

**National Institute on Aging
National Institutes of Health**

A Call for Novel Methodologies and Approaches for Dyadic Analyses in the Context of the Family and Intimate Relationships

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Meeting Summary

Humans are highly social animals, and a substantial body of research has demonstrated that mental and physical health is influenced by relationship quality. In-depth study of the ways that particular dyadic relationship processes influence health has been limited by a number of methodological and ethical limitations. However, new technical and analytical methods provide opportunities to expand our understanding of how relationship factors, in contrast to individual factors, influence health and wellbeing. The National Advisory Council on Aging has advised the Division of Behavioral and Social Research (BSR) at the National Institute on Aging (NIA), National Institutes of Health (NIH) to pursue research that identifies and specifies the dyadic processes within interpersonal relationships (particularly intimate and family relationships) that influence health. On May 20, 2016, BSR commissioned the National Academies to convene a meeting to elicit input from five expert panelists on the most promising targets and methodological approaches for improving understanding of the ways that dyadic interactions influence health outcomes.

The meeting, organized by the Board on Behavioral, Cognitive, and Sensory Sciences (BBCSS), consisted of two parts. First, each invited expert gave a brief presentation of the methodological approaches they use in their own research. Second, a moderated discussion addressed five guiding questions:

1. What are the most robust and consistent behavioral and physiological measures that characterize high-quality relationships and explain their associations with health outcomes?
2. What methods can be considered the gold standards for operational definition of quality and satisfaction in dyadic relationships? What other important aspects of dyadic relationships should be defined?
3. What are the methodological barriers in the relationship sciences? What are the best solutions for resolving ethical challenges?
4. What relationship processes have not been, but should be, studied, within dyads and beyond?
5. What are the most promising new tools and ecologically valid methodological approaches to specify and measure dyadic relationship processes? What new tools are needed to complement existing tools, such as naturalistic observation methods (i.e., Ecological Momentary Assessment and Electronically Activated Recorder)?

Several key themes emerged from the meeting:

- Global self-report measures alone are often insufficient for assessing relationship quality. An ideal research approach would use a combination of aggregated self-report data, objective observation, and other forms of data, including physiological measures and informant reports.
- New methodologies, such as facial recognition, speech analysis, and naturalistic data

recording, present opportunities to overcome methodological limitations within the field and to provide insight into the relationship between dyadic relationships and health outcomes.

- Relationship metrics tend to show a great deal of stability over time. It is valuable to study transition points where dyadic behavior might vary from a previously established equilibrium. These transition points can inform researchers about the processes by which partners regulate their relationships and can provide insight into the factors that influence relationship quality and success.
- Interventions targeting relationship violence are more likely to be effective the earlier they are undertaken. More research is needed to identify predictors of relationship violence and to design effective intervention techniques.

This document summarizes the proceedings of the meeting. Appendix 1 contains the meeting agenda, and Appendix 2 contains a list of meeting participants.

Introductory Remarks

Melissa Gerald, Division of Behavioral and Social Research, NIA

Dr. Gerald reported that BSR supports social, behavioral, and economic research within an aging and life course context that contributes to areas important to health and wellbeing. Recognizing that family and intimate relationships are critical to wellbeing, BSR has a long-standing interest in understanding the ways that relationship quality influences health outcomes. Feedback from this workshop will inform future programmatic developments in the field of dyadic relationship research. BSR is particularly interested in understanding the role of relationship dynamics in adaptation to life transitions, chronic illness, or disability; intimate partner violence and elder abuse; caregiving for dementia and other age-related diseases; and explaining well-documented associations between social relationships and aging-relevant health outcomes, including mortality.

Methods Blitz

Each invited expert gave a 3-minute presentation of the methodological approach he or she employs to study dyadic social interactions and a key health-related finding from the work. Each presentation was followed by a short question-and-answer period.

