



***An interdisciplinary conference on mixed emotions: theory, methods, and applications***

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## Meeting Summary

### Introduction

Emotions have a profound impact on health and behavior, but it is rare for an activity or event to elicit just one emotion. Understanding the ways that emotions co-occur and interact, as well as how the experiences of mixed emotions (positive and negative) vary across individuals, is necessary to capture the complexity of the human experience and to understand behavioral and health outcomes. Research is being done to explore the nature and consequences of mixed emotions across a wide variety of contexts.

On October 23 and 24, 2015, the University of Michigan Bio Social Methods Collaborative, in collaboration with the University of Michigan Institute of Social Research and the NIH National Institute on Aging, convened a 2-day meeting to discuss the current state of mixed emotion research. Organizers sought to engage conference participants in discussions of open research questions, methodological concerns, and health and policy implications of mixed emotions research.

The workshop was divided into four sections, each consisting of four to five presentations followed by a discussion period in which all the speakers from the session answered questions and discussed issues that were raised by the presentations. The first day of the conference focused on theoretical and methodological issues in the study of mixed emotions, while the second day focused on empirical findings across a range of contexts, with an emphasis on life-span issues. This document briefly summarizes each talk and synthesizes the overall points of discussion in a final section.

### Perspectives and Conceptual Frameworks

#### Emotion Theories and Mixed Emotions

*Phoebe C. Ellsworth, PhD, University of Michigan*

The conference began with a brief overview of emotion theories. Some theories of emotion are primarily *categorical*, postulating a limited number of discrete, categorically distinct emotions. These theories are limited in that they require that all emotional experiences fit into a few basic categories, such as Happiness, Sadness, Fear, and Anger. They also provide little insight into how emotions relate to one another, or how people transition from one emotion to another. *Dimensional* theories overcome these limitations by placing emotions in a multidimensional space. Although the dimensions vary across theories, nearly all dimensional theories include a valence (unpleasant–pleasant) dimension and an arousal (deactivation–activation) dimension, and the most popular include only these two. However, lived experience of emotion does not seem to make use of this space evenly—high arousal emotions may be more differentiated in lived experience than in dimensional models, while low arousal emotions may be more differentiated in these models than in experience. *Constructivist* theories argue that conscious assessment of the situational context determines emotional experience, although the process by which this occurs is often not well defined. *Appraisal* theories provide more detail about

how context might influence the experience of emotion, focusing on assessment of particular elements of an emotional stimulus, including novelty, valence, certainty, agency, goal relevance, and control.

Each of these theoretical contexts takes a different approach to mixed emotions. Categorical theorists see more complex emotions as “blends” of basic emotions: for example, the simultaneous experience of joy and fear might be experienced as guilt. In dimensional theories, it may be difficult to represent mixed emotions—more complex emotional states would still be defined in reference to an individual’s overall level of valence and arousal. From an appraisal point of view, the question of whether a person can experience multiple emotions at once depends on whether he or she can hold multiple appraisals at once. Although it may not be possible to hold multiple arousal appraisals at the same time, it may be possible to hold multiple agency appraisals, thus making it possible to experience, for example, anger and guilt simultaneously.

Although some of these theories suggest ways that multiple emotions can be experienced simultaneously, is it possible that the subjective experience of mixed emotions results from the rapid alternation of multiple emotional states. On a mechanistic level, it may be very important to understand whether multiple emotions can truly co-occur. However, the answer to this question may not be critical to understanding behavior, given that emotional events are often complex and people’s subjective experience may reflect several emotions, whether or not these emotions are actually experienced simultaneously at a particular instant or in rapid succession.

### **The Many Emotions across the Adult Life Span, and How We Interpret Them**

*Susan Charles, PhD, University of California, Irvine*

Socioemotional Selectivity Theory posits that as humans age, emotional goals take greater precedence in decisions, thoughts, and behaviors, leading older adults to report higher levels of subjective well-being. However, this theory does not fit all the data on emotion regulation across the life span: older adults do not differ from younger adults on all measures of emotion regulation, and they even perform worse on some emotion regulation tasks. Charles suggests that a framework of strength and vulnerability integration can reconcile these findings. In short, aging adults may have additional strengths in how they appraise, process, and regulate their emotions because of their perspective from the later end of life, as Socioemotional Selectivity Theory suggests. However, aging also causes reduced physiological flexibility, leading to vulnerabilities in hypothalamic-pituitary-adrenal (HPA) arousal, cellular inhibition, and blood pressure among older individuals. This unique set of strengths and limitations can lead to higher well-being in contexts where older adults can make use of their strengths, but worse emotional functioning in some high-stress contexts.

Data suggest that older adults may process or experience positive emotions differently than do younger adults, but that negative emotions may be less influenced by appraisals and more tied to physiology. For example, diary data showed age-related differences in reporting of positive affect—older adults report more PA—but no age differences in negative affect after controlling

for daily stressors. Similarly, factor analyses of diary data found similar constellations of negative emotions among older and younger adults, but more differentiation of positive emotions in older adults. This research demonstrates the importance of considering the unique relationships between positive and negative affect and well-being.

