Improving The Process of Cancer Care

Session 1 of a 5 part series

Process of Care Research Branch

Division of Cancer Control and Population Sciences/Behavioral Research Program

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Series Purpose – for NCI

- Solicit opinions from three sectors of the community regarding problems in the quality of cancer care
  - Providers, Researchers, Health Care Purchasers
- Identify potential research topics that might address those problems
- Focus the research agenda of PCRB upon major underlying factors affecting the processes of cancer care.

For Participants

- Understand the perspectives of three communities with respect to problems in cancer care delivery
- Learn conceptual, analytic, and practical approaches to understanding and addressing problems in cancer care delivery
- Contribute to the development of NCI's research agenda

Ms F

Unmarried and Desirous of Children

Last MD Visit PE/Pap at age 18

6 yrs pass as she does not have an MD

Gets insurance. Decides needs PE

MD Visit PE/Pap

2 weeks

Phone call for F/U

MD Visit

-Refer to Gynecologist
-Cervical Carcinoma In situ
-Need Cone Bx

GYN Visit

One Month Delay

Oncology

Need Hysterectomy

Hysterectomy Performed June 14, 2001

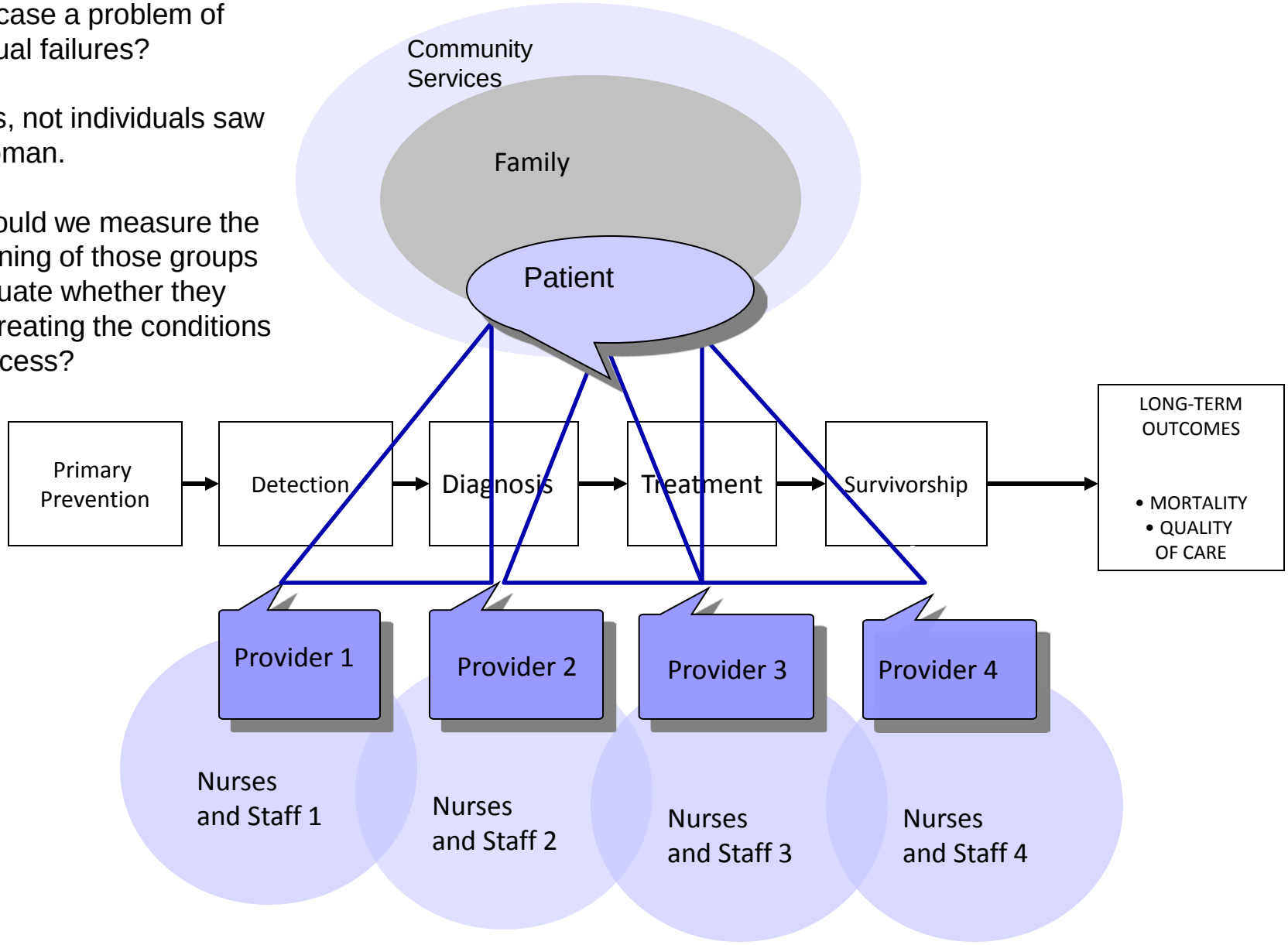
Radiation

Chemotherapy October 2001

Is this case a problem of individual failures?

Groups, not individuals saw this woman.

How could we measure the functioning of those groups to evaluate whether they were creating the conditions for success?



Adapted from Taplin et al 2009 (16)

Objectives

- Describe decision-based framework for designing team performance systems.
- Illustrate tradeoffs between components of this framework.
- Discuss applied and research-based examples of measuring team performance with observation and social sensors.

Understanding the tradeoffs

A FRAMEWORK FOR DEVELOPING MEASURES OF TEAMWORK

Decision Point Design Framework for Team Performance Measures

JOHNS HOPKINS MEDICINE

Why?
- Evaluation
- Feedback
- Research
- Certification
- Needs analysis

What?
- Teamwork competencies
- Multi-level evaluation

- What are the key decisions?
- What are the main options?
- What are the tradeoffs?
- What are the inter-dependencies?

