Abstract

Individuals differ in their dynamic patterns of affect and behavior over time and space. Between person individual differences reflect the unique parameter settings of these dynamic processes. With the use of cell phones text messaging or the use of mobile "apps" it is possible to assess mood states for individuals multiple times per day as participants go from situation to situation. We report two studies examining how patterns of anxious reactions to situations vary across subjects. Subjects differ in their choices of anxiety inducing situations as well as in their responses to these situations.

The dynamics of affect: the example of anxiety

part of a symposium:
Anxiety from cognitive and differential perspectives
International Society for the Study of Individual Differences,
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Outline

Introduction: Personality structure and process: the study of dynamics
- Traits, states and time

Theories of dynamic models

Initial support for dynamic models

Recent studies of the dynamics of choice behavior

Affect varies by situational choice and activity
- Affect by temperamental "type"
- Affect by "Big 5" trait

Conclusions

Beyond the 2 disciplines: experimental, correlational, intensive longitudinal, computational modeling

1. Although it is traditional to divide the scientific study of psychology into experimental versus correlational approaches (Cronbach, 1957, 1975; Eysenck, 1966, 1987, 1997; Revelle & Oehlberg, 2008; Revelle, 2013) we should add to this dichotomy computational modeling (Read, Vanman & Miller, 1997; Read, Monroe, Brownstein, Yang, Chopra & Miller, 2010; Revelle & Condon, 2015; Brown, 2017) and intensive longitudinal studies (Bolger, Davis & Rafaeli, 2003; Bolger & Laurenceau, 2013; Wilt, Funkhouser & Revelle, 2011).
2. For in addition to the traditional experimental random assignment or cross sectional correlational study, we can now do experiments on computational models and we can observe natural experiments as individuals go from situation to situation (Brown, Blake & Sherman, 2017; Rauthmann, Gallardo-Pujol, Guillaume, Todd, Nave, Sherman, Ziegler, Jones & Funder, 2014; Rauthmann, Sherman & Funder, 2017; Wilt & Revelle, 2017b)

Traits and States

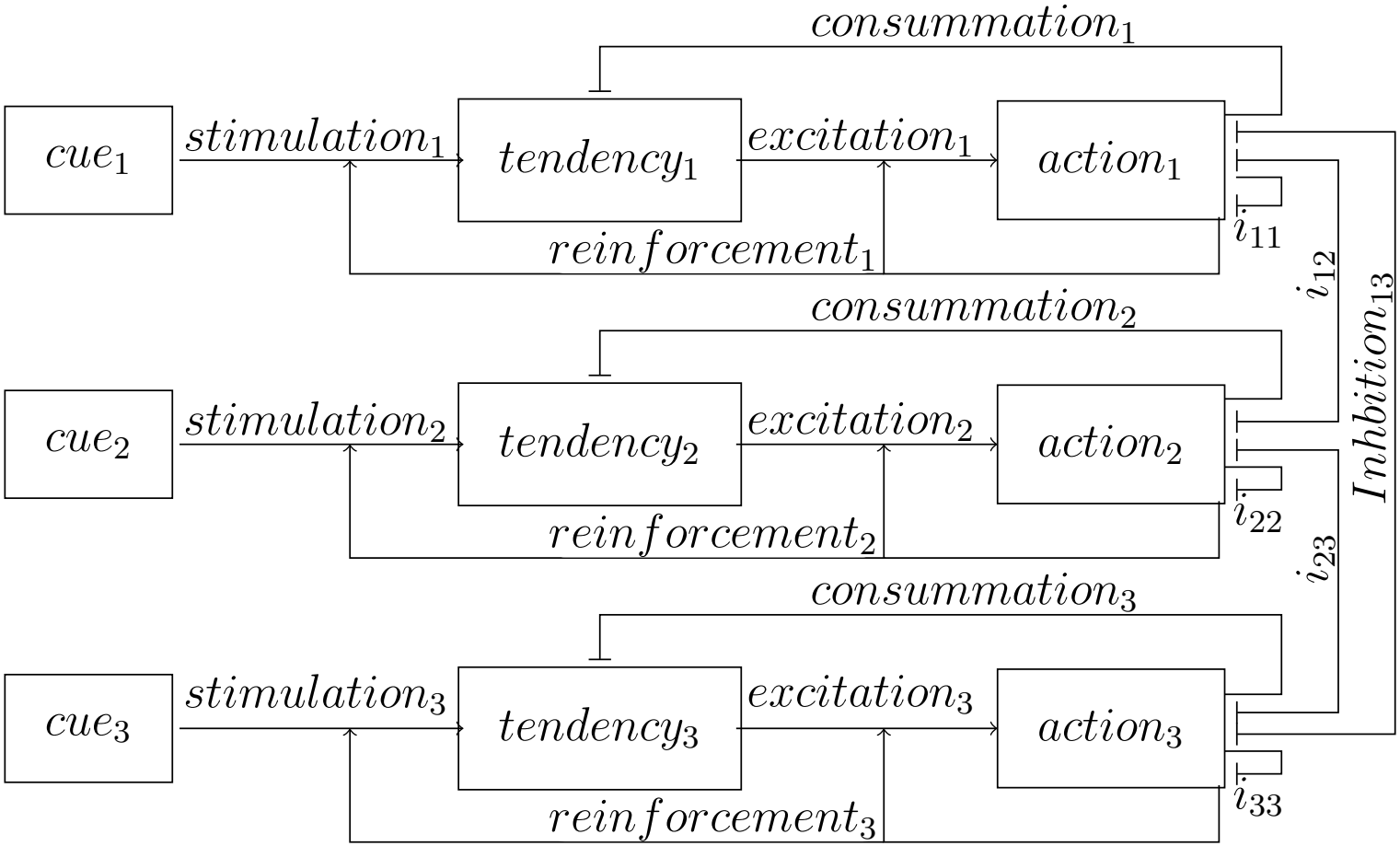
1. To us, personality is the coherent patterning over time and space of affect, behavior, cognition, and desire (the ABCDs of personality). Although many study *mean levels* of the ABCDs, we find it more fruitful to study how the ABCDs *change* over time and across situations.
2. The trait-state distinction is typically seen as the distinction between what one *usually* feels, does, thinks, or wants and what one is feeling, doing, thinking or wanting at the *moment*. This distinction is seen in the instructions for such measures as the State-Trait Anxiety Inventory (Spielberger, Gorsuch & Lushene, 1970) with such instructions as to respond how you normally feel versus how you feel right now.
3. Indeed, Fleeson and his colleagues (Fleeson, 2001; Fleeson & Jayawickreme, 2015) think of traits as merely the central tendencies of the distribution of personality states.