Avatars, Random Assignment, Facial Affect Coding, and Dyadic Dynamics

Steven Boker, University of Virginia

Dr. Boker's laboratory applies principal components analysis to faces to create highly realistic video avatars.¹ These avatars' gender, race, appearance, and facial expression can be manipulated without the knowledge of naïve participants, who believe they are watching live

¹ Theobald, B., Matthews, I., Mangini, M., Spies, J., Brick, T., Cohn, J. F., & Boker, S. (2009) Mapping and Manipulating Visual Prosody. *Journal of Language and Speech* 52:2, 369–386. PMID: PMC2716035

video.^{2,3} Video of a human face can be reduced to 8-10 components, which can then be used to create an avatar. This principal components analysis will eventually allow researchers to extract a multi-dimensional emotion space from humans in real time, allowing for observation and subtle manipulations of dyadic interaction dynamics, such as mirroring behavior.

Avatars are created using 40 frames of input that are annotated and then subjected to principal components analysis. A bitmapping algorithm renders the resulting components as an avatar. Although the demonstrations presented at the workshop tracked a single person, a model that tracks the behavior of both people in a conversation is currently being built. This new model will allow for measurement of the structure of the coordination of people's movements in a conversation and how this structure evolves over time.

Observational Methods

Richard Heyman, New York University

Using analog, laboratory-based tasks, Dr. Heyman's laboratory observes interactions between couple and parent-child dyads. To study romantic couples, tasks are designed to elicit conflict and support by encouraging partners to discuss important issues within their relationship. Parent-child dyads are given compliance tasks to elicit coercive processes. Eliciting strong emotions such as anger is surprisingly easy in the laboratory setting using these types of paradigms. Results from this research have shown that distressed couples are more hostile than non-distressed couples and have demonstrated particular patterns of interaction (such as reciprocating and escalating hostility) that can be investigated as possible drivers of health-related outcomes. A new study on coercion in 100 parent-child and couple dyads examines how negative relationship processes influence health outcomes, including diabetes and early childhood caries.

One goal of this research is to create and validate a simple measure of coercion. The current approach, using hand coding of video data, is very labor intensive but provides a rich testing ground for new hypotheses. It is not yet known whether a short self-report measure could effectively measure coercive behavior. Researchers are currently working on tools that could automatically code affect on this type of task.

The Over-Time Actor-Partner Interdependence Model

Deborah Kashy, Michigan State University

To understand the ways that couple and family relationships influence wellbeing, Dr. Kashy uses statistical models of interdependence. Recent work assessed positive and negative communication behaviors in patients with head, neck, and lung cancer and their spouses at three time points. An over-time model was used to predict psychological distress as a function

² Boker, S., Cohn, J., Theobald, B., Matthews, I., Brick, T., & Spies, J. (2009) Effects of Damping Facial Expression in Dyadic Conversation Using Real-Time Facial Expression Tracking and Synthesized Avatars. *Philosophical Transactions of the Royal Society B*, 364, 3485–3495. PMID: PMC2781890

³ Boker, S., Cohn, J., Theobald, B., Matthews, I., Mangini, M., Spies, J., Amabadar, Z. & Brick, T. (2011) Something in the Way We Move: Motion Dynamics, not Perceived Sex, Influence Head Movements in Conversation. *Journal of Experimental Psychology: Human Perception & Performance*, 37:2, 631–640. PMID: PMC2781890

of earlier communication patterns, controlling for distress at baseline. Results showed that distress was highly stable, but that patients and spouses who communicated more positively with their partners were less distressed at subsequent time points, controlling for their own past distress. Partner positive communication did not have an effect. However, patients and their spouses were impacted by the negative communication behaviors of their partner, which led to more distress at later time points. No differences were found between patients and their spouses in how their distress was impacted by communication within the relationship.

More research is needed to determine whether similar patterns would be found in couples who are not undergoing health crises. The model used in this study controlled for many variables, including an individual's own distress and positivity at baseline. When these factors were in the model, positive communication from partners was not a significant predictor of future distress. Future analyses looking within one time point would be needed to test whether an individual's tendency toward positive communication could provide a buffer against distress.