How?
- Observation
- Self-report
- Scoring methodology

Where?
- Learning environment
- 'On the job'
- Hybrid approach

When?
- Frequency
- Timing relative to interventions

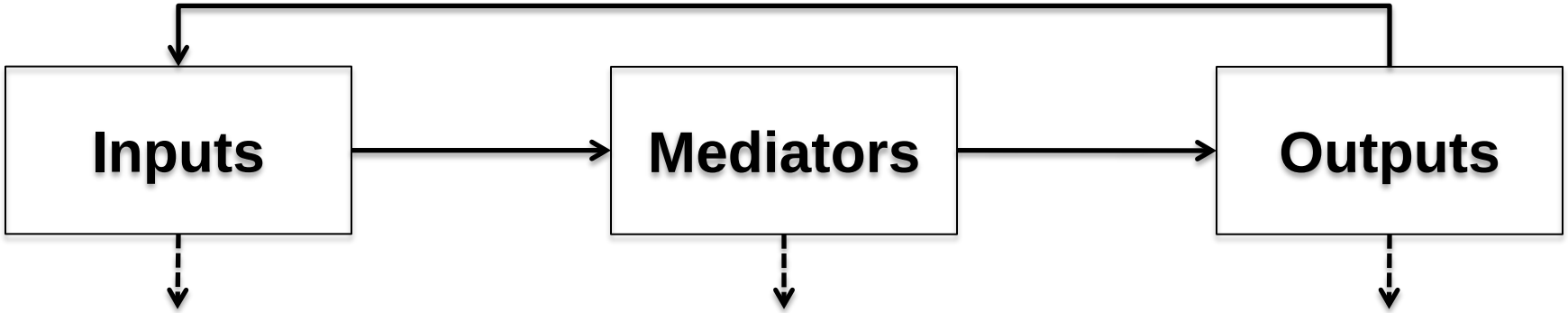
Who?
- Selecting, training, and supporting raters

Rosen, Scheibel, Salas, Wu, Silvestri, & King, 2013

How do you measure?

Method	Strengths	Challenges
Self-report Surveys	Familiarity Flexibility Established validity	Temporal resolution Respondent burden
Observation Behavioral markers	Objectivity Established validity	Maintaining reliability Cost / logistics
Social sensors Automated collection of social interaction data	Continuous / dynamic Low-cost	Privacy / trust Complexity of data
Activity traces Enduring data produced through task completion (email, ping, e-white boards, EMR use)	'Free data' (sort of) Can characterize distributed interaction	Privacy / trust Complexity of data

What do you measure?



Knowledge stock
- Shared mental models
- Transactive memory systems

Task characteristics
- Interdependence

Org. context
- Culture

Action processes
- Communication
- Leadership
- Performance Monitoring
- Back-up behavior
- Adaptation & learning

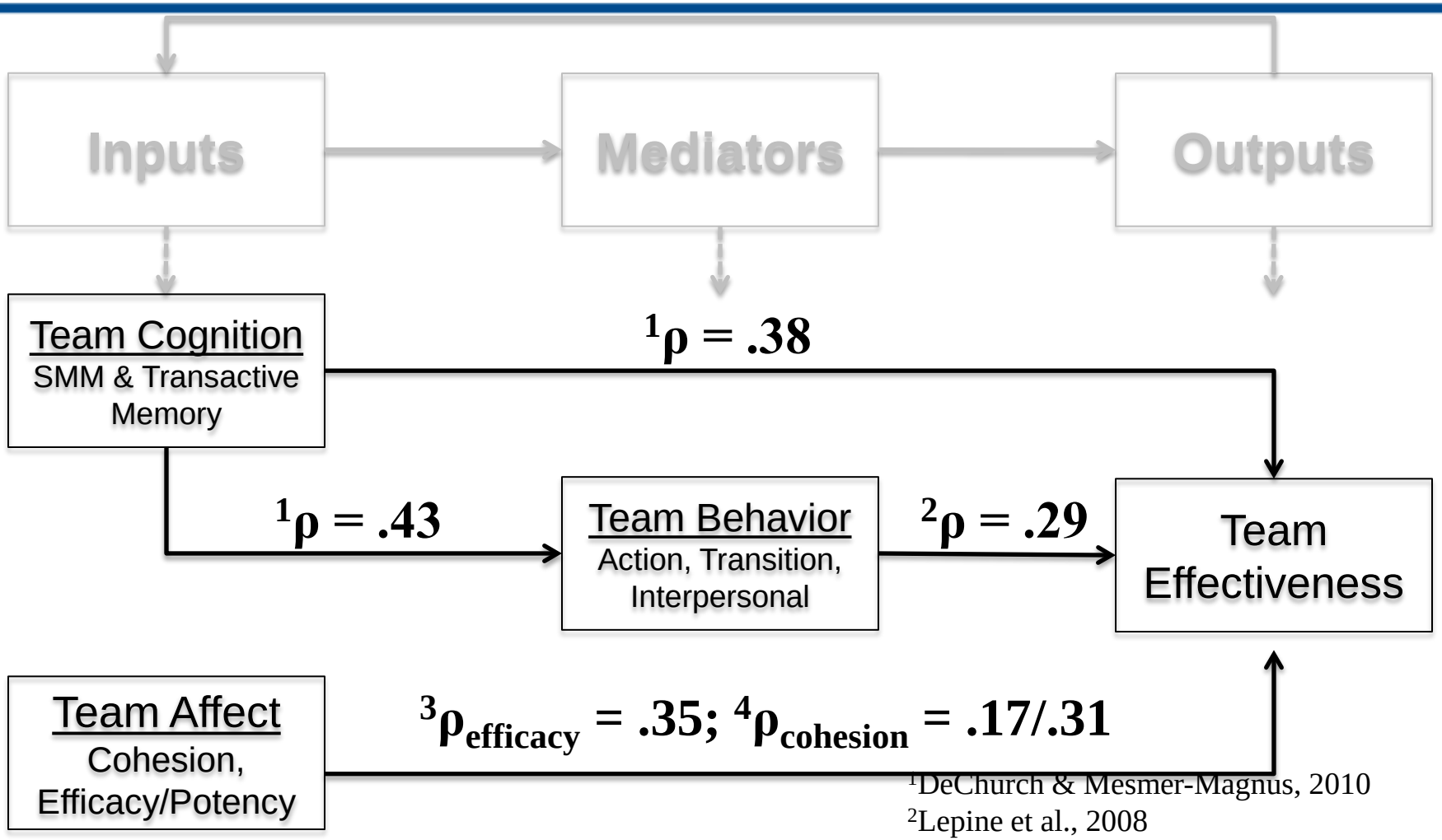
Transition processes
- Planning
- Goal specification