Traits, states, and time

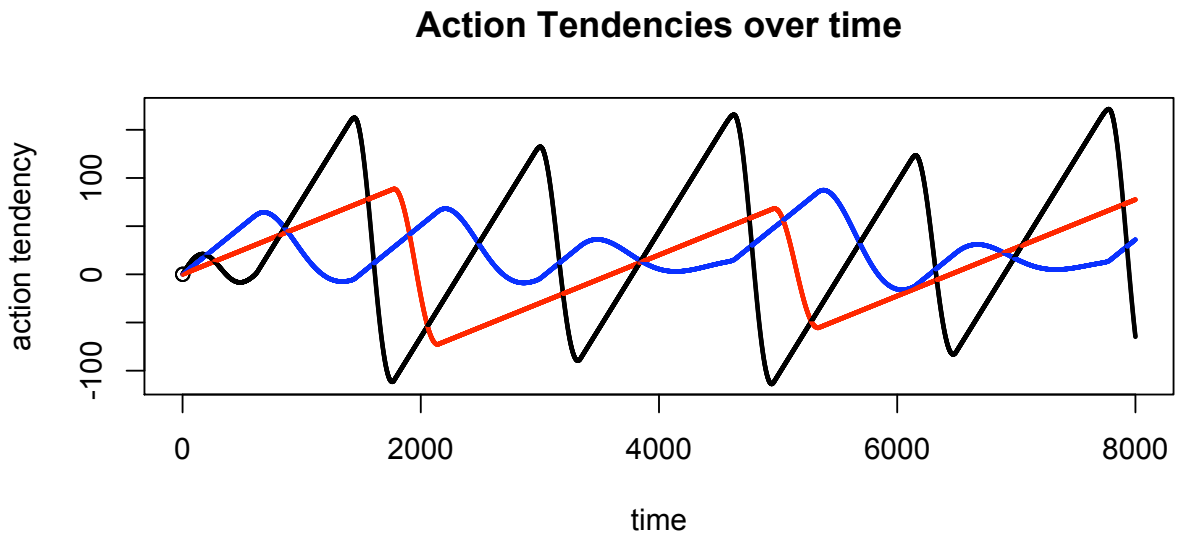
1. Inspired by the work of Atkinson & Birch (1970) on the *Dynamics of Action* we have emphasized the temporal sequencing of states and incorporated time as a necessary variable to consider in our models (Revelle & Michaels, 1976; Humphreys & Revelle, 1984; Revelle, 1986; Revelle & Condon, 2015).
2. We refer to the reparameterization of the original DOA model as the CTA model (for Cues-Tendency-Action) (Revelle, 1986; Revelle & Condon, 2015)
3. Although the formalization of this model is a set of differential matrix equations, this can be seen as a flow diagram (Revelle & Condon, 2015) which results in a dynamic model of rising and falling action tendencies as actions are expressed.
4. An example of a computational model combining the CTA model with Reinforcement Sensitivity Theory has been given by Brown (2017) as well as others (Fua, Horswill, Ortony & Revelle, 2009; Fua, Revelle & Ortony, 2010).

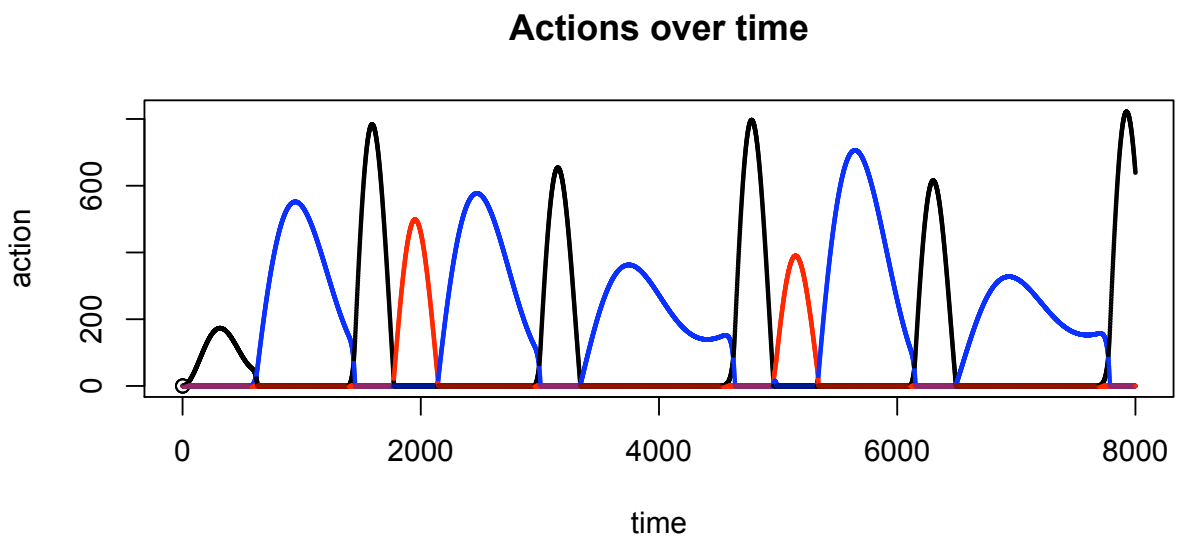
CTA: Cues-Tendency-Action model as a flow diagram representing two matrix differential equations

$$dt = Sc - Ca \qquad dA = Et - Ia$$



CTA: Tendencies (desires) run in parallel, but Actions are in serial





- Action Tendencies run off in parallel Growing in response to cue strength Decaying when the corresponding Action is firing