Using Informants to Assess Relationship Quality

Edward Lemay, University of Maryland

Informant reports from friends, family, coworkers, and others can predict behavior beyond what is predicted by self-report measures. Informant reports are a commonly used tool in personality research. Dr. Lemay's research uses informant reports to assess relationship quality. Informant reports may be less contaminated by social desirability or positive illusions biases than self-report measures. They are based on natural interactions rather than laboratory experiments and can be aggregated over multiple informants for improved reliability. They are also relatively inexpensive. In a study of 219 dyads, each target dyad member provided contact information for two friends or family members who were then paid to complete online questionnaires assessing their perceptions of each partner's concern for the other's welfare. Targets also completed self-report questionnaires that measured relationship satisfaction and concern for their partner's welfare and a conflict discussion task that was objectively coded for responsive behaviors. Informant reports of partners' concern for each other's welfare captured unique variance in predicting each target's relationship satisfaction that was not captured by self-report or objectively observed responsive behaviors. Informant reports, but not self-report or objective observations, predicted targets' self-reported social anhedonia a year later.

Targets gave informed consent to ask informants about their relationship. Consent was also obtained from informants. Informants were also asked about the relationship satisfaction of each member of the dyad, but were not asked about emergent properties of the relationship. One key difference between the objective laboratory measure and the informant ratings was that the laboratory task explicitly elicited conflict, while informants may have observed different types of interactions between the target dyads. Another key difference is that objective observers based their judgments on a single interaction, while informants saw patterns of behavior that occurred over time in the relationship.

Overview: An Acoustic Window into Social Life

Izhak Shafran, Google

Early methods for creating fine-grained records of behavior were obtrusive and labor-intensive. It is now easy to record human and animal behavior using video recording. However, video methods generate enormous amounts of data, creating storage and analysis challenges. Acoustic recordings from telephone calls or other audio sources generate smaller datasets that are relatively easy to store, but nonetheless provide a fine-grained measure of social behavior occurring in naturalistic contexts. Continuing the thread of work pioneered by James W. Pennebaker and Matthias Mehl,⁴ and replacing their natural annotation with automated inference using state-of-the-art speech and language technology, Dr. Shafran's work has shown that analysis of phone conversations can identify high-level features such as the type of relationship between conversation participants with greater than 80 percent accuracy. Individual characteristics can also be inferred: a study of teens and parents using acoustic analysis techniques was able to classify teens with depression with an overall accuracy of 74 percent.

Classifiers can be trained based on relatively small datasets. For example, the depression study involved 60 minutes of data from each of 126 dyads. High-level inferences can be made from acoustic data using syntactic parsing tools that are publicly available.

Moderated Discussion

Experts and BBCSS members discussed a set of questions that were distributed before the meeting. BSR expressed particular interest in identifying measures of relationship quality that could be included in large panel studies; can identify couples at risk of violence or abuse; or can be targeted for intervention or used to validate intervention success. Experts were asked to identify innovative ideas for extracting and analyzing data or evaluating hypotheses to better specify the processes within close relationships that influence health outcomes.

Methods and Constructs for Defining Relationship Quality and Satisfaction

This section summarizes discussion around the first two questions:

- What are the most robust and consistent behavioral and physiological measures that can characterize high-quality relationships and explain their associations with health outcomes?
- What methods can be considered the gold standards for operational definition of quality and satisfaction in dyadic relationships? What other important aspects of dyadic relationships should be defined?

Key Methods

Experts discussed a number of methodological paradigms that assess relationship quality. The most robust, well-validated measures included

- Self-report questionnaires

⁴ Mehl, Matthias R., & Pennebaker, J.W. (2003). The sounds of social life: a psychometric analysis of students' daily social environments and natural conversations. *Journal of Personality and Social Psychology*, 84(4), 857-870.