### **What Mixed Emotions Can Tell Us about the Structure of Affect**

*Jeff T. Larsen, PhD, University of Tennessee*

Theoretical models of emotion differ in whether they predict that individuals can experience positive and negative emotions at the same time, as in the experience of “bittersweetness.” Some dimensional models of emotion, such as the Positive/Negative Affect Model (Watson & Tellegen, 1985) predict that reporting of positive and negative emotions such as happiness and sadness should be perfectly negatively correlated. Other dimensional models, such as the circumplex model (Russell & Carroll, 1999), suggest that happiness and sadness should be mutually exclusive. By contrast, positivity and negativity could be somewhat independent dimensions, making it possible to experience emotional ambivalence. Attitude researchers have modeled similar ambivalence in the field with an evaluative space model (Cacioppo & Berntson, 1994). The study of mixed emotions can therefore provide an empirical test of these theoretical models of emotion.

Larsen’s data show that people frequently report experiencing both happy and sad emotions in certain contexts (e.g., after watching a bittersweet film; on college graduation day). To determine whether these emotions are experienced simultaneously rather than in alternation, participants were asked to report the intensity of their experiences of happiness and sadness at the same time using a grid reporting method while watching a film clip. Results were analyzed using Kaplan’s (1972) MIN statistic, which is defined as the minimum of a person’s happiness and sadness intensity ratings at a given point in time: MIN values greater than zero indicate simultaneous experience of both positive and negative emotions. MIN scores greater than zero were rare when participants watched control clips that were not expected to elicit mixed emotion (mean MIN score = 0.09), but they were not uncommon when they watched bittersweet film clips (mean MIN score = 0.36). Furthermore, judges who were blind to participant condition also gave MIN scores greater than zero when analyzing the facial expressions of participants watching bittersweet film clips. Together, these findings suggest that the simultaneous experience of mixed emotions within a short time window may be rare, but it does occur reliably in certain contexts. Models of emotion that predict mutual exclusivity or a perfect negative correlation between positive and negative emotions cannot account for these data.

### **Concerns about Self-Report Measures in Intensive Repeated Measures Designs**

*Richard E. Lucas, Michigan State University*

Many researchers rely on intensive repeated measure designs to collect data that are more accurate, fine-grained, and dynamic than global self-report measures of emotion and well-being. These designs include the experience sampling method (ESM) and the day reconstruction method (DRM). However, these methods come with their own unique

challenges. This talk addressed two key challenges: individual differences in response styles, and the effects of repeated measures on participants' interpretation of questions.

Personality and emotion fluctuate depending on context to varying degrees depending on the individual. However, in attempting to assess intra-individual variability in emotion or personality, researchers may just be tapping into stable differences in response to styles across individuals. Lucas and colleagues found that although questionnaires and diary measures designed to measure this variability provided measures that were stable across time, data collected by these different methods were not correlated with one another or with personality components that would be expected to covary with overall personality stability. Of concern, however, is that these measures did correlate with variability in participants' ratings of their friends' personalities across contexts, their ratings of neutral objects, and their ratings of the personalities of fictional characters. This suggests that rather than indexing intra-individual variability in personality, these measures were indexing individual differences in response styles: some participants are more likely to provide variable answers across questions, regardless of the content of the question.

Respondents make inferences about a questioner's intent from the questions they are asked, and they may make different inferences about how they should answer questions in a repeated measures context. When participants were asked to evaluate their personality across several distinct roles (e.g., as a student, in a family context), their responses differed more from how they rated their personality on a global measure than when only asked about one role. Because the same question was asked multiple times, respondents appeared to focus more on the differences in their personality across contexts. Similarly, DRM responses appeared more strongly affected by situational factors than ESM responses (e.g., people reported feeling more different when they were in class and later when they were out of class when they recalled these in sequence in the DRM), presumably because of the DRM's focus on the activity in which they were engaged.

## **Methods, Measurement, and Theoretical Integration**

### **Emotion Tracking and Thin Slice Rating: Eight Dimensions of Affect Perception Semantics**

*Steven M. Boker, PhD, University of Virginia*

Boker reported on a number of novel methods used to study emotion expression. Rather than watching emotional film clips, participants watched stimuli of individuals interacting with a partner via videoconference, taking turns describing emotional memories. This process elicits emotionally charged recollections and may have more validity for understanding the experiences of emotion in daily life compared to watching film clips.

To evaluate the underlying structure of emotion word semantics, participants watched 5-second clips from these videoconferences and rated the degree to which the person in the video felt each of 32 emotion adjectives. Factor analysis of these data found that the 32

emotions could be reduced to 8 clearly distinct factors: joy, anger, disguise (the degree to which people were masking their emotions), shame, sadness, calm, interest, and anxiety. This suggests a low-dimensional structure for emotion semantics. It is noteworthy that in 88 of the 96 clips, participants rated at least 2 of these factors as being present, suggesting that mixtures of these factors were the norm rather than the exception.