  .
- Actions inhibit each other and run in series

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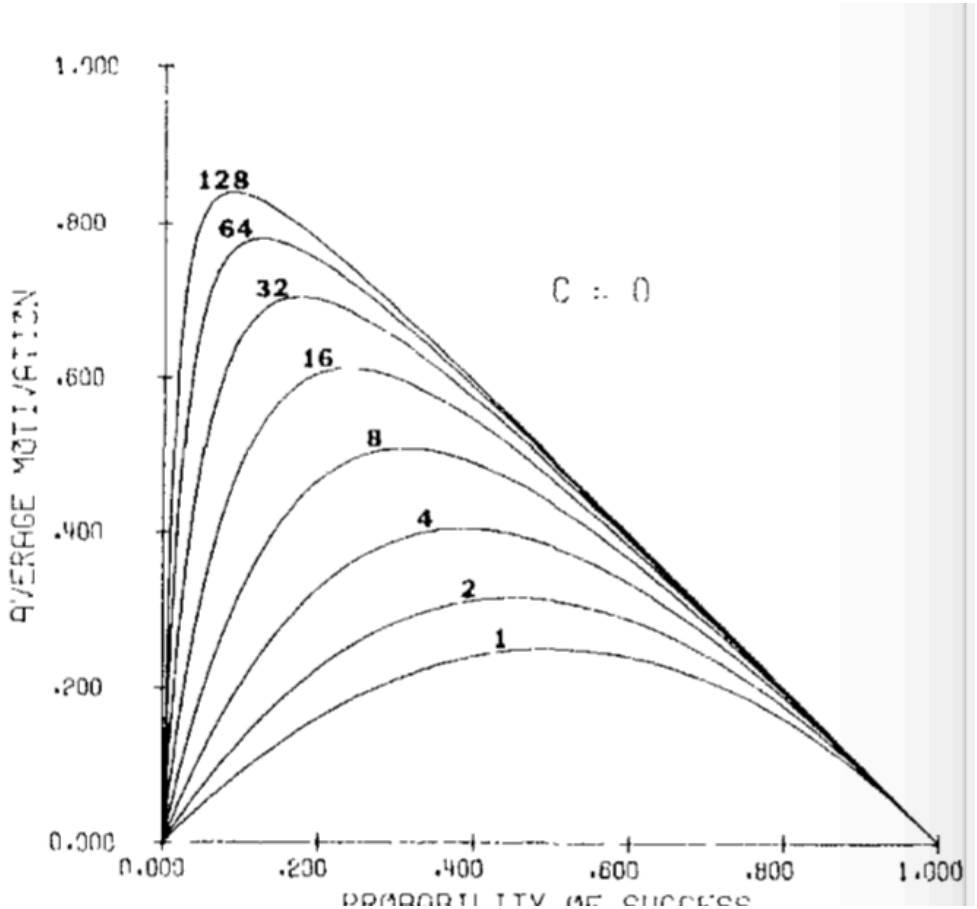
2. With the basic assumption that motivational states have *inertia* and resulting carry over from trial to trial we have shown (Revelle & Michaels, 1976) that modeling the prior history of success and failure as a function of task difficulty leads to a reconciliation of the curvilinear models of motivation of Atkinson (1957) with the linear effort model of Locke (1968).

Effort varies as a function of prior trials



- A single trial is most motivating at p=.5
- Because failure occurs more often the harder the task, there is more carryover of motivation from trial to trial the harder the task.
- Carryover effects are strongest as the number of trials increases.

Effort varies as a function of prior trials

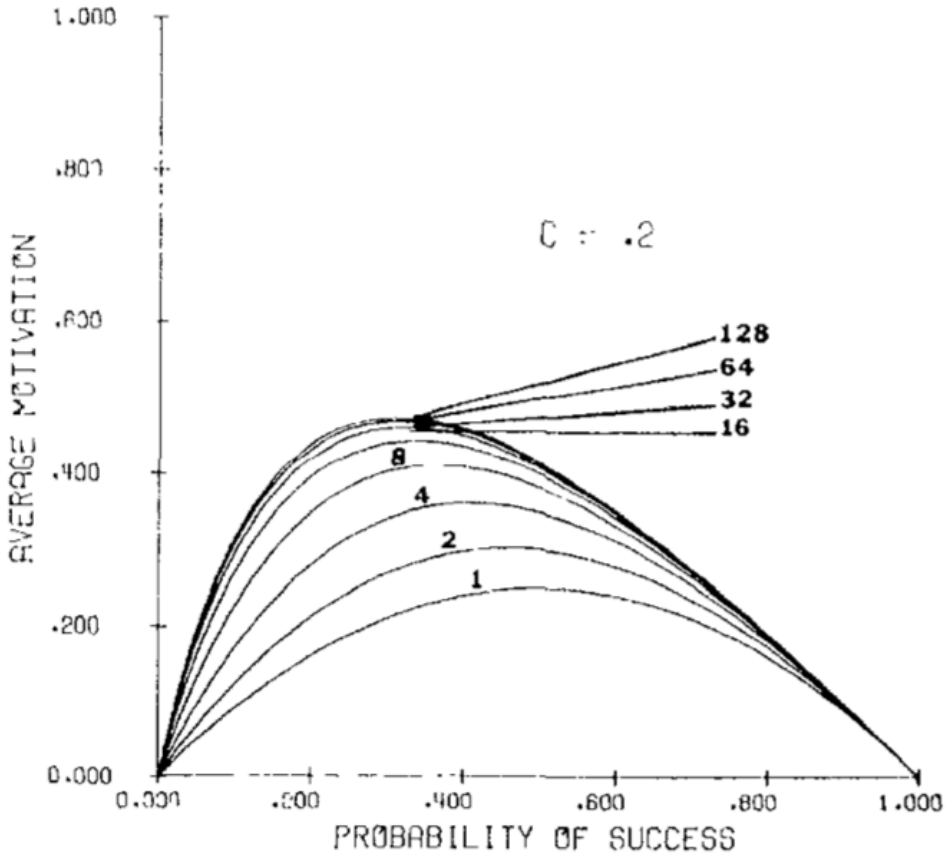


FIGURE 2. Expected level of motivation as a function of task difficulty (probability of success) and total number of experimental trials. (The expectation is taken over Trials 1 through n for $n = 1, 2, 4, 8, 16, 32, 64$, and 128. c is the consummatory value of failure. M_s is assumed to be equal to 1 and M_{af} equal to 0.)

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3. We have also shown that it is the *decay rate* of the effect of anxiety impairing performance that is itself a function of trait anxiety (Gilboa & Revelle, 1994).