- Observer report measures
- Analysis of emotion through voice and facial expressions
- Physiological measures

Item response theory is a powerful tool for creating self-report questionnaires that provide the best possible precision of measurement while optimizing efficiency. For example, Ronald Rogge developed a four-item measure that distills decades of research on relationship satisfaction into the most critical indicators.⁵ Repeated measures in which participants report on their feelings in the moment are more accurate than global self-report measures, where participants attempt to aggregate their experiences over time. Ideally, repeated observations can be randomly sampled to create an accurate aggregate measure. Informant reports can also provide more objective perspectives on relationships to supplement self-report measures.

Individual mental health variables are also important predictors of relationship quality, because individual attributes affect both people within long-term relationships. Implicit attitude tests can also be used to predict relationship outcomes such as divorce. Large datasets and panel studies provide an important resource for studying relationships, although there is a tradeoff between measurement precision and the size and breadth of a sample. Newer approaches, including computational methods that analyze naturalistic video and audio recording, also hold significant promise for improving researchers' understanding of how relationship quality influences health outcomes, if ethical issues can be resolved. Experts suggested that the best measure of relationship quality would be a latent variable that captures shared variance across a variety of methods.

Key Constructs

Relationship quality consists of a number of constructs, including support behaviors, commitment, capitalization (enhancing a partner's experience of positive events), behavioral regulation, caring for each other's wellbeing, coercion, escalation, hostility, and focus on self, versus the relationship. These constructs can be measured directly by objective observers in the laboratory or in naturalistic settings, or can be measured by self- or observer-report questionnaires. Predictions about future relationship quality are also powerful predictors of relationship commitment and of behavior toward one's partner. More research is needed to understand normalizing behaviors that couples use to de-escalate and reduce conflict.

Methodological and Ethical Barriers in the Relationship Sciences

This section summarizes discussion around the following question:

- *What are the methodological barriers in the relationship sciences? What are the best solutions for resolving ethical challenges?*

⁵ Funk, J. L., & Rogge, R. D. (2007). Testing the ruler with item response theory: increasing precision of measurement for relationship satisfaction with the Couples Satisfaction Index. *Journal of Family Psychology*, 21(4), 572.

Randomization and Manipulation

A central challenge in relationship research is the inability to randomize participants to relationships, or to manipulate key aspects of partners and relationships in convincing and meaningful ways. Most relationship research is nonexperimental, consisting largely of prospective studies that cannot fully establish causation. When researchers are able to manipulate how partners interact and view each other, careful ethical consideration is necessary to ensure that there are no long-term consequences for the dyads being studied. Novel methods that make use of online relationships and digital avatars may provide new opportunities to conduct meaningful manipulations of dyadic interactions. However, thoughtful and subtle experimental designs are still necessary to address the ethical concerns inherent in manipulating variables within close relationships.

Identifying Causes and Predictors of Violence in Relationships

Intimate partner violence, child maltreatment, and elder abuse are problems that arise within close relationships. Interventions that effectively prevent or curtail violence in relationships are badly needed. Violent behavior patterns become more difficult to change as they become more established over time, suggesting that interventions may be most effective if they are implemented before violent behavior begins. However, this would require accurate identification of individuals or couples who are at risk for violence. Behaviors that might intuitively seem to predict physical violence, such as hostile and coercive relationships and even emotional abuse, are in fact far more common than physical violence, presenting a real challenge to researchers in determining when poor relationship dynamics will lead to physical violence. New approaches such as naturalistic data collection (discussed below) may prove particularly helpful for identifying relationship patterns that can predict violence.

Research into the health consequences of relationship violence faces a second methodological problem: nearly all relationship violence takes place within relationships that also exhibit nonphysical problems such as hostility and emotional abuse. It can be difficult for researchers to disentangle the health effects of physical violence from the effects of more common harmful relationship factors. It is critical to properly control for the impacts of hostile environments and emotional abuse when measuring the health effects of physical violence. Detailed data are necessary to fully explicate the interplay between physical violence and hostile relationship patterns; however, such data are extremely difficult to collect or access. As a result, the unique and interactive effects of hostility, emotional abuse, and physical abuse are not well understood. Large and detailed studies are needed to assess what types of relationship patterns and behaviors are most harmful for long-term health outcomes, as well as to explore the possible buffering effects of positive dyadic interactions.