A computer-generated imagery system can capture facial expressions with remarkable accuracy with only 12 data points because individual facial movements are highly correlated. These low-dimensional images look so realistic that participants do not realize they are not actual video images. This suggests that the human brain uses lower dimensional heuristics to interpret facial input and provides a valuable tool for modeling facial expressions of emotion. Future research can analyze facial expressions using the 8-factor semantic model described above, potentially shedding further light on the relationship between specific facial movements and emotional expression.

### **Remixing Mixed Emotions: Searching for a Timescale of Intraindividual Dynamics**

***Nilan Ram, PhD, Pennsylvania State University***

There are vast individual differences in emotional experience. There are differences not only in the specific emotions but also in the diversity of emotions experienced from one person to the next (intraindividual emotional diversity). Using novel approaches to model and visualize this emotional diversity can lead to new insight into the nature of these individual differences and can deepen understanding of emotional experience.

Data on intraindividual emotional diversity can be studied at many levels of analysis. Differences in average intraindividual emotional diversity can be compared across countries: they appear to be negatively correlated with subjective well-being. Data can also be gathered on individuals within a culture using repeated-measures designs in order to study the fine-grained contextual factors that might influence this variability. Comparison of summary statistics reported at the end of the day with measurements made throughout the day reveals distinct patterns of variability. Among individuals who report diverse or consistent emotional patterns, the specific patterns experienced also vary greatly, and these differences can be studied to gain insight into the range of individual emotional experiences.

How does diversity of emotional experience change over time, and what timescales are most meaningful for asking such questions? In general, intra-individual variability appears to decrease with age. Novel visualization approaches allow researchers to see changes in emotions over hours, or changes in stressors over days, providing new insights into the lived experience of mixed emotions. These insights can help to generate hypotheses about what timescales may be most meaningful for understanding emotional diversity.

Models of approach/avoidance dynamics may help to explain the development of emotion regulation and the interplay of mixed emotions. Emotions may exist in equilibrium states, but events and stressors may perturb these states, resulting in mixed emotional states that the

individual must then resolve. Modeling approaches may help us to understand these emotional dynamics, including time course of the resolutions of these unstable emotional states.

### **Disability, Subjective Well-Being, and Mixed Emotions in Later Life**

***Vicki Freedman, PhD, University of Michigan***

Research on the subjective well-being of older adults has left open questions about how disability impacts subjective well-being. Hedonic Adaptation Theory suggests that individuals adapt to life events such as disability and eventually return to pre-disability levels of well-being, but evidence for this pattern is weak. The present work explored the effect of disability on well-being in older adults by targeting specific negative and positive emotions (e.g., happiness, frustration, worry, and sadness) using a DRM. Emotion ratings across different activities were analyzed in relation to degree of impairment, controlling for psychological, social, and economic factors that may have confounding relationships with disability and well-being.

Older adults with disability reported more frustration, worry, and sadness than those without disability. Those with the highest degree of impairment reported the most negative emotions. This effect was not related to economic or activity-related differences between the groups. However, differences in psychological and social factors accounted for 20-40 percent of the effect.

To think about mixed emotions in this context, we can ask whether disability and demographic factors have an overall heightening effect on emotion, leading participants to report more positive and negative emotions; a dampening effect, leading to fewer positive and fewer negative emotions; or a positive or negative “substitution” effect, causing emotions of one valence to push out emotions of the other valence. In general, the data suggest a predominant pattern of disability leading to negative substitution: those with higher levels of impairment experience more negative and fewer positive emotions. The amount of negative substitution in disabled individuals was predicted by psychological factors, such as neuroticism and self-efficacy. In non-disabled individuals, social (having a romantic partner) and activity-related (working) factors led to negative substitution.

### **Modeling Mixed Emotion**

***Richard Gonzalez, PhD, University of Michigan***

Mixed emotions can be difficult to model. However, a variety of theoretical and mathematical approaches may be helpful in modeling mixed emotions.

First, it is critical to select appropriate variables to capture the nature of mixed emotions. Although they can capture the frequency with which both positive and negative emotions are reported during an activity, simple metrics are limited because they do not reveal the overall strength (intensity) of the emotions or the relative strength of positive versus negative emotions (polarization). A rotation of 45° from a circumplex model results in axes of intensity and polarization. A variety of measures have been proposed to measure intensity and polarization, including Kaplan’s MIN statistic. These measures make unique predictions about the relationship between positive affect (PA), negative affect (NA), and ambivalence. These



predictions can be visualized as “indifference curves” in a two-dimensional plot. Differences in the predictions of these theories can be tested in experimental studies. Theoretical principles can also constrain hypothesized slopes of indifference curves; for example, a model should predict that ambivalence will increase as both PA and NA increase.