Interpersonal processes
- Conflict management

Effectiveness
- Task Outcomes
- Member Satisfaction
- Viability

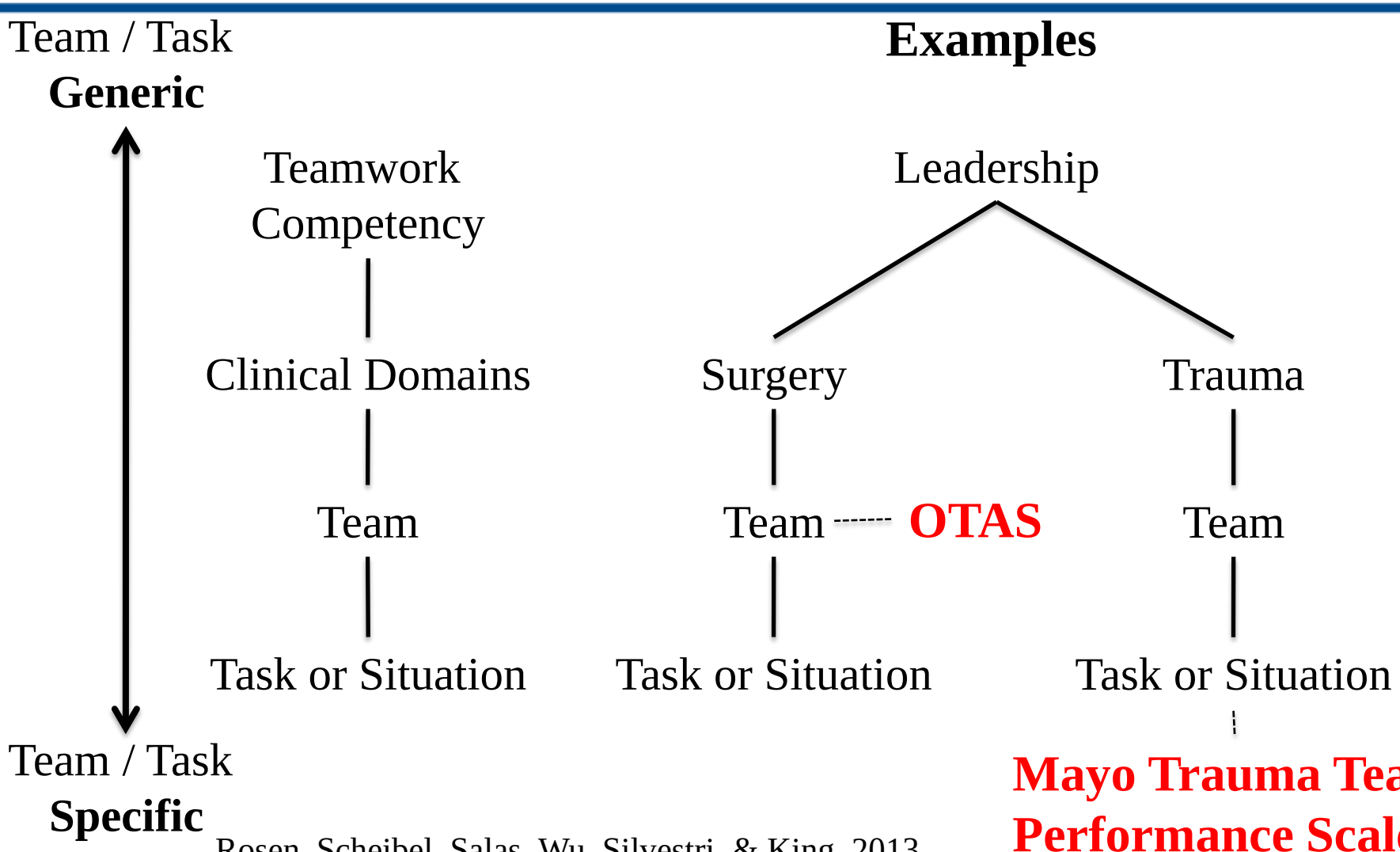
Team Learning Outcomes
- Δ Knowledge
- Δ Skill
- Δ Attitudes

What do you measure?