Models of Time in Relationship Research

Careful use of longitudinal research methods can overcome many of the methodological challenges inherent in relationship research. When conducting such research, it is critical to carefully identify an appropriate model of time to use in analyses before beginning data collection. Researchers should consider whether they expect to see change in their measures over time, and what time points and intervals are most informative to answer their research

questions. Linear growth models are often unrealistic models of relationship phenomena, especially following interventions, when most relationships will stabilize around an existing or new equilibrium rather than continue to improve. Clear theoretical predictions and thoughtful study design are critical when conducting longitudinal research.

Different models are needed to assess factors that impact relationships on shorter and longer timescales. Connecting short- and long-term models of relationship change is a key challenge in the field of relationship research. Another challenge in comparing relationship quality over time is that participants may interpret self-report measures differently as they age. Using objective observer tasks may help mitigate this problem, although research has found age differences in a couple's willingness to identify a conflict to discuss in a laboratory conflict task.

Regulatory Relationship Dynamics and Responses to Transitions

One common finding in relationship research is stability of relationship traits over time. This can present a challenge to researchers who are interested in studying short-term variability in relationship quality, or in designing interventions to prevent unhealthful behaviors within a relationship context. Small perturbations from equilibrium may also be overlooked by researchers who focus on aggregate measures of relationship quality over time. Thus, stability is not always a desirable quality of relationship metrics. Several methodological approaches could help researchers identify departures from equilibrium and regulatory dynamics that contribute to maintaining equilibrium. First, it may be useful to target key transition points within relationships, such as illness, retirement, or the transition to parenthood. These transition points can lead to temporary or permanent changes in relationship quality, and comparing couples who are successful and unsuccessful at restoring a beneficial equilibrium after a transition could provide important insights into relationship behaviors and characteristics.

Introducing couples to novel, challenging tasks in the laboratory could provide an opportunity to observe regulatory relationship dynamics on a smaller scale. An even more subtle approach could use the avatar method discussed by Dr. Boker to measure participants' reactions to subtle perturbations in a partner's movements or facial expressions during a dyadic interaction. Finally, dense data derived from telephone, texting, or email conversations could allow researchers to identify and study transition points within relationships.

Challenges in Naturalistic Observation Methods

Data mining of email, text, and phone conversations can provide a rich source of information about relationships. Technical challenges to collecting, transcribing, and analyzing these data are quickly being overcome. However, important concerns about privacy remain. These methods could allow researchers to link a large number of observations over time to the same individual; however, granting such extensive access can be viewed as risky and uncomfortable by participants. Studies that do not adequately protect privacy risk erode the trust of research participants, so it is critical that all researchers are well informed and proactive about protecting patient data when engaging in this type of research.

One way to overcome privacy concerns is to conduct all analyses automatically so that researchers never see participants' raw data. Ideally, this analysis can be conducted on the participant's own device, with only anonymized summary statistics transmitted to researchers. Consumers appear to be willing to give up data privacy if they believe they receive a benefit from doing so. Providing analytics or feedback to participants might increase willingness to participate in this type of study. Allowing participants to control their own data may also encourage participation in data-intensive research.

Ethical issues in naturalistic data collection must be resolved by not only obtaining participant consent, but also passing grant and Institutional Review Board (IRB) review and abiding by laws that vary by locality. The NIH can facilitate progress in this area by making recommendations about privacy and data management standards that will facilitate public trust, identify bad study designs, and enable thoughtful projects to receive funding. Similar standards can be applied to data sharing once large datasets are established.

In addition to the technical and ethical challenges to the data mining approach, there are many methodological and theoretical questions about the ways that day-to-day interactions (and other measures collected using data mining approaches) can inform researchers' understanding of relationships. Laboratory observational paradigms tend to focus on emotionally charged interactions. Data mining approaches will presumably collect data from many more mundane interactions, and the utility of these interactions in predicting relationship quality is not yet known.