Multiple regression approaches to modeling mixed emotions tend to define ambivalence differently depending on the specific data that are used and the outcome variable that is measured, which may be problematic for understanding mixed emotions on a broad theoretical level. A number of mathematical and theoretical tools may be helpful for designing theoretical models. Functional equations are a powerful tool that could allow researchers to solve for a function of ambivalence. Prospect theory also provides measures of intensity and polarization, although in its current formulation does not work for mixed-valence outcomes. Variance-based, correlation-based, and dimensional approaches may also help to decompose intensity and polarization. Because many of these measures amount to transformations of one another, they should not be used together in regression models as independent predictors of ambivalence.

## **Specific Phenomena and Contexts over the Life Span**

### **Is Life Satisfaction a Positive Emotional Buffer for Structural Conditions of Life That Likely Produce Negative Emotions?**

*James S. Jackson, PhD, University of Michigan*

Negative changes in structural life conditions (e.g., perceived financial status and poverty) can have a profound negative effect on happiness and health; however some individuals appear to be more resilient to changes in life circumstances. Understanding this resilience is particularly important for understanding and helping vulnerable groups, including African Americans and the elderly. This study tested the hypothesis that changes in life satisfaction can buffer the negative impact of a decline in financial status on health and well-being.

Using data from two longitudinal surveys (the National Panel Survey of Black Americans: 1979–1992 and Americans’ Changing Lives: 1986–1994), Jackson and his colleagues measured the interaction between changes in life satisfaction and changes in financial status over time on psychological distress, happiness, disability, self-esteem, and poor health, controlling for demographic variables. In support of the hypothesis, the results showed that across all five dependent variables, increases in life satisfaction mitigated the negative effects of declines in financial status on social, health, and psychological outcomes. These effects were most pronounced for African Americans and older individuals. More work is needed to better understand what predicts changes in life satisfaction over time—the demographic and situational data included in these surveys accounted for less than 10 percent of the variance in changes in life satisfaction over the time period.

## **Immediate Versus Anticipated Emotions in Social and Economic Choice**

*David Dunning, PhD, University of Michigan*

Much of the research on decision-making in economics and psychology considers the impact of anticipated emotions on decision-making—how you expect you would feel after making a choice given a potential outcome. However, emotion may also influence a decision choice at the level of the “immediate emotion” felt while considering different options. The studies in this presentation examined whether these immediate emotions influence decision-making and how their impact compares to that of anticipated emotions.

Experiment 1 asked participants to choose between keeping \$5 or betting \$5 on a coin flip, with the possibility of winning \$10. Before choosing, participants rated their immediate emotions when thinking about each of the two options (playing it safe or flipping the coin), as well as their anticipated emotions given the four possible outcomes (e.g., choosing to flip the coin and winning). Participants’ actions were best predicted by their immediate emotions: anticipated emotions were at best a marginally significant predictor of behavior.

Experiment 2 explored how emotions and behavior changed when the source of risk was another person rather than a chance event. People anticipate more negative emotions if being betrayed in a trust game than if losing a game of chance. Therefore, if they rely on anticipated emotions, then they should be more likely to select the game of chance if the alternative is a trust game. However, if they rely on immediate emotions, then they should be more likely to take the risk in the trust game scenario, since they report feeling anxious about indicating they do not trust the other person by deciding to go with the game of chance. Results suggest that participants rely on immediate emotions: they are more than twice as likely to select the trust game than they to leave the outcome up to chance.

This research demonstrates that people regulate themselves in relation to their emotions around the actions they pursue, rather than the outcomes of these actions. This work has potential applications in understanding changes in emotion regulation across the life span.

## **Aging and Mixed Emotions: The View from Emotion Regulation Research**

*Derek M. Isaacowitz, PhD, Northeastern University*

Taken together, Socioemotional Selectivity Theory and the Process Model of emotion regulation predict that older adults may select and modify situations, and deploy their attention, in ways that promote positive emotions. Past research has shown that older adults deploy attention differently than do younger adults: they tend to focus more on positive stimuli and less on negative stimuli, leading to more positive emotion. The studies described here tested whether older adults also differ in selecting and modifying situations to promote positive emotions.

When given the option to view videos with positive content, neutral content, or negative content, individuals of all ages tend to choose a variety of emotional inputs, suggesting a general tendency to seek out a mixture of emotions. In some contexts, no age differences in the selections were found. However, in other contexts, older adults appeared to show a preference

for more neutral, low arousal content compared to younger adults, who had a relative preference for positive (and in some cases negative) content and higher arousal content. When given the option to modify content by fast-forwarding through it, older adults were more likely to modify negative content, presumably avoiding negative emotions. Overall, people of all ages appear to actively create mixed emotional input for themselves, although older individuals may prefer lower-arousal, relatively more neutral inputs than younger adults.