Dynamic prediction for anxiety intensity and duration (from Gilboa & Revelle (1994)

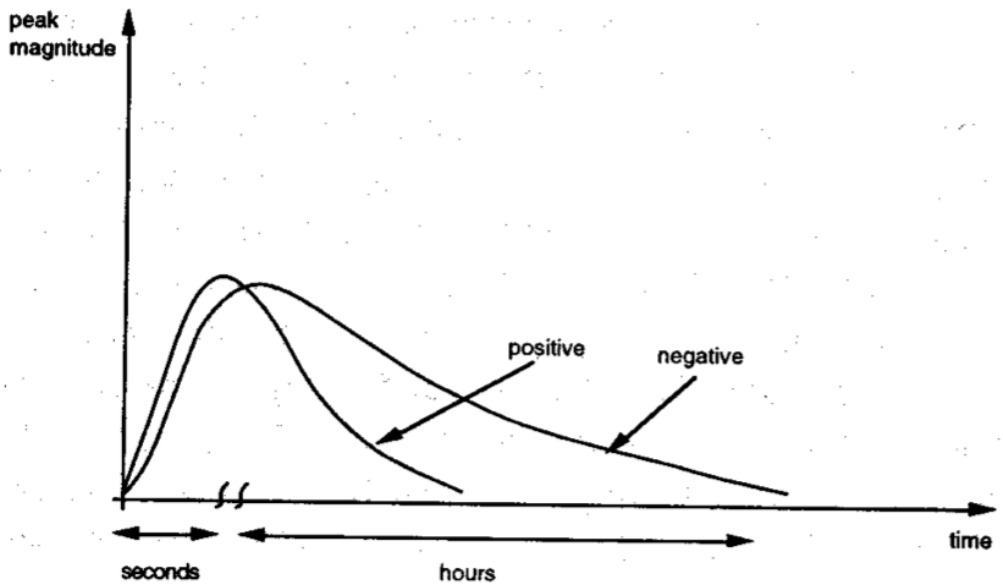
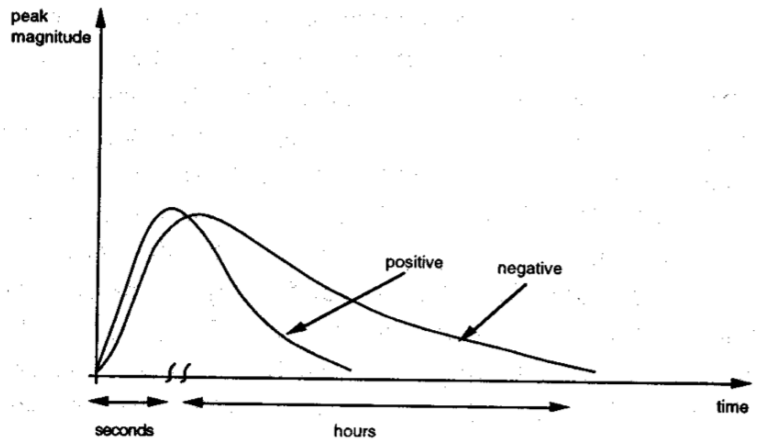


FIG. 5.1. Schematic representation of the duration of positive and negative emotions.

Initial intensity does not differ, duration of state effects does



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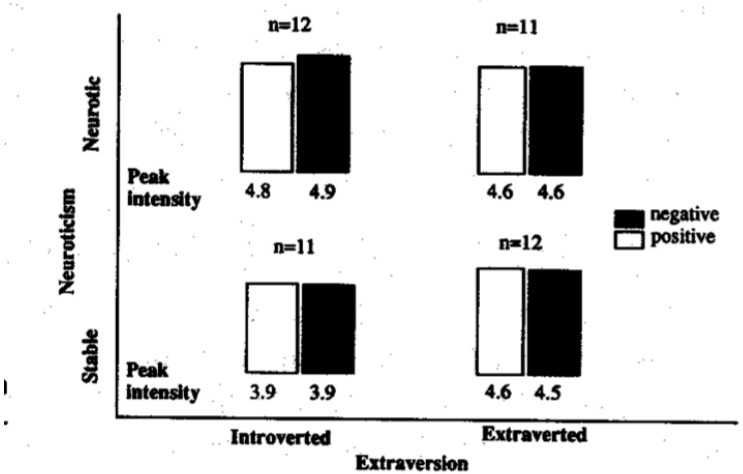
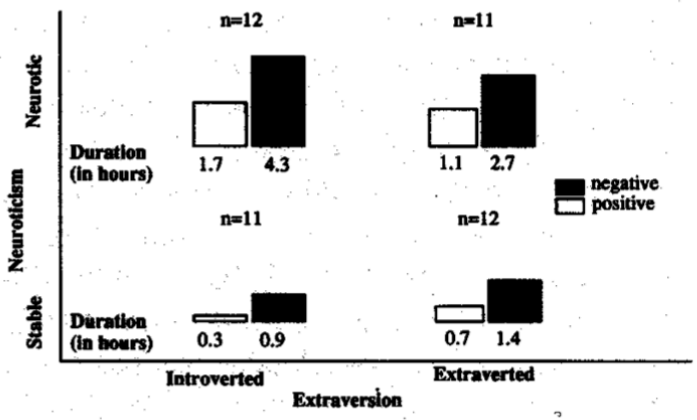




Anxiety and time course of processing

1. We also have examined how the effects of time moderate the effects of anxiety and general dysphoria in a *dot probe* task with angry and happy faces (Oehlberg, Revelle & Mineka, 2012).
2. Happy and angry faces were presented for 300, 500, and 1250 ms followed by a dot probe replacing the figure or on the opposite location from the figure.
3. A follow up study presented stimuli for 300 or 1,000 ms. and found that the results varied over the time course.
4. The dot-probe bias results showed negative affectivity biases towards angry faces at 300M but away from sad faces at 1,000 ms.