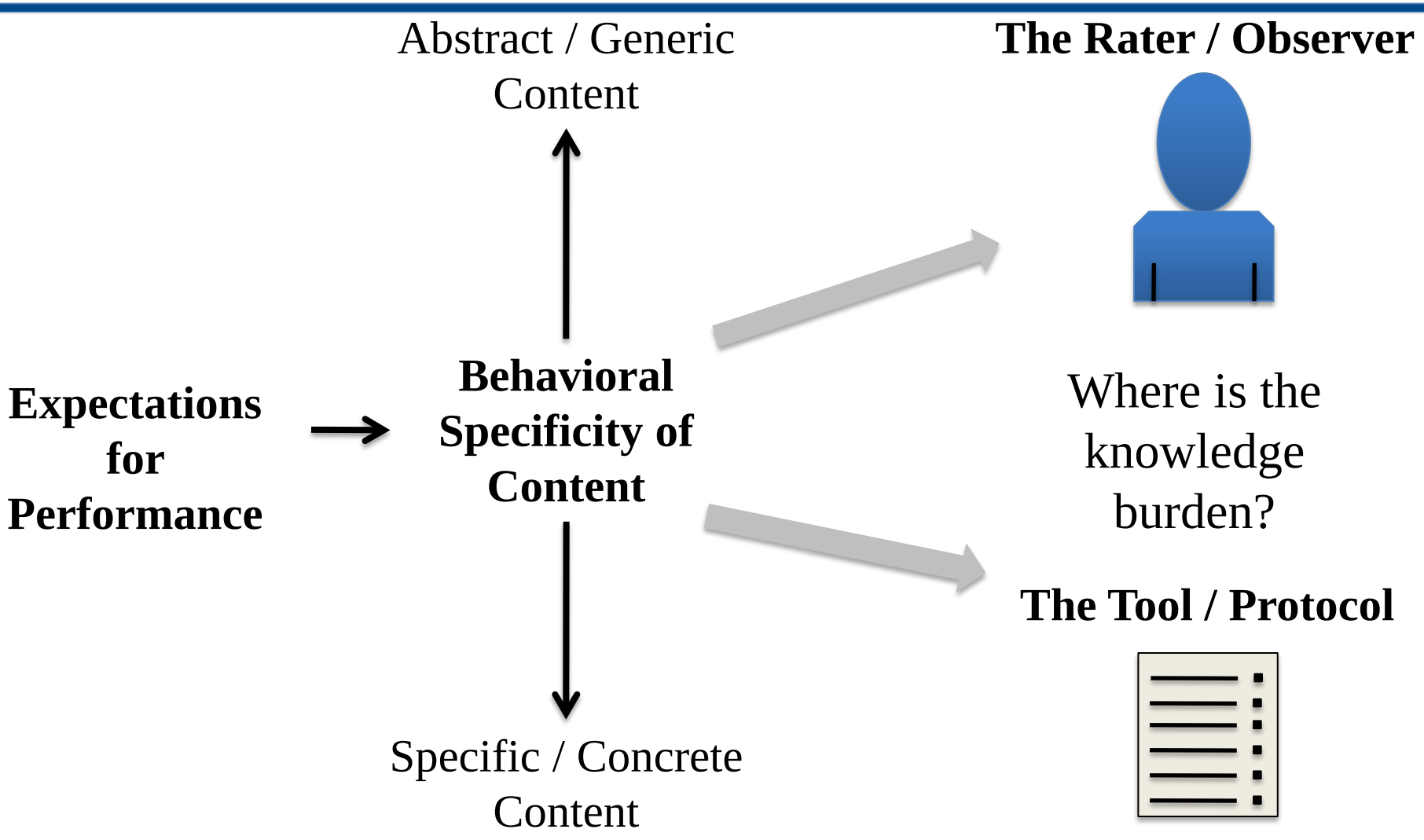
[1]DeChurch & Mesmer-Magnus, 2010
[2]Lepine et al., 2008
[3]Gully et al., 2002
[4]Beal et al., 2003

Abstraction Hierarchy for Behavioral Markers



Rosen, Scheibel, Salas, Wu, Silvestri, & King, 2013

Measurement Systems: From Markers to Metrics



Example

SOCIAL SENSORS

Developing methods to measure healthcare team performance in acute and chronic care settings

Michael A. Rosen, PhD

Assistant Professor, Armstrong Institute for Patient Safety and Quality

November 6th , 2013

Capabilities

- IR and Bluetooth sensors
  - Proximity
  - Location
- Microphones
  - Speaking (yes/no) and conversational analysis
  - Pitch / volume
  - Actual audio
- Accelerometer
  - Activity
  - Posture

Emerging validity evidence

- **Team inputs**
  - Personality traits (~ r = .3 to .4)[1,2]
- **Team Mediators**
  - High reliability with observational measures in the ED (r = .96, p <.001)[3]
  - Classification of trauma team tasks (87.5% accuracy)[4]
- **Team mediators → outcomes**
  - Face to face interaction time predicted LOS in PACU (r = .53, p < .01)[1]

1. Olguin Olguin et al., 2009
2. Mehl, Gosling & Pennebaker, 2006
3. Kannampallil et al., 2011
4. Vankipuram et al., 2011