### **Mixed Emotions: The Lessons from Measuring Attitudinal Ambivalence**

***Dale Griffin, PhD, The University of British Columbia***

Work in the attitudinal ambivalence literature has revealed some serious methodological issues with attempting to measure a combination of negative and positive attitudes. These problems are also relevant to the mixed emotions literature. In short, it is difficult to determine whether what is being measured is an effect of mixed emotions or attitudes specifically, or simply a main effect of the less dominant attitude or emotion.

The key question in both of these literatures is whether ambivalence has emergent properties: does ambivalence itself predict outcomes over and above the effects of negative and positive attitudes? However, in many situations, variance in ambivalence can be entirely due to variance only in negative or positive attitude scores. For example, nearly all newlywed couples report being happy with their partners, while a smaller subset also report being unhappy with their partners. In this case, ambivalence becomes simply an index for negative attitudes.

This problem cannot be addressed by measuring ambivalence directly rather than creating composite measures. Asking participants directly about ambivalence can still index a concept that primarily varies as a function of negative (or positive) attitudes. Jeff Edwards has provided a set of constraint tests that can be used to evaluate models to measure ambivalence. It is necessary to include coefficients for both positive and negative emotions, together with a separate coefficient for ambivalence. This makes it possible to determine whether an effect is driven by ambivalence, or entirely by positive or negative affect. There is no way around this problem—researchers must consider separate effects of positive and negative affect in addition to ambivalence. It is critical that researchers understand this problem and how it plays out in their particular data sets. As a field, more work needs to be done to establish chains of construct validity from basic components, through subjective experience, and to summary metrics such as subjective well-being.

### **Snapshots of Activity-Related Mixed Feelings: New Windows on the Lives and Well-Being of Older Adults**

***Jacqui Smith, PhD, University of Michigan***

To understand emotional patterns across activities over the life span, it is necessary to have emotion measures in large longitudinal datasets. A minimal DRM paradigm was added to the Health and Retirement Study (HRS) in 2012, and there are now two waves of data with this measure. This resource could be used in any number of ways: for example, it can help

researchers to understand variability in life satisfaction, and how life satisfaction relates to specific activities and emotions.

For most activities, most people reported either a mixture of positive emotions, or a mixture of positive and negative emotions; it was rare that an activity only elicited negative emotions. By looking at Activity Affect Complexity, the proportion of activities for which a person reported experiencing both positive and negative emotions, Smith examined patterns of mixed emotions in data from the HRS and Experienced Well-Being in the Population over 50 Research On wellBeing & US of Time (ROBUST) study. Results indicated more mixed emotions in older adults; in people high in neuroticism and openness to experience; in individuals with higher cognitive abilities or higher need for cognition; and in individuals with illness or functional limitations. Mixed emotions were related to the experiences of pain, tiredness, and stress. The activities of working and watching television generated high levels of mixed emotions compared to other activities. Further analysis of these data may help us to understand whether there are optimal mixtures of positive and negative emotions for daily experience.

### **Emotional Well-Being of the Elderly in East Asia: Cross-Country Differences in Age Gradients and Other Determinants**

*Jinkook Lee, PhD, University of Southern California and RAND*

Although data from Western countries shows a U-shaped relationship between age and well-being, suicide rates in East Asian countries increase with age and are the highest among elderly populations. The current research sought to understand the common factors that contribute to poor emotional health among the elderly in Japan, Korea, and China, as well as the specific factors that may influence depression within each country. Using a comparative data set with longitudinal data from the China Health and Retirement Longitudinal Study, the Korean Longitudinal Study of Aging, and the Japanese Study on Aging and Retirement, Lee and colleagues studied the relationships between country, demographics, economic, health, and family variables on depressive symptoms.

Results showed a positive association between age and depression in both China and Korea, but the opposite pattern in Japan. Across cultures, lower education levels and worse health were associated with more depression; however, some patterns were country-specific. In China and Korea, economic factors played a large role, but in Japan, where older individuals receive pensions that make poverty less prevalent, economic factors were not as strong a predictor. Similarly, contact with children was a significant negative predictor of depression in China, where parental ties are highly valued.

Although 83 percent of the difference in depressive symptoms between the Chinese and Japanese samples could be explained by economic and health differences between the two populations, these factors explained far less of the difference between Korea and the other two nations. Elder Koreans appeared to be more likely to be depressed than Chinese or Japanese individuals of similar health and economic status.

The recent economic growth in East Asian countries has had a traumatic impact on age-related economic inequality, because older adults have not benefited from the growth to the same extent as the rest of society. These data demonstrate the negative effects of this inequality on depression in the elderly populations. However, they also demonstrate that country-wide economic practices (such as Japan's pension system) and cultural factors (in the case of Korea) can have strong impacts on depression and suicide rates over and above the effects of economic, social, and health factors.