Personality traits lead to differences in situational choice

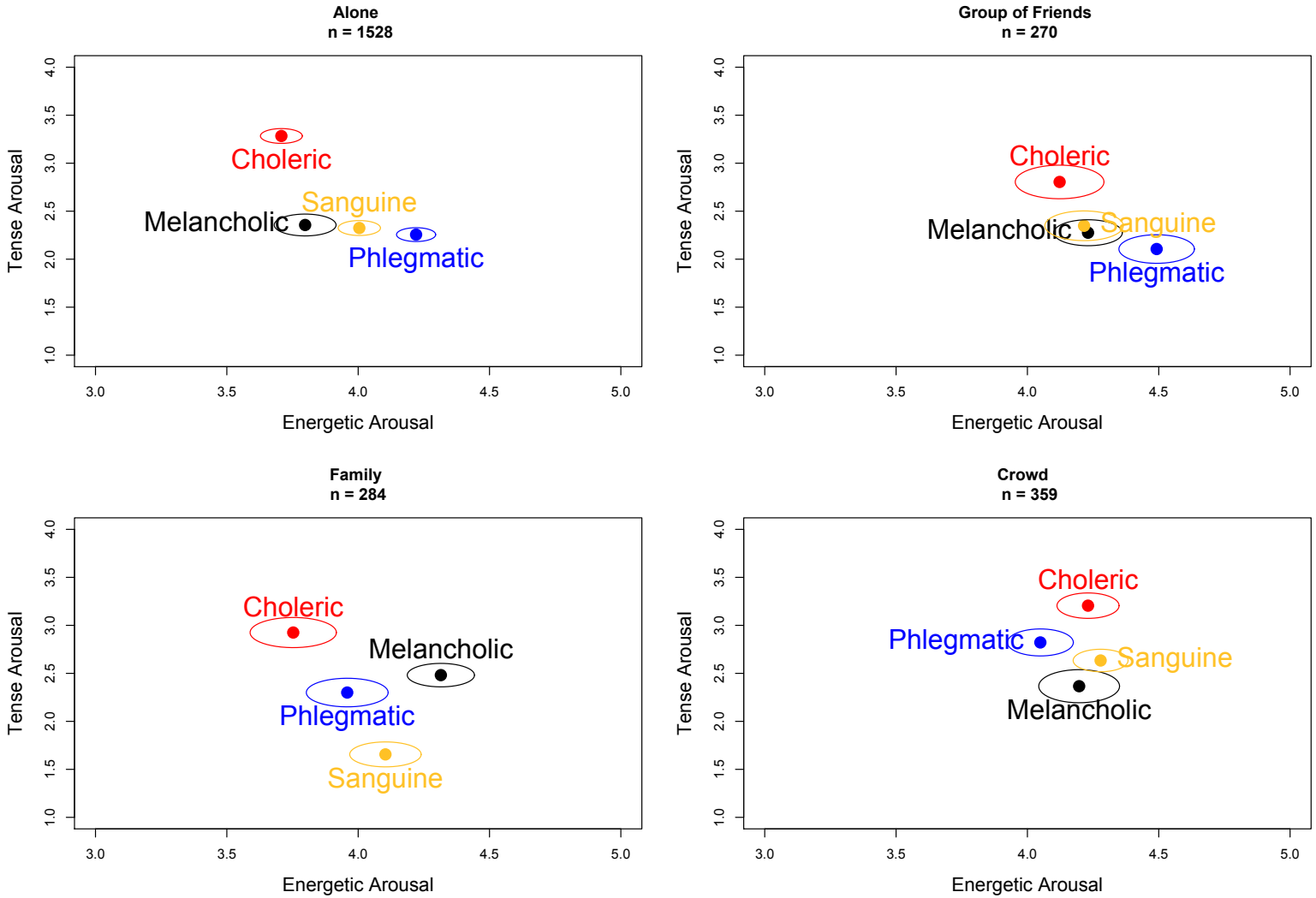
1. In our dynamic model, personality traits (such as anxiety) are seen as rates of change in affective and motivational states.
2. This leads to two consequences of personality traits:
   - 2.1 Personality traits bias situational choice
     - This is the relative probability of being in particular situations.
   - 2.2 Personality traits bias the persistence of choice.
     - This is the persistence of one activity and the latency for an alternative activity
3. Situational choice then lead to affective states (reactions to these situations) which differ by personality traits.

Similar ideas were discussed in the excellent symposium yesterday on "Self regulation and Emotion regulation" by Agata Wytykowska, Chris Englert and Edward Nęcka who discussed control theory and feedback.

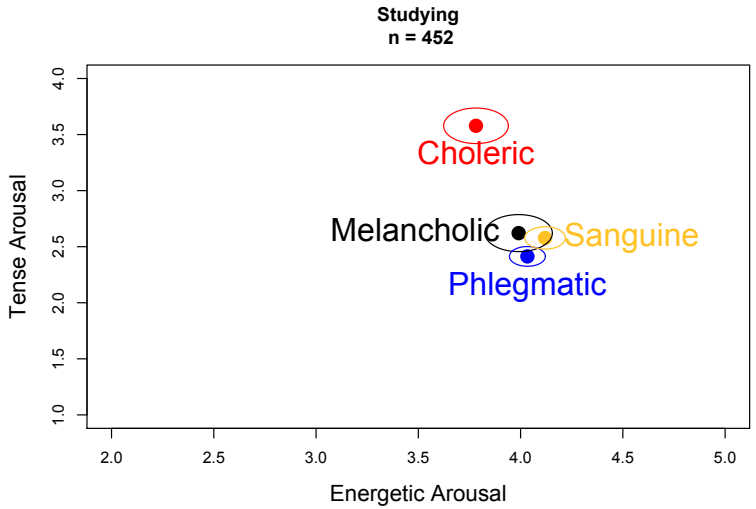
Recent evidence for dynamic models

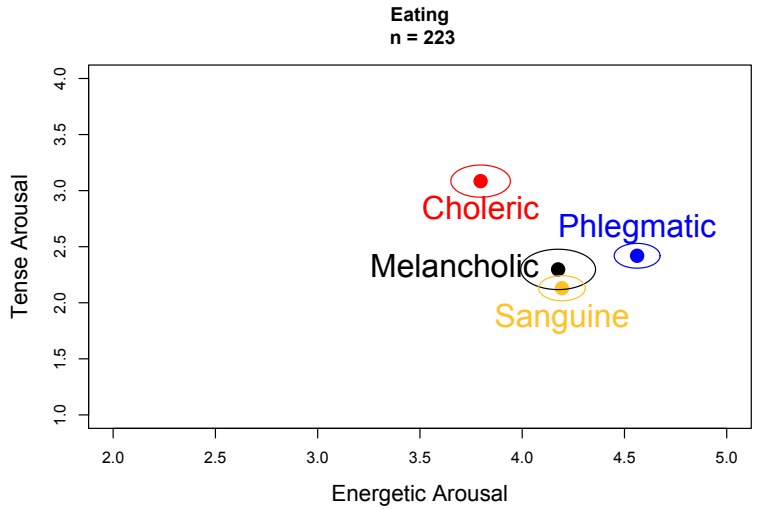
1. We report data from several studies summarized in Wilt & Revelle (2017b) and Wilt & Revelle (2017a)
   - These were data collected by using cell phones to study the dynamics of affect and choice
   - Trait measures were given to all participants who then given a small card with a set of questions.
   - Each participant was then sent text messages 4-5 times per day for 7-14 days asking their responses to the preselected questions.
   - These questions included what situation was the person in and their current level on several emotional states
2. Following earlier studies, we report data in terms of Energetic Arousal (EA) and Tense Arousal (TA) (Thayer, 1989).
3. Although measured on continuous variables, we find it convenient to graphically display the data in terms of Galen's Types (ie. High and low Extraversion by High and Low Neuroticism).