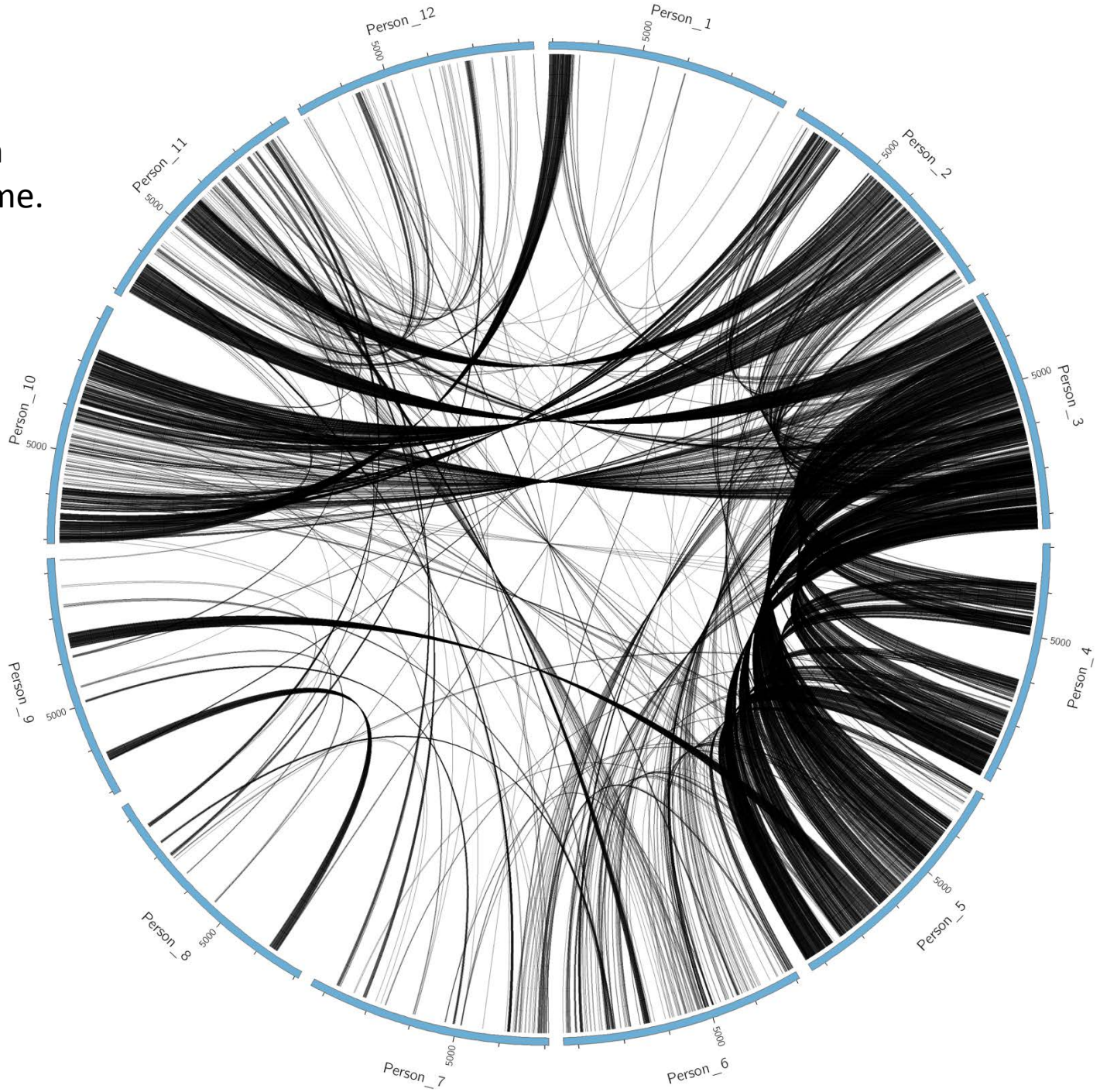
Pilot work

- **‘Micro’ validity evidence generated**
  - Sensor data covaries reasonably well with perceptions of interaction ($r = .59$, $p < .01$)
- **Data visualization**
  - We can’t analyze all of the complexity yet (more on this later), but we can see it.
  - Basis of the ‘interaction mirror’ intervention

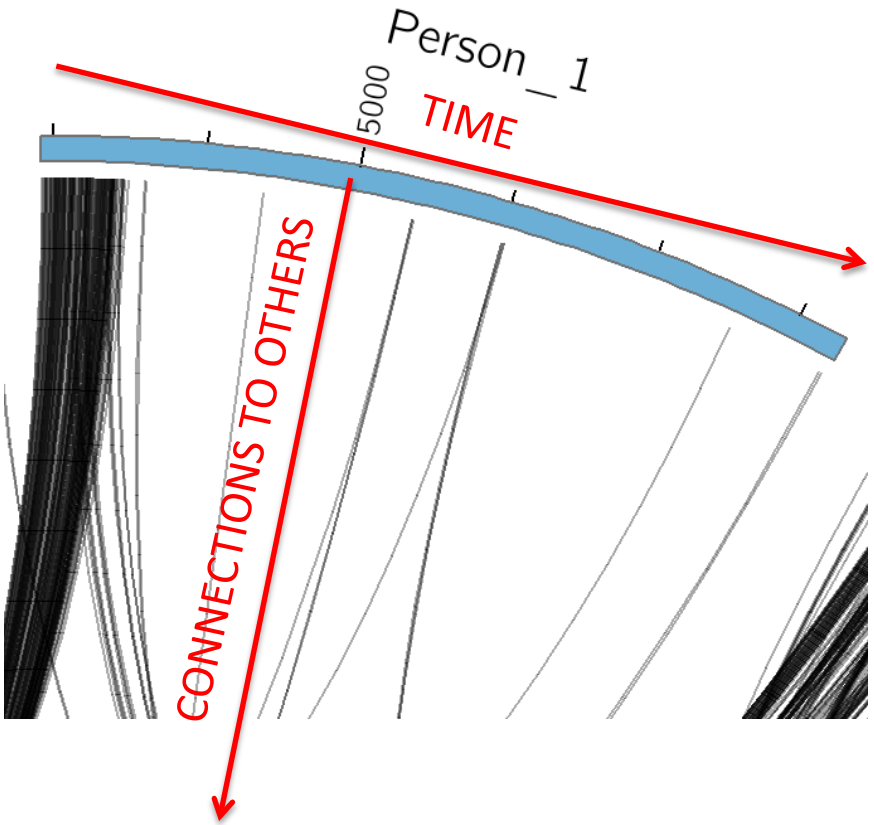
Bluetooth detections

Each blue segment is a person.

Each line is a connection between people over time.