### **Affect Complexity: Implications for Health and Well-Being**

***Anthony Ong, PhD, Cornell University***

The Dynamic Model of Affect (DMA) predicts that the relationship between PA and NA may not be constant: specifically, it predicts that when stress levels are low, PA and NA will be relatively uncorrelated, while under high stress, processing limitations will cause PA and NA to collapse into a simple bipolar dimension of inversely coupled affect.

Ong tested these predictions in the cases of populations with chronic pain, mood disorders, bereavement, and lab-induced stress, finding support for the model in each case:

- Patients with high levels of chronic pain report a stronger negative correlation between PA and NA than those with low levels of pain.
- Although depressed patients showed high levels of NA overall, anxious patients showed a much higher negative correlation between PA and NA than did depressed patients, consistent with the idea that anxiety is uniquely indicative of stress.
- Among bereaved individuals, those who were independently coded as “resilient” showed only a weak correlation between PA and NA (-0.43), while those coded as “symptomatic” showed a very strong correlation (-0.95).
- When stress was experimentally manipulated using a public speaking task, the negative relationship between PA and NA was significant immediately following the stressor, but the two were relatively independent at baseline and recovery time points.
- Individual differences measures suggest that factors that tend to increase cognitive load lead to a stronger correlation between PA and NA.

These findings demonstrate that the relationship between NA and PA is highly context-dependent. They also raise questions about whether an increase in affective complexity could lead to improved adjustment following stress. Experiencing PA and NA independently as mixed emotions could relate to resilience or ability to recover from a stressful event.

### **The Benefits of Retail Therapy**

***Scott Rick, PhD, University of Michigan***

Appraisal theory suggests that changing one's appraisal of a situation should lead to a change in one's emotional state. Because sadness is characterized by appraisals of low control, activities that emphasize control over one's environment may help to alleviate feelings of sadness. Thus, an activity that involves making choices, such as shopping, may be an effective way to increase one's sense of control, thus having a specific impact on reducing feelings of sadness.

Three studies demonstrated that engaging in choice behavior can be effective at reducing the experience of sadness, but not of anger. After watching a sad film clip, participants showed greater alleviation of their sadness when asked to select which of a series of items they would like to buy, rather than to simply identify which items fit within a particular category. This type of choice activity did not appear to reduce feelings of anger. Identifying a preference was not enough if participants did not feel in control of the outcome: when they voiced a preference, and then the preferred item was selected through an apparently random process, participants did not report as much reduction in sadness. Simply recalling an event in which the participant had high control over a situation also appeared to alleviate feelings of sadness (but not of anger) more than recalling an event when the participant had low control.

Overall, the results suggest that the choice element of shopping may be effective at changing people's appraisals of personal control, thus eliminating feelings related to a low sense of control, such as sadness.

### **Change in Positive and Negative Affect in the Marital Relationship: Dyadic Analysis of Husbands and Wives**

***Brenda L. Volling, PhD, University of Michigan***

Marital relationships provide one of the most important affective contexts of daily life. It is well established that on average, marital satisfaction tends to decline after the birth of a child. This work sought to examine the effects of the birth of a child on marital satisfaction in more detail: are changes primarily because of decreases in PA, or to increases in NA? Furthermore, what patterns of correspondence exist between mothers' and fathers' emotions, and how might this correspondence affect overall marital satisfaction?

Using a growth mixture modeling approach on self-report data collected at five time points surrounding the birth of a second child, Volling and colleagues identified four patterns of emotional adaptation to the child's birth. About 44 percent of couples in the sample followed a "smooth transition" pattern, with fairly correspondent patterns of high positivity (love and relationship maintenance) and low negativity (negative affect and conflict). A "rocky transition" group that showed a modest decline in positivity and a modest increase in negativity made up another 35 percent of the sample. This group also showed high correspondence between maternal and paternal ratings. The remaining two groups showed more difficult transition patterns, marked by much larger discrepancies in the emotional patterns reported by each partner and strong "honeymoon effects" where negativity decreases shortly after the birth but then increases to the same or higher levels than before the birth at later time points (4-12 months). These more difficult, more discrepant patterns were predicted by more destructive marital communication patterns, as well as with maternal depression, neuroticism, and unplanned pregnancy.

These analyses show the importance of distinguishing between declines in PA, and increases in NA, in making sense of changes in well-being or marital satisfaction. They also demonstrate the importance of considering the correspondence between the emotional experiences of people in relationships.

## Conference Themes Overview

This section summarizes the major themes that arose both from the discussions at the end of each session, as well as from a final wrap-up talk given by Lisbeth Nielsen of the National Institute on Aging.