Relationship Processes in Need of Further Study

This section summarizes discussion around the following question:

- *What relationship processes have not been, but should be, studied, within dyads and beyond?*

Assessing the Impacts of Multiple Relationships on Health

Most people have several important relationships in their life. As a result, focusing on any one dyadic relationship creates an incomplete picture of a person's support network. Assessing relationship processes across multiple close relationships may provide new insights into how close relationships influence health. Aggregating data across multiple interactions could determine how interacting with different close relationship partners influences stress levels, and how these interactions relate to long-term changes in health.

This type of paradigm can also lead to greater understanding of how consistently individuals behave across different relationships, how these patterns are influenced by early experiences, and the extent to which behaviors are open to intervention. Studying a subset of a large longitudinal sample, and including interactions with unacquainted individuals, could allow researchers to gain a more thorough understanding of individual predictors of healthy and unhealthy relationship dynamics.

Other Opportunities

The panel identified several other potential targets for future study:

- The dynamics of caregiving relationships from diagnosis through end of life, particularly for patients with diseases that lead to rapid decline, such as cancer.
- The benefits, as well as the costs, of caregiving for one's own mental health and wellbeing, and the role that additional supportive relationships play in easing caregiving burden.
- The lasting consequences of early adverse relationship experiences on later relationships and on health.
- How couples in military families respond to stress in adaptive and harmful ways. This should be studied longitudinally, beginning before military deployment and continuing after the deployed family member returns.
- New types of relationships created by technological innovations, such as Fitbit friends, virtual communities of Parkinson's sufferers, and other social network contacts. More research is needed to understand how technology promotes new relationships and how these differ from traditional face-to-face relationships.

New and Emerging Tools and Methodologies for Measuring Dyadic Relationship Processes

This section summarizes discussion around the following questions:

- *What are the most promising new tools and ecologically valid methodological approaches to specify and measure dyadic relationship processes? What new tools are needed to complement existing tools, such as naturalistic observation methods (i.e., Ecological Momentary Assessment and Electronically Activated Recorder)?*

Capitalizing on Existing Panel Studies to Understand Relationships

Panel studies such as the Health and Retirement Survey, the National Social Health and Aging Project, and the Panel Study on Income Dynamics are powerful, data-rich tools that provide longitudinal data on relationships and on numerous individual factors that might contribute to relationship outcomes. These resources can be augmented with intensive measurement of subsamples over short periods of time. Using panel study subsamples may be a particularly powerful method for studying transitions from relationship equilibrium. After identifying transitions in existing longitudinal data, it may be possible to use data from earlier sessions to identify reliable predictors of these transitions. Informant reports may also be a valuable way to identify individuals at risk of transition. By using these methods, or by identifying individuals with increased variability in ratings of relationship quality, a subset of participants can be selected for more detailed study. Intensive measurements can be made of the subsample over a relatively short period of time using detailed questionnaires, diary studies, and naturalistic observation methods. The resulting data could be analyzed to gain more detailed insights into predictors of relationship transitions, as well as into what factors influenced the way relationships were impacted by transitions (e.g., when transitions led to relationship dissatisfaction or even divorce, and when couples were able to return to a state of harmonious equilibrium). A similar study design could be used to identify predictors of relationship violence.

Opportunities in Naturalistic Observation Methods

If ethical and technical challenges can be overcome, smartphones offer tremendous opportunities to study relationships in depth. In addition to analysis of text messages, emails, and recorded telephone calls, cell phone cameras can be used to record and analyze facial expressions when texting and emailing. The locations and proximity of multiple individuals can be tracked, and when two individuals are in close proximity, their cell phones can automatically record their face-to-face conversations. Once some data is collected and classified, experimental metrics can be personalized for subsets of study participants. For example, people who frequently engage in angry interactions can be given measures that assess anger in detail. Publicly available tools can be used to conduct speech recognition and extract meaning from voice and text data. The necessary tools are available to create classifiers that can automatically detect key features such as negative tone of voice, coercion, and capitalization.

