BI

Behavioral Informatics SIG History

- 2002 - The SIG is proposed
  - Friedman, Houston, Ahern
- 2003 - First SIG meeting
- 2004 - First Sponsored Workshop
  - Spinning a New Web: Translating Theory to Practice for Web-Based Health Promotion Tools
- 2005 - Symposium

Who is in the SIG?

- N = 28
- Disciplines
  - Psychologists, Nutritionists, Physicians, Nurses, Health Educators
- Degrees
  - PhD, MD, MPH

Research by SIG members - (Article Titles)

- The use of computer telephony to provide interactive health information
- Experiences of patients who were early adopters of electronic communication with their physician
- Feasibility of incorporating computer-tailored health behavior communications in primary care settings

Research - Smoking

- Smoking cessation treatment on the Internet: content, quality, and usability
- Computer-based smoking cessation interventions in adolescents: description, feasibility, and six-month follow-up findings
- Acceptability of computer assessments among ethnically diverse, low-income smokers

Social Support

- A Model of Computer-Mediated Social Support Among Older Adults
- Internet support groups for depression: a 1-year prospective cohort study

More Research

- HIV-AIDS patients' evaluation of health information on the internet: the digital divide and vulnerability to fraudulent claims
- Development of an adaptive multimedia program to collect patient health data
- Science and the advancement of eHealth: a call to action

Summary

- Important
- Exciting
- Transdisciplinary
- Working to link Behavior-Technology

Behavioral Informatics: A Perspective From Behavioral Medicine

Beth Bock, PhD
Centers for Behavioral and Preventive Medicine
Brown Medical School
The Miriam Hospital

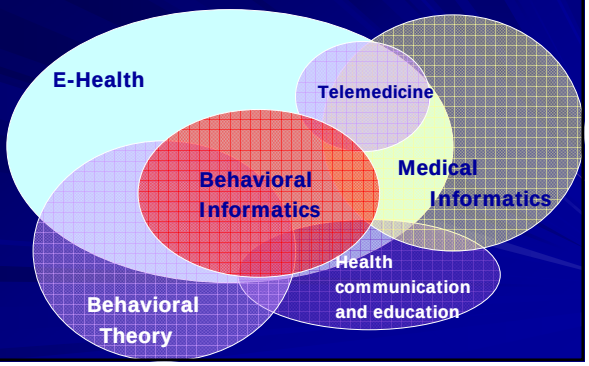
What is Behavioral Informatics?

- Definitions
- The body of knowledge
- Investigators
- Salient research questions
- Future Development

Definitions
"*Behavioral what*"?

- Google it!

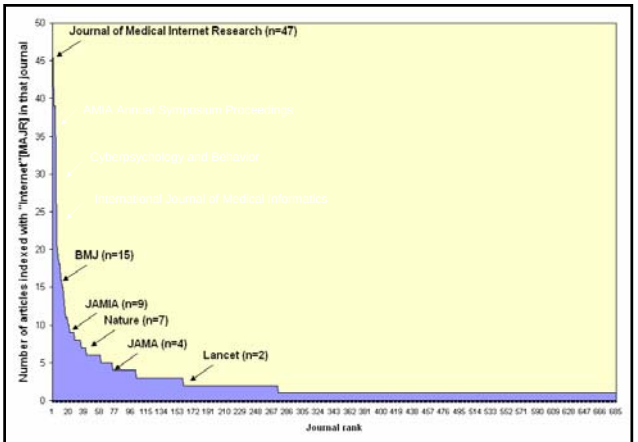
Overlapping Domains



A Transdisciplinary discipline

- Many definitions and Domains
- Diverse resources
  - A search of “Internet” as a MeSH term
  - 2003-2004
  - 1,702 articles
  - 685 journals

Eysenbach & Norman, 2005 JMIR; 6(4); 1-5



Eysenbach & Norman, 2005 JMIR; 6(4); 1-5

B.I. Research: Who’s doing it & where are they?

- Many researchers
- Diverse geographic areas
  - United States, Canada, Switzerland, China, Australia, Germany…..
- Diverse areas of training
  - business/industry academic/medical.