### Defining Mixed Emotions Phenomena

The presentations in this conference covered mixed emotions from many angles, which, as Nielsen described, can be broadly divided into three distinct phenomena:

1. Momentary co-occurrences of two or more emotions. There are open questions about how these co-occurrences manifest (e.g., are the two emotional states experienced simultaneously or in oscillation—see below), but it is clear that mixed emotional experiences do occur on relatively short timescales. Further understanding of this phenomenon may require more biological data, as well as the use of cognitive processing models.
2. Two or more emotional experiences associated with an event, episode, activity, or interaction. There is a large amount of data available for exploring this phenomenon, although there are some difficult methodological questions facing the field in terms of how best to analyze these data, and how to create useful cumulative metrics of emotional experience.
3. Individual differences in experiences or reporting of the above mixed emotion phenomena. Understanding these differences can help researchers to understand what demographic and contextual variables contribute to mixed emotional experience and can provide insight into the relationship between specific emotional experiences and summary metrics such as subjective well-being.

Conference attendees pointed out that there is a great deal of overlap in what methodological and modeling tools may be useful for measuring these distinct phenomena, particularly between the first and second phenomena described above, which differ primarily in the time scale of interest.

### Simultaneous Versus Sequential Experience of Mixed Emotions

The question of whether individuals are able to experience two emotions simultaneously, or whether they rapidly alternate between two emotional states, was a theme throughout the conference. In an appraisal theory framework, it would be possible to experience two emotions simultaneously if one can hold two appraisals at the same time, although it is also plausible that people alternate attention between different aspects of a situation, generating different emotions. Neural network models vary in whether they enact a “winner-take-all” structure, which would lead to serial experiencing of emotion, or a more fuzzy structure where different emotions could be co-experienced at different levels of intensity. Some attendees suggested that what appear to be two simultaneous emotions when viewed in a two-dimensional space could in fact be the shadow of a single emotional entity when more dimensions are considered. Attendees also raised the possibility of physiological “after images” of emotion: while attention

and appraisal can shift quickly, physiological consequences of these psychological shifts may be more long-lasting, leading to more complex conscious experiences of emotion.

Even very short timescales (e.g., the 5-second windows used in Boker's task) may still be insufficient to ask questions about the simultaneity of emotions. However, attendees had a few suggestions for ways to resolve questions of simultaneity:

- Better biological models of emotion might constrain the understanding of what types of emotions can be experienced simultaneously, as well as of the time course of emotional experiences.
- Collecting data from multiple channels (e.g., eye tracking, electroencephalogram, self-report) on the same participants, and using data science methods to analyze the relationships between them, may provide a fuller picture of how mixed emotions interact in time.

Finally, attendees noted that, for many questions of interest to the field, it might not matter whether emotions are alternating or simultaneous on a physiological level. Introspection and self-report measures suggest that people experience mixed emotions as occurring simultaneously, and this conscious experience level may be most likely to have an impact on behavioral outcomes.

## **The Value of Mixed Emotions**

### ***(When) are mixed emotional states desirable?***

Negative emotions are unpleasant and can be physiologically taxing. However, data from several talks demonstrated that individuals sometimes actively seek out mixed emotional experiences. Why then might mixed emotional experiences be desirable?

Research has found large cultural and individual differences in attitudes and preferences toward specific emotions and toward complex emotions: some people enjoy being disgusted or watching bittersweet movies, while others demonstrate different emotional preferences. Smith's data suggest some demographic and psychological variables that may contribute to the drive to seek out mixed emotions. Conference attendees agreed that the drive to seek out negative and mixed emotions, as well as the potential benefits of experiencing mixed emotions, warrant further study. Several possible functions of mixed emotions were proposed:

- Mixed and negative emotions may motivate individuals to change their behavior.
- Mixed emotions may be a means to an end when pursuing long-term goals.
- People may seek out negative emotions because they are novel: in some situations (e.g., when watching television), novelty may be a stronger goal than hedonics.
- People may also value negative emotional experiences when they provide opportunities for large emotional transitions to positive emotions, when they provide emotionally complex experiences, or when they allow people to see their own experiences in a better light.



### ***Why are mixed emotions important to study?***

Conference participants identified several important reasons to study mixed emotions:

- The study of mixed emotions can provide strong tests of competing theories of emotion.
- Mixed emotions may be more likely to occur during particularly meaningful events in people's lives.
- The study of mixed emotions can help improve understanding about global measures such as subjective well-being that aggregate across a broad range of emotional experiences.
- Mixed emotional states are frequent, perhaps even typical, in day-to-day subjective experience. Understanding them is thus intrinsically interesting and informative to the study of emotion.

As Nielsen and other conference attendees stated, perhaps the primary reason for studying mixed emotions is that their frequency in lived experience makes them informative for causal theories of behavior. Mixed emotions can guide behavior by serving as a goal, or as a means to an end. Furthermore, individual differences in mixed emotional experiences may have causal relationships with outcomes of interest, such as well-being or psychological health. Nielsen highlighted several of the many causal stories that were present in the conference talks:

- Older adults may seek out relationships that evoke complex emotions (Charles).
- People may be attracted to stimuli that evoke mixed emotions (Isaacowitz).
- Mixed emotional states may signal a conflict that requires resolution (Ram).
- Mixed emotional states may evoke interest or enhance growth (discussion panels).
- Different channels of conflicting emotional information, perhaps processed in parallel, may mix together to shape choice behavior (Dunning).
- Motivation to engage in mixed emotions may vary depending on demographics and context (Smith).

