The study of dynamics is very old and yet very new

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Outline

Introduction

The dynamics of personality have been studied for more than a century. Each new generation of researchers tends to think they are studying a new problem, but are actually revisiting some long examined issues.

Taking a long view, we can see that progress is made when new methods of data collection are married with new methods of data analysis.

I will review the long history of dynamic studies, emphasizing recurring problems and solutions and offer some suggestions of what are the basic requirements of any dynamic system.

Personality as coherent patterning of the ABCDs over time

1. Just as a song is a coherent patterning over time of different notes and rhythms, so is personality a coherent patterning over time and space of feelings, actions thoughts, and goals.
   - A song is not the average note played, nor should a person be seen as an average of affects, behaviors, cognitions, and desires (Revelle et al., 2010).
   - For it is the dynamic patterning of these components that is the unique signature of a song as well as of a person.
   - That it is the patterning, not the specific notes, is clear when the haunting tune of Gershwin's "Summertime" is played by a guitar trio, or a Beatles' tune is played by the London Symphony Orchestra.
2. Unfortunately, although easy to define personality in terms of dynamic patterns, it is much more difficult to study these patternings over time. (Revelle and Wilt, 2021)

Dynamics is more than just motivation

1. Much of what is currently included in dynamic models reflects either explicitly or implicity theories of motivation: the how and why of behavior. The terminology of motivation is that of needs, wants, and desires. The study of motivation is the study of how these needs and desires are satisfied over time. That is to say, to study motivation is to study dynamics (Atkinson and Birch, 1970; Heckhausen, 1991).
2. However, there is more to dynamics than just motivation. For the patterning of thoughts, feelings and desires can be seen to reflect stable individual differences in rates of change of internal states in response to external cues.
3. I think this emphasis on dynamics should continue as new methods are introduced but some of the older models should not be forgotten.

Kurt Lewin and field theory

1. Kurt Lewin (1951) wrote that to study behavior was to study its dynamics, for behavior was a change of state over time.
2. People's states changed in response to the self perceived situation, not the situation as defined by an observer (Lewin et al., 1935)
3. They responded to the entire field, not to any particular cue.
4. Lewin's distinctions between identical motor movements needing to be understood in terms of their broader meaning (copying text versus writing a letter), or the significance of a post box when one has a letter to mail versus not make clear the need to study the motivational dynamics of behavior rather than the behavior per se.

Early work on dynamics

1. Review by Allport and Vernon (1930) is a classic history of personality, including dynamics, until 1930.
2. Other early work inclues Tolman (1932) and Lewin et al. (1935).
3. Woodworth spent a career investigating dynamics (Woodworth, 1918) and (Woodworth, 1958).
4. Most of this was discussions of the importance of collecting dynamic data, but a little weak on data.
5. The dissertation of Johnson (1937) was a monumental study of 30 female students at UCB over 65-90 consecutive days.
   - One measure/day of "euphoria/depression" on 11 point scale.
   - Analysis was primarily graphical.

Johnson (1937) examined mood within subjects over 65-90 days

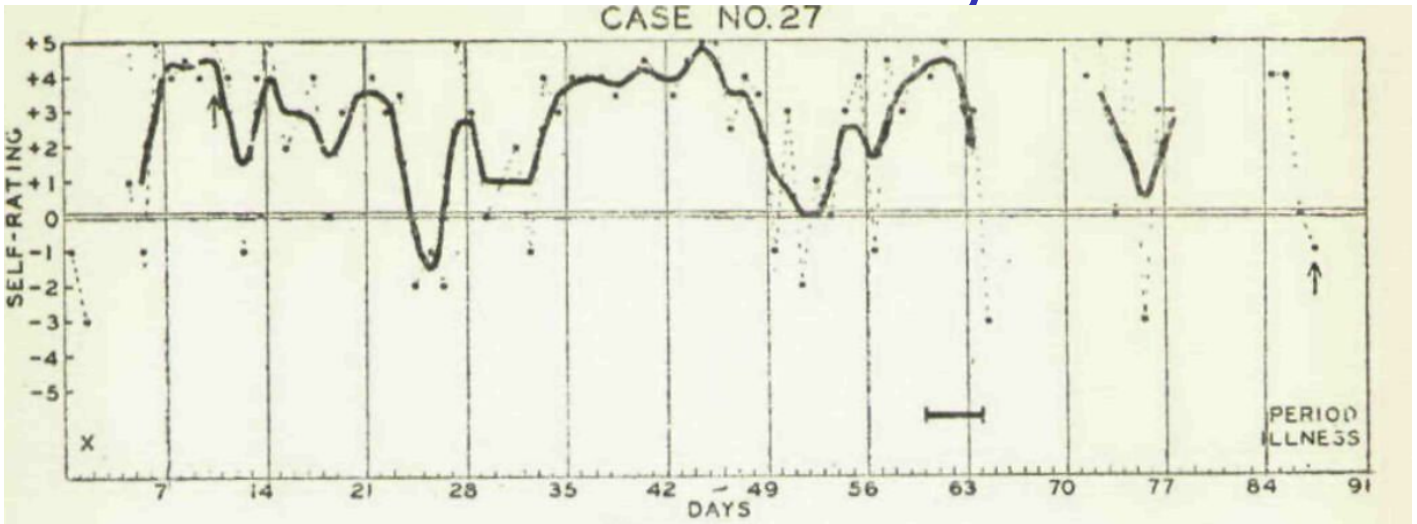