Technologies

- Internet
- Interactive automated telephone
- Computers (lap, desk and kiosk)
- Expert systems
- Wireless networks
- PDAs
- CD-ROM and DVD-ROM

Searching…..

Term	PsyInfo	PubMed
Internet	5,464	9,477
Expert System	465	1,249
Hand-held/PDA	440	463
Wireless	139	987
Cell phone/Text msg.	121	78
Informatics	880	3,050
Computer	44,104	98,945
Desktop/laptop	195	472
Computer + tailored	121	306

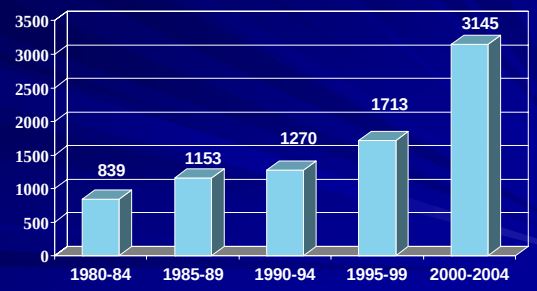
Searching for B.I. literature

Health Behavior	Articles	"I"	"B.I."
Nutrition/weight	30,205	90	37
Physical activity	3,640	25	9
Smoking	14,400	84	32
Alcohol/drug use	46,988	90	27
Diabetes	5,754	33	10
Asthma	2,914	8	4
Medication mgt.	789	72	17

Finding Relevant Content

Topic	Articles
Adolescent/teen	1,057,607
Substance use/abuse	208,405
Informatics terms	67
Behavior	31
B.I.	15

Number of B.I. articles



Research Challenges

- Measurement
  - Validity
  - Reliability
- Ethics
  - Consent
  - Confidentiality
- Research Design
  - Control conditions
  - Recruitment

Where are we?
B.I. & Health Behavior Change

An example from Smoking Cessation

- Assessment/measurement
- Tailored Print
- Internet
- E.M.I.

Where are we going?
Evolution of the field

- Population-level studies
- Outcome measures and metrics
- Dynamic theoretical models

Are we building a better mousetrap?

….. Or a smarter mouse?

Behavioral Informatics: The Informatics Perspective

Timothy Bickmore, Ph.D.

Boston University School of Medicine

Overview

- Origins and Evolution
- Using IT to Measure
- Using IT to Intervene
- Using IT to Change Research Methodology
- The Future

Origins and Evolution

- 1966 – Weizenbaum's ELIZA

Eliza: hi, i'm eliza. what do you want to talk about?
Me: behavioral informatics
Eliza: please go on.
Me: I'd like to know how technology can help researchers in behavioral medicine.
Eliza: what else comes to mind when you ask that?
Me: how can you help people stop smoking?
Eliza: perhaps you would like to be able to help people stop smoking.
Me: yes.
Eliza: i understand.

Origins and Evolution

- Very difficult to estimate number of IT researchers who have worked on BI applications
  - 28 attendees at AAAI Fall 04 Symposium on Dialog Systems for Health Communication
- Some Sub-Disciplines Discussed Today:
  - Sensing, Signal Processing, Wearable Computing, Ubiquitous/Pervasive Computing, Human-Computer Interaction, Computational Linguistics, Social Agents

Using IT to Measure

- Ability to detect & measure behavior is undergoing a revolution
- Use to study natural phenomena / causal models
- Use in interventions

Relevant Technologies: Sensing & Signal Processing

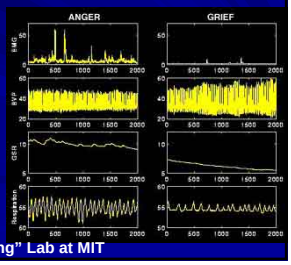
- Measuring what you couldn't measure before
- Identifying user affective state
- Identifying user activities
- Identifying social situations




From Rosalind Picard's "Affective Computing" Lab at

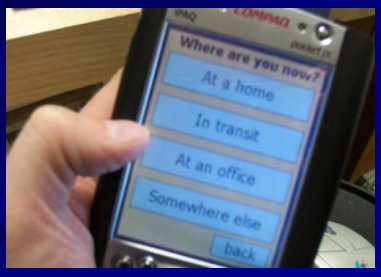
Recognition of Emotional State

- Recognition of emotional state from integration of multiple physiological signals
  - skin conductivity
  - blood volume pressure
  - respiration
  - electromyogram (EMG) on the jaw
- Good recognition rates on subjects intentionally expressing emotions