To increase participation and investment in this type of research, studies can provide feedback to participants with insights into their communication patterns. This could even serve as an intervention, with the data collection system notifying participants of perturbations from equilibrium and encouraging regulatory behaviors or positive interactions. This type of system could also integrate health data collected through smartphones directly with relationship data to provide insights on the interactions of relationship and health behaviors.

Other Opportunities

Several other new tools and methodologies were discussed:

- Increased communication between relationship researchers and health-care practitioners could lead to innovative study designs and novel insights.
- Computational data mining approaches could provide new ways to analyze data from structured interviews.

Conclusions and Next Steps

The field of relationship research is moving away from using global self-report as a primary measure of relationship quality. Well-established techniques, such as multiple self-report measures over time, objectively observed behavior, and physiological data, provide meaningful insights into dyadic interactions. New techniques for observing behavior, including speech and facial expression analysis, open up exciting possibilities for overcoming methodological barriers within the field. Because behavior in relationships tends to be quite stable over time, predicting and identifying transition points is critical to understanding relationship dynamics and providing opportunities for effective intervention. More research is needed on how positive behavior can act as a buffer against negative outcomes, particularly within romantic and caregiving relationships.

Appendix 1

Meeting Agenda

- 1:00 *Welcome to the Academies*
 Barbara Wanchisen, Director, BBCSS
- 1:05 *Introductory Remarks from the National Institute on Aging*
 Melissa Gerald, Division of Behavioral and Social Research
- 1:10 *Setting the Stage for the Seminar*
 Janice Kiecolt-Glaser, The Ohio State University
- 1:20 *Methods Blitz*
Each invited expert will give a 3-minute presentation of a methodological approach he or she employs to study dyadic social interactions and, where possible, link it to a key health-related finding from the work. At the end of each talk, 2 minutes will be devoted to Q&A.
 Steven Boker, University of Virginia
 Richard Heyman, New York University
 Deborah Kashy, Michigan State University
 Edward Lemay, University of Maryland
 Izhak Shafran, Google
 Moderator: Janice Kiecolt-Glaser
- 1:50 *Moderated Discussion*
Invited experts and BBCSS members will share thoughts on the questions below. Throughout the discussion, the moderator will call upon invited experts (using a round-robin approach) to share the three innovative ideas that they brought to the meeting for extracting new forms of data, analyzing data, or evaluating new hypotheses that can help identify and better specify the dyadic processes within interpersonal relationships that influence health.
- What are the most robust and consistent behavioral and physiological measures that can characterize high-quality relationships and explain their associations with health outcomes?
 - What methods can be considered the gold standards for operational definition of quality and satisfaction in dyadic relationships? What other important aspects of dyadic relationships should be defined?
 - What are the methodological barriers in the relationship sciences? What are the best solutions for resolving ethical challenges?
 - What relationship processes have not been, but should be, studied, within dyads and beyond?

- What are the most promising new tools and ecologically valid methodological approaches to specify and measure dyadic relationship processes? What new tools are needed to complement existing tools, such as naturalistic observation methods (i.e., Ecological Momentary Assessment and Electronically Activated Recorder)?

Moderator: Janice Kiecolt-Glaser

3:00 Break

3:15 *Moderated Discussion, continued*

4:30 *Conclusions, Next Steps*

Using personal research experience and original discoveries as the basis for their opinions, invited experts and BBCSS members will discuss what they thought to be the best ideas resulting from the previous discussion and new ideas generated.

4:50 *Final Thoughts: Priorities for moving forward in the relationship sciences*
Janice Kiecolt-Glaser

Appendix 2

List of Meeting Participants

Invited Participants

Steven M. Boker, University of Virginia
Richard Heyman, New York University
Deborah Kashy, Michigan State University
Edward Lemay, University of Maryland
Izhak Shafran, Google

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