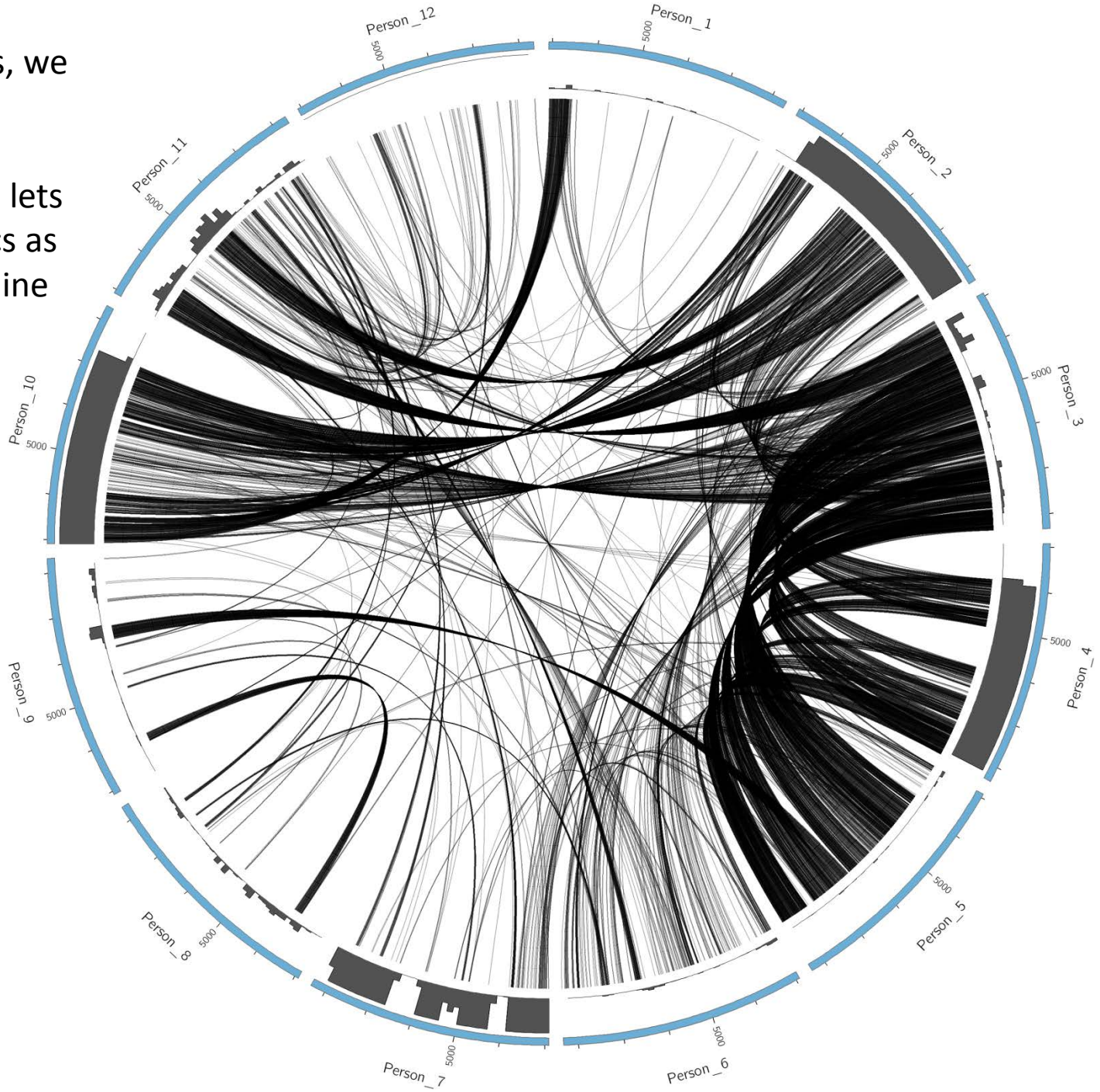


This data was collected at over 6 ½ hours.



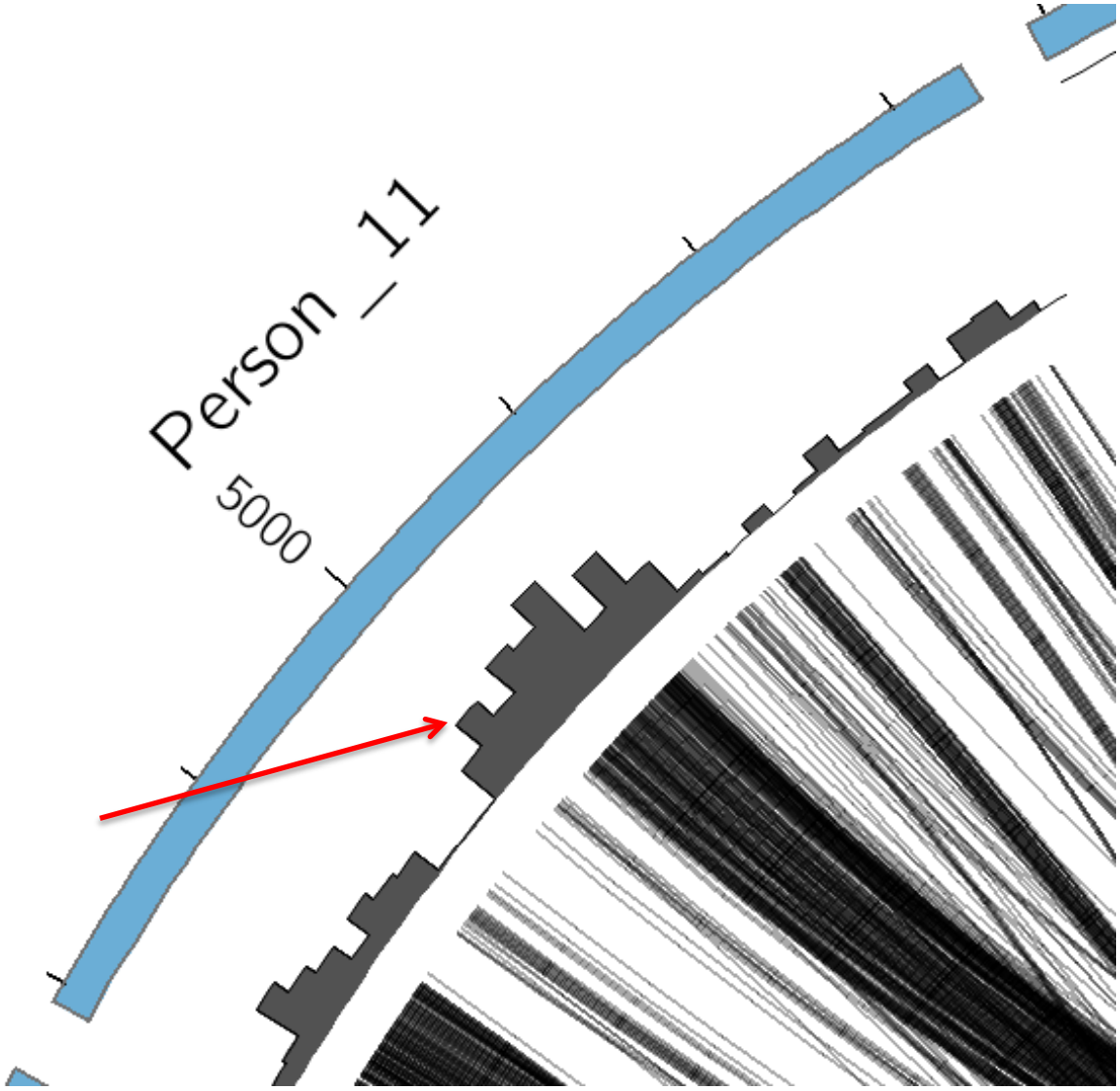
Time speaking.