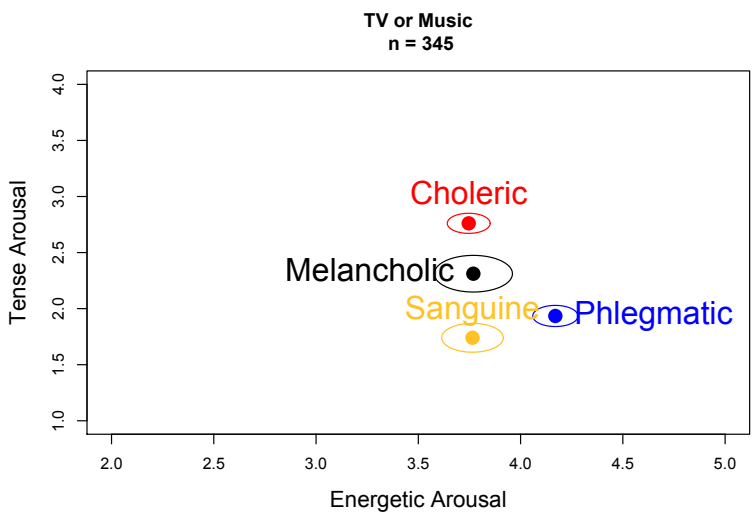
People differ in the situations they choose: company