From Rosalind Picard's "Affective Computing" Lab at MIT

Tools for Behavioral Medicine: Ecological Momentary Assessment



Ability to prompt for in-situ data based on sensor data

Tools for Behavioral Medicine: PlaceLab

Dozens of sensors continuously record
- door openings
- appliance use
- motion
- videotape
- audiotape

Also
- GA Tech Aware Home
- Phillips HomeLab

Using IT to Intervene

- Human-Computer Interaction
- Games
- Intelligence & Natural Language Dialog

Using IT to Intervene: Human Computer Interaction

- New ways of interacting with computers, e.g.
  - Virtual reality (MMVR)
  - Gaze
  - Haptics / Tangibles
  - Multi-modal

Using IT to Intervene: Games

- Example: DiaBetNet
- Children compete with each to guess their glucose levels

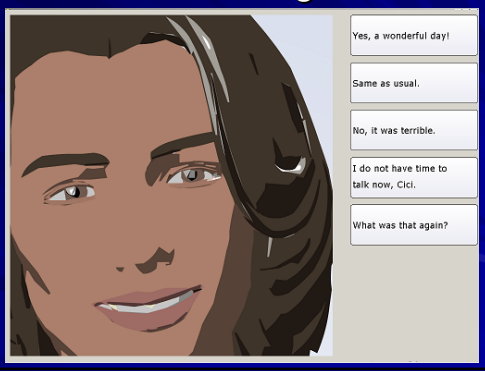
Using IT to Intervene: Computational Linguistics

- Ability for computers to communicate with us in unconstrained English
  - Words
  - Grammar
  - Discourse
- Embodied conversational agents
  - Hand gesture
  - Gaze
  - etc.
- e.g., tailor documents

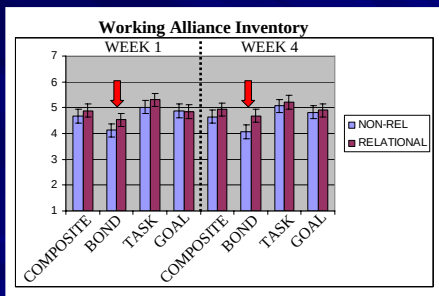
Example Intervention: Telephone Linked Care

- Automated system that users talk to on the phone
  - Digitized system voice, Touch-tone or speech user input
  - Typically weekly contact, 5-20 minute conversation, user or system initiated
  - Successfully applied to wide range of health applications

Example Intervention: Relational Agents

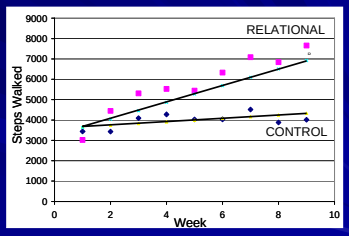


MIT FitTrack



Differences in BOND subscales significant:
WK1 p<.05
WK4 p=.007

FitTrack for Older Adults



Using IT to Change Research Methodology

- New technologies can fundamentally change the way research is conducted
  - New measures
  - New data collection methodologies
  - New human communication stimuli
  - New ways of representing & testing theory

New Methodology : Just-in-Time PA Intervention

New Methodology: Human Communication Stimuli

Ability to finely control
- speech intonation
- speech content
- nonverbal behavior
- timing / synchronization
- affective displays

New Methodology:

- Formalization of behavioral medicine theories, principles & strategies
  - Most interventions today are "scripted"

ON 5th INTERACTION WITH USER:
System: "On a scale of 1 to 10, how motivated are you?"
User: "5"
System: "Why not zero?"

  - Each intervention must be developed from scratch
  - Not scalable
  - No way to trace intervention messages back to theory (validation)
  - Can't directly compare underlying theories of two interventions
  - Very difficult to change or extend

New Methodology:

- Formalization of behavioral medicine theories, principles & strategies

Future Directions

- More natural, multimodal interfaces
- Orders of magnitude more tailoring
- Orders of magnitude increase in system intelligence and complexity
- Logical formalization of theories

Conclusion

- More info

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CONCLUDING REMARKS

Robert H. Friedman, MD
Boston University

WHAT IS BEHAVIORAL INFORMATICS?