Several talks focused on population-based studies looking at subjective well-being. These can inform and enhance our causal understanding of mixed emotions by relating differences in lived experience to specific contexts and life circumstances. These studies might also shed light on the possible ways that specific affect patterns cause individuals to select different activities or contexts that influence their emotional states.

### **Outstanding Methodological Issues**

#### ***How do theories of emotion shape and constrain the study of mixed emotions?***

Dimensional theories provide an appealing starting point for researchers because of the ease of collecting, modeling, and communicating emotion data in a two-dimensional space. Although working from this model can provide insight into mixed emotions, doing so might ignore some rich aspects of emotional experience. Attendees wondered how using appraisal theories of

emotion as a starting point might change the hypotheses that researchers consider and the methods that they use.

### ***Calibration between direct and indirect measures of mixed emotion***

Most researchers measure mixed emotion indirectly, deriving it from measures of individual emotions. The relationship between self-reported experiences of mixed emotions (e.g., “bittersweetness”) and reports of their component emotions is not well understood and may benefit from further study. One challenge in measuring mixed emotions directly is that participants may vary in how they define a term such as “bittersweet” compared with more common emotion terms such as “happy” and “sad.” Additionally, as Griffin pointed out, measuring mixed emotions directly does not get around the methodological issue of determining whether mixed emotion effects are more than the sum of their parts.

### ***Distinction between stress and negative emotions***

How does stress differ from negative emotional experience? Stress is most frequently operationalized either on a physiological level (e.g., by measuring cortisol levels) or by an objective categorization of outside forces (e.g., stressful events). Negative emotions are typically operationalized on the level of subjective experience. Conference attendees suggested that the relationship between these variables might benefit from more exploration.

### ***Defining an emotional baseline***

When rating the intensity of an emotion on a scale of 0–5, for example, 0 is often taken to mean “not experiencing the emotion at all.” However, it may not be meaningful to think about a complete absence of emotion. Researchers suggested that in some cases it might be more useful to think about deviations from a baseline emotional state, rather than the complete presence or absence of an emotion. Conference attendees discussed whether it is possible or desirable to measure a participant’s emotional baseline, or the deviation of other states from that baseline. Several suggestions were made:

- Emotional reports using 0–100 sliders tend to elicit normally distributed emotion ratings, suggesting that participants interpret the zero point differently in this context than with a 0–5 scale.
- In Boker’s studies, rather than asking people to use a scale that ranges from, for example, “not happy” to “very happy,” the participant is prompted with a statement, for example, “the person in this video felt happiness” and is asked to rate its accuracy on a scale that ranges from “extremely inaccurate” to “extremely accurate.” This may be a way of achieving greater variability and avoiding an assumption of a zero point of emotion.
- Participants can be asked to rate their emotions relative to “how they usually feel;” however, this makes it difficult to compare data across individuals.
- Researchers sometimes make the assumption that taking a mean of a participant’s emotion ratings across several tasks reflects a baseline, but this assumption has not been empirically tested.

- Freedman finds that when participants perform mundane tasks such as laundry, they often give zero ratings for all emotion words tested: perhaps this would be an example of a resting emotional state.
- Other researchers question whether an emotional baseline can truly exist, given the dynamic nature of emotional experience.

### ***Choosing appropriate summary metrics***

Measures of subjective well-being are now prevalent in large surveys and longitudinal data sets, and can potentially be valuable tools for influencing policy making. However, it is important to ensure that these indices are meaningful for that purpose. More work is needed to determine which summary metrics are most informative in terms of showing meaningful relationships with outcomes of interest. Additionally, more work is needed to understand when single metrics such as subjective well-being are informative, and when finer-grained measures, such as those that separate out positive and negative affect or provide a more granular view of emotion across activities or contexts, are necessary.

### ***Biological constraints on mixed emotion phenomena***

A better understanding of potential biological constraints on mixed emotion phenomena can help constrain hypotheses about what occurs at the level of conscious experience. For example, there may be physiological limits on what can be represented simultaneously, or on the time course of emotions, and understanding these limits can inform researchers' understanding of emotional experience.

### ***Possible socioeconomic disparities in the conceptualization of mixed emotions***

Nielsen raised the question of how the experience of mixed emotion might vary by socioeconomic status, and whether the opportunity to pursue situations that elicit mixed emotions (to the extent such states are considered desirable) may be limited in some social groups. Moreover, conditions of scarcity or high levels of social stress may impose psychological constraints that impact the ability to experience complex emotions. A greater understanding is needed of the role of contextual and structural factors in the motivation to seek out or experience mixed emotions.

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