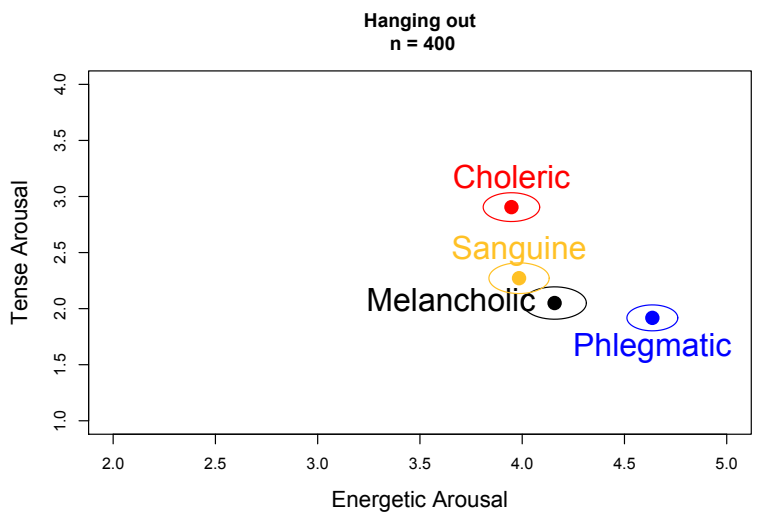


People differ in the situations they choose: activity

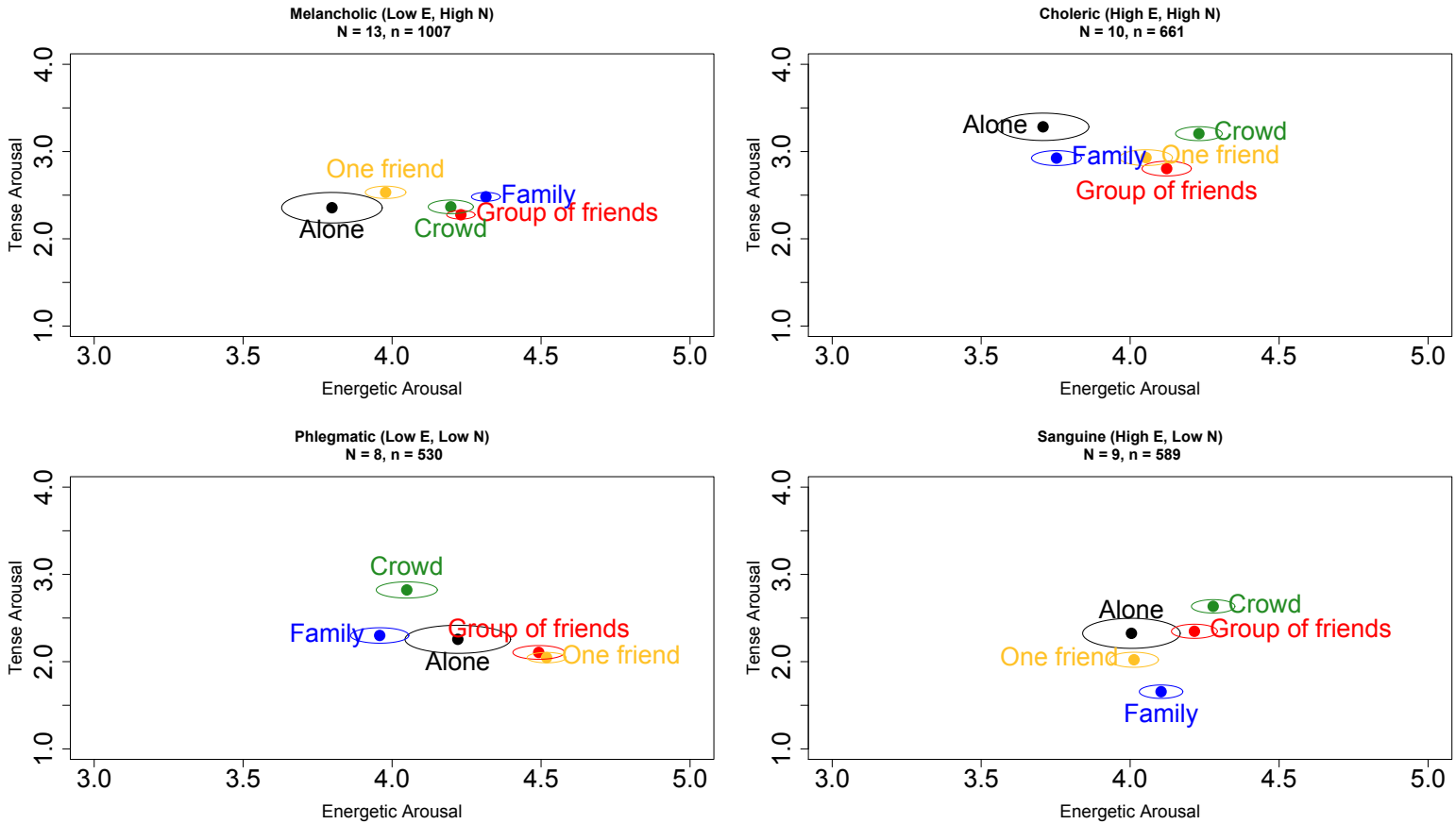




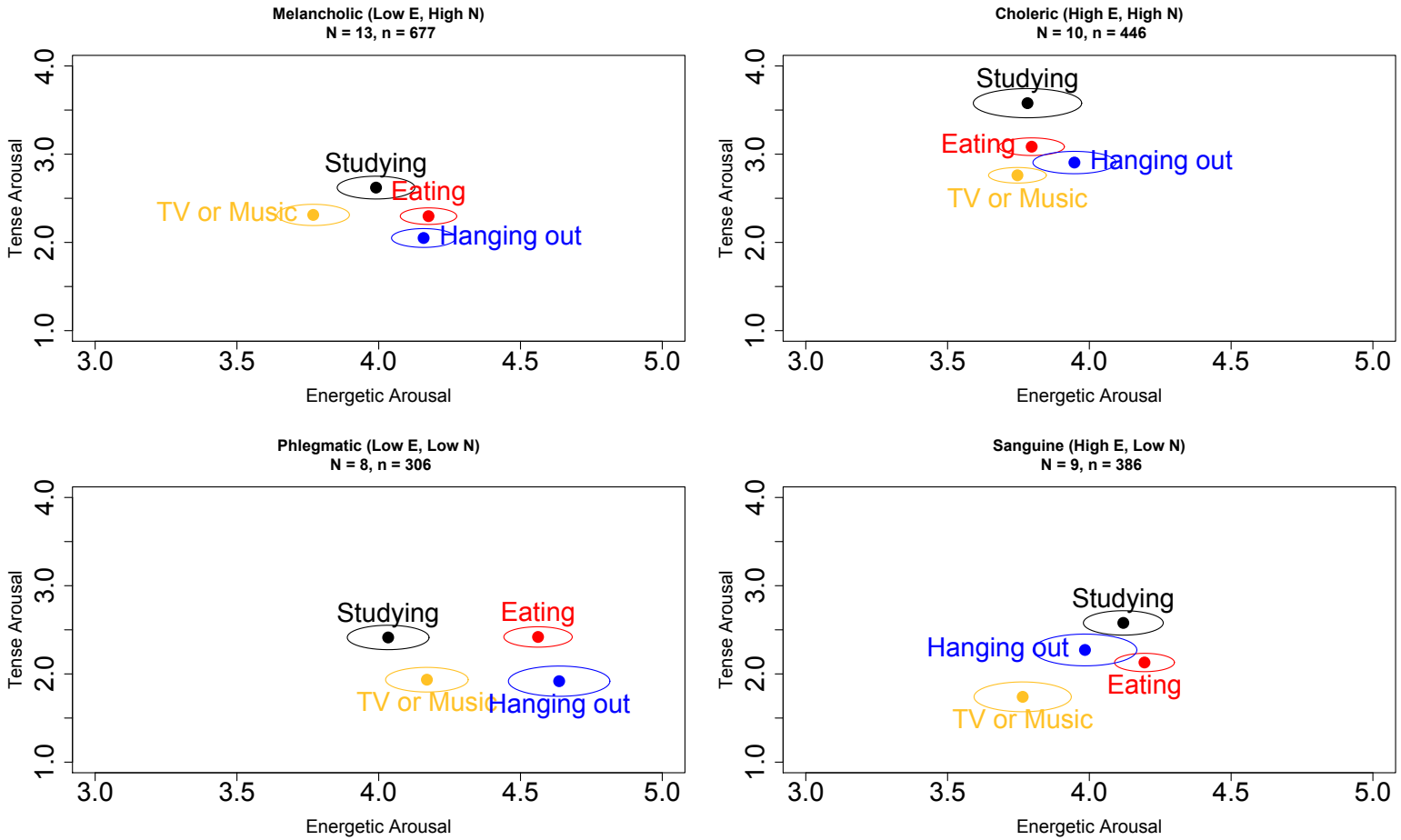




Company organized by Galen's "Types"



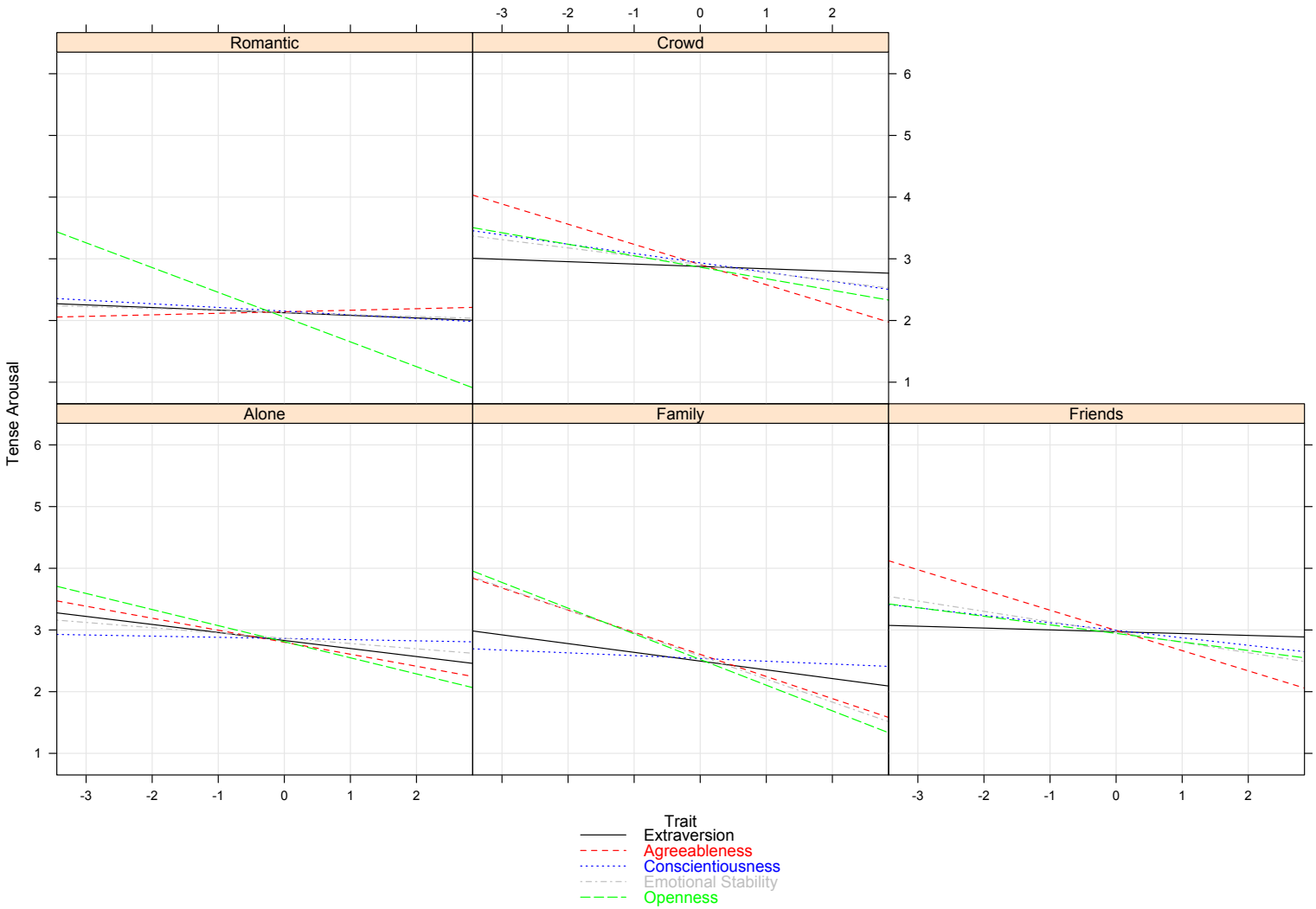
Affect varies by situational choice: Activity