In addition to detections, we can extract a variety of information from the microphone data. Circos lets us visualize these metrics as histograms, heat maps, line graphs, etc.

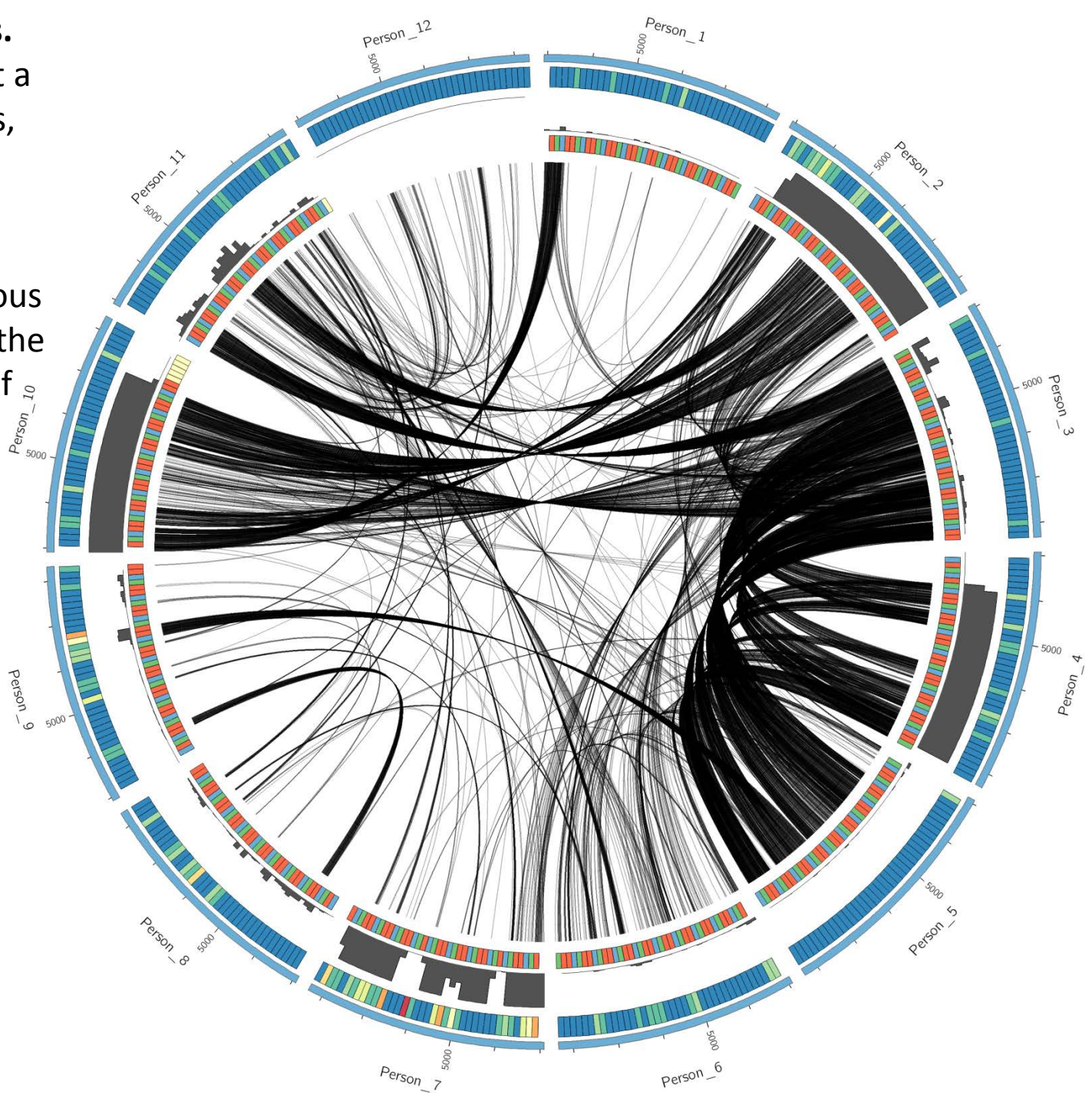


Speech analysis.
For each badges, the raw microphone data is parsed and each second of speech categorized as: *speaking*, *listening* (badge is silent in the proximity of another badge speaking), *overlap* (two badges in proximity are speaking), and *silent* (all badges in proximity are not speaking). This can be broken down to a 60 second time scale (or lower if needed).