An emerging discipline consisting of…

- the development and study of systems used
  - by or for patients/consumers and/or health professionals
    - for measurement and/or intervention
    - that combines the use of behavioral medicine content and/or principles with one or more information technologies.

WHAT IS BEHAVIORAL INFORMATICS?

An emerging discipline consisting of…

- the development and study of systems that
  - gather information from their users and/or
  - provide to their users
    - information and/or
    - counseling and/or
    - decision-making support and/or
  - facilitate unidirectional or bi-directional communication between its users.

WHAT IS BEHAVIORAL INFORMATICS?
An emerging discipline consisting of…

- the study of the designs of systems including:
  - their interfaces
  - their interactions with users
  - the structures, strategies, principles and theories used to
    - assess
    - educate, and
    - counsel the user

WHAT IS BEHAVIORAL INFORMATICS?
An emerging discipline consisting of…

It is a transdisciplinary discipline.

There are 'contributing' disciplines.

There are 'component' or 'overlapping' disciplines.

CONTRIBUTING DISCIPLINES TO BEHAVIORAL INFORMATICS

1. Behavioral Medicine
2. Communication Science
3. Computer Science
4. Biomedical Engineering
5. Health Services Research

DISCIPLINES THAT OVERLAP WITH BEHAVIORAL INFORMATICS

1. Biomedical Informatics (also medical informatics, health informatics)
2. eHealth (also consumer informatics)
3. Telemedicine

HOW I EXPECT BEHAVIORAL INFORMATICS TO EVOLVE

It will follow a course of development of other transdisciplines in health (e.g., behavioral medicine) and informatics (e.g., medical informatics).

HOW I EXPECT BEHAVIORAL INFORMATICS TO EVOLVE

FOCUS ON…

- The Researchers
- The Research
- The Professional Organizations that Represent the Researchers

DEVELOPMENT OF A TRANSDISCIPLINE: THE RESEARCHERS

1. Initially, individuals cross traditional discipline boundaries through collaboration and/or learning about the 'other' component discipline(s).
2. Subsequently, educational training programs create individuals with knowledge and skills in the component disciplines.

DEVELOPMENT OF A TRANSDISCIPLINE? THE RESEARCHERS

1. Initially, few researchers, very few researchers trained in all/most of the component disciplines, limited collaboration across the component disciplines and limited 'use' of component disciplines in research.
2. Subsequently, growth in numbers of researchers, increased cross-disciplinary training of researchers, increased collaboration across component disciplines, and more transdisciplinary research.

DEVELOPMENT OF A TRANSDISCIPLINE: THE RESEARCH

1. Initially, the focus is on creating practically useful things/programs/services.
2. Subsequently, there is a focus on developing a body of knowledge about the underlying processes, content, structures, and effects of the things/programs/services.

DEVELOPMENT OF A TRANSDISCIPLINE: THE PROFESSIONAL ORGANIZATION

1. Initially, there is no organization that 'represents' the transdiscipline.
2. Next, the transdiscipline is recognized as a component of other discipline(s).
3. Finally, the transdiscipline has its own professional organization.

WHAT DOES BEHAVIORAL INFORMATICS NEED TO DEVELOP?

- Participation of researchers trained in computational disciplines (computer science, medical informatics, biomedical engineering, etc.).
- Training programs at post-doctoral level, and later at pre-doctoral level.

WHAT DOES BEHAVIORAL INFORMATICS NEED TO DEVELOP?

- More sophisticated research in terms of types of systems developed and research questions addressed.
- Development of a unique body of knowledge and theory.

WHAT DOES BEHAVIORAL INFORMATICS NEED TO DEVELOP?

- Development of behavioral informatics professional organizations (in SBM, AMIA, etc. and ultimately a separate organization).
- Engagement with behavioral informatics researchers who are in industry, outside the U.S. and outside of behavioral medicine.

In Closing…

behavioralinformatics.blogspot.com
www.hetinitiative.org

Join the SIG listserve!
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