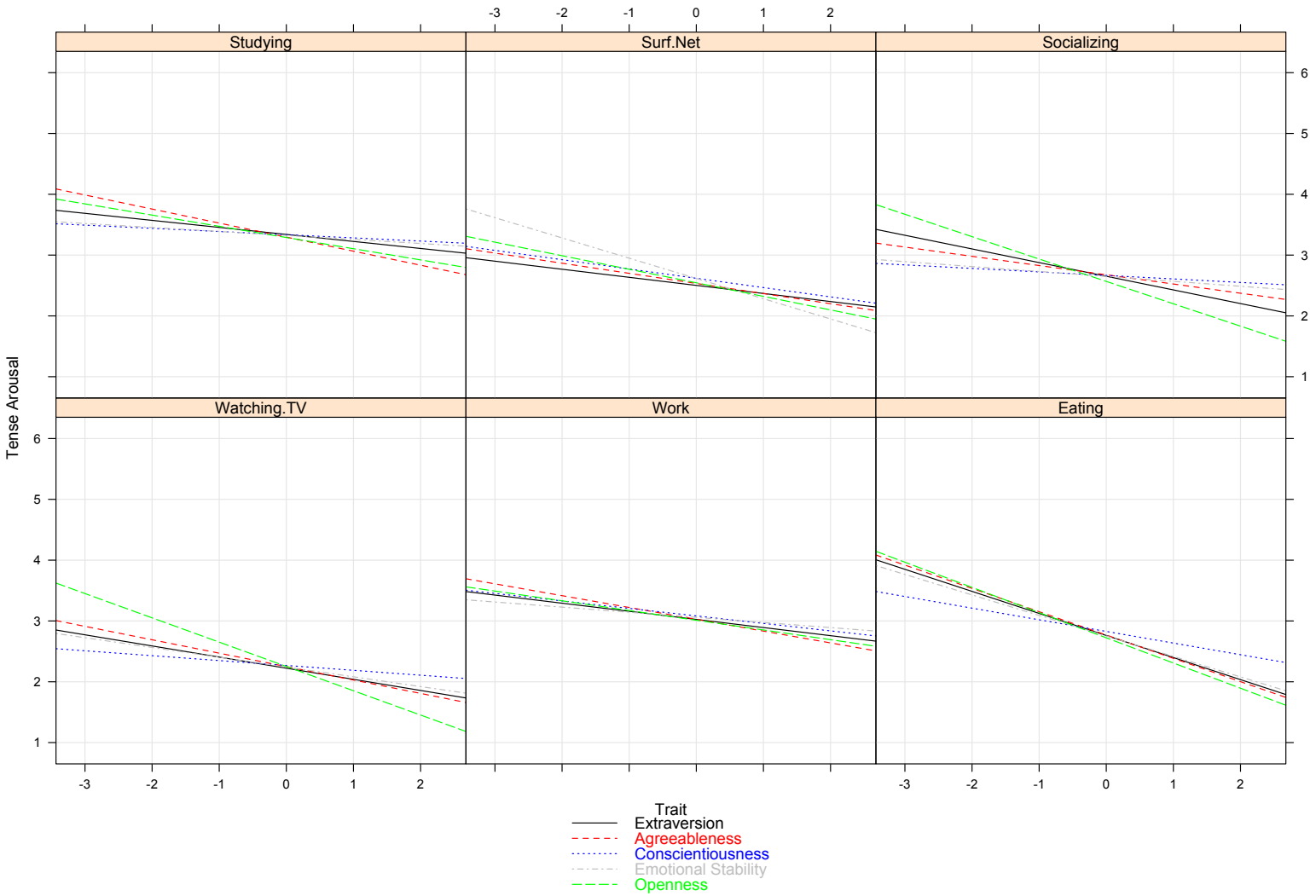
Affect varies by traits and situational choice and activity

1. We can also do a multilevel analysis of Tense and Energetic Arousal by the "Big 5"
2. Although we just show the Tense Arousal, we also have Energetic Arousal measures.
3. Discussed in more detail in Wilt & Revelle (2017a)

Tense Arousal varies by traits and company



Affect varies by activity within situation



Conclusions

1. Stable characteristics of personality (Traits) may be seen as determining the rates of change in affective, cognitive, and behavioral states.
2. The appropriate measures of personality thus include persistence, latency, and choice.
3. Traits affect the probability of being in particular situations, as well as the reaction to that situation.
4. To study anxiety, or any other personality trait, is to study the dynamics of the resulting states and how they vary across situations.
5. For more information and for a copy of these slides see http://personality-project.org/sapa or contact us at revelle@northwestern.edu or joshua.wilt@case.edu.

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