Total number of seconds speaking over 10 minute period

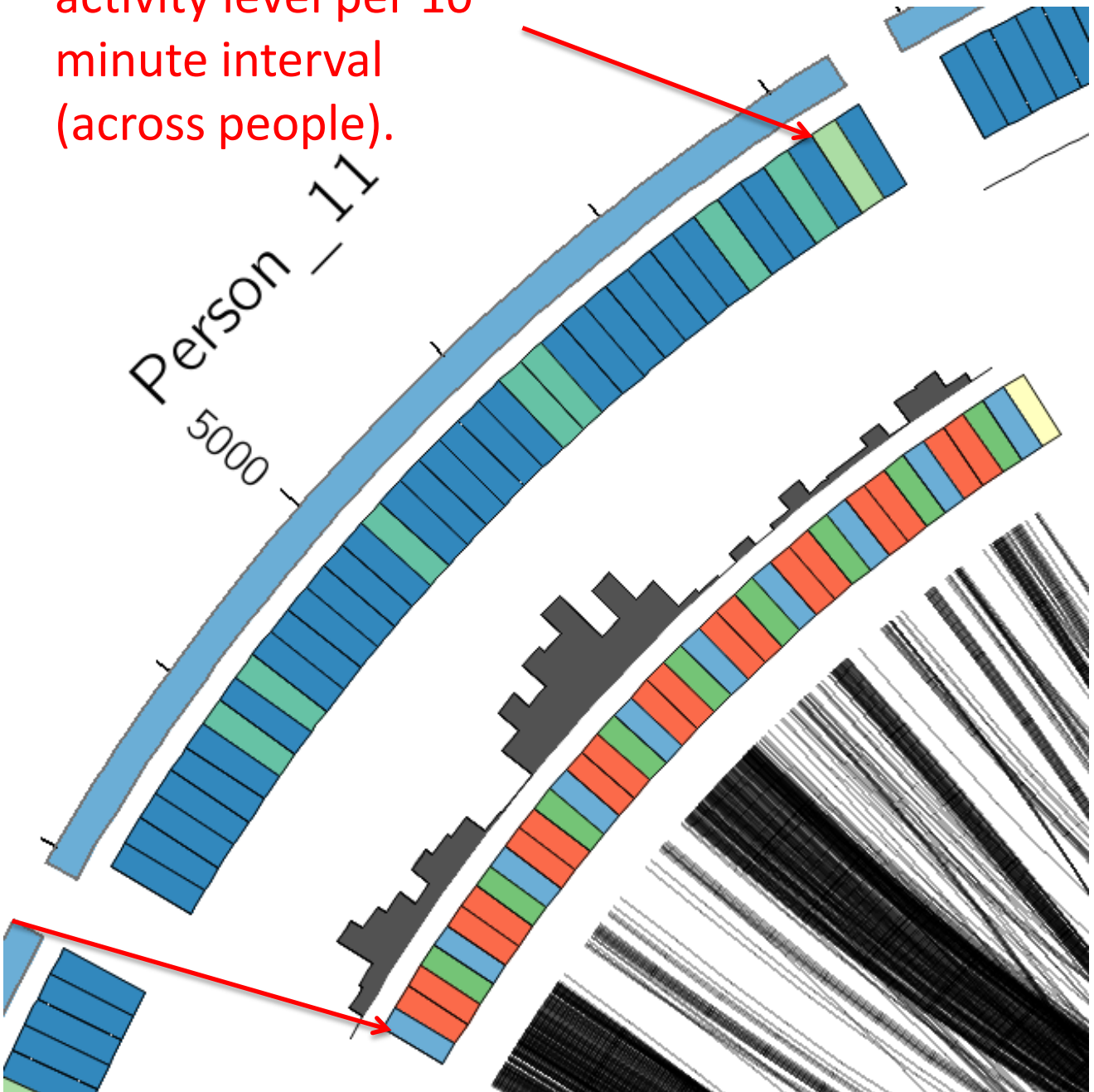


Additional data streams. While the badges collect a number of other metrics, the most immediately useful are *activity level* captured through an accelerometer, and various forms of *voice analysis* (the badges provide a form of spectral analysis).



Additional data streams. While the badges collect a number of other metrics, the most immediately useful are *activity level* captured through an accelerometer, and various forms of *voice analysis* (the badges provide a form of spectral analysis).

Heat map of mean activity level per 10 minute interval (across people).



Heat map of mean volume level per 10 minute interval, standardized within person.

Needed research in this area

- **Technical**
  - improving sensor properties and performance
- **Analytic**
  - developing real-time predictive algorithms
- **Psychometric**
  - establishing validity and generalizability evidence
- **Socio-cultural**
  - building a culture of trust in sensor-based systems
- **Interventional**
  - feedback and alerting displays

Our next steps

- Iterative participatory design of **feedback displays** for different roles and levels: individual, team, and unit views for immediate feedback and analyzing trends over time.
- **Validation of sensor-based measures** against traditional gold standards for teamwork and workflow (self-report and observational methods).
- Development of **predictive analytics** for dynamic network data: advancing the methods of tensor decomposition of networked sensors.

Questions?

- Mike Rosen
  - mrosen44@jhmi.edu

Continuing the Discussion

- We invite you to join us in the upcoming Cyber Discussions. Remember, your participation is essential to shaping this research agenda.
- **Save-the-dates:**

Wednesday, March 19, 2014, 2:00 PM - 3:00 PM EST
Cooperation, Competition and Team Performance: Towards a Contingency Report
Dr. Stephen Humphrey

July 9, 2014, 2:00 PM - 3:00 PM EST
Team Based Measures in Primary Care
Dr. Richard Ricciardi

November 5, 2014, 2:00 PM - 3:00 PM EST
Research Priorities in Cancer Care Teams Research
Dr. Eduardo Salas

July 1, 2015, 2:00 PM - 3:00 PM EST
Team Cognition: Understanding the Factors That Drive Process and Performance
Dr. Steve Fiore

- To register, go to: http://dccps.nci.nih.gov/brp/pcrb/cyberseminars.html
- If you have questions, contact Veronica Chollette (cholletv@mail.nih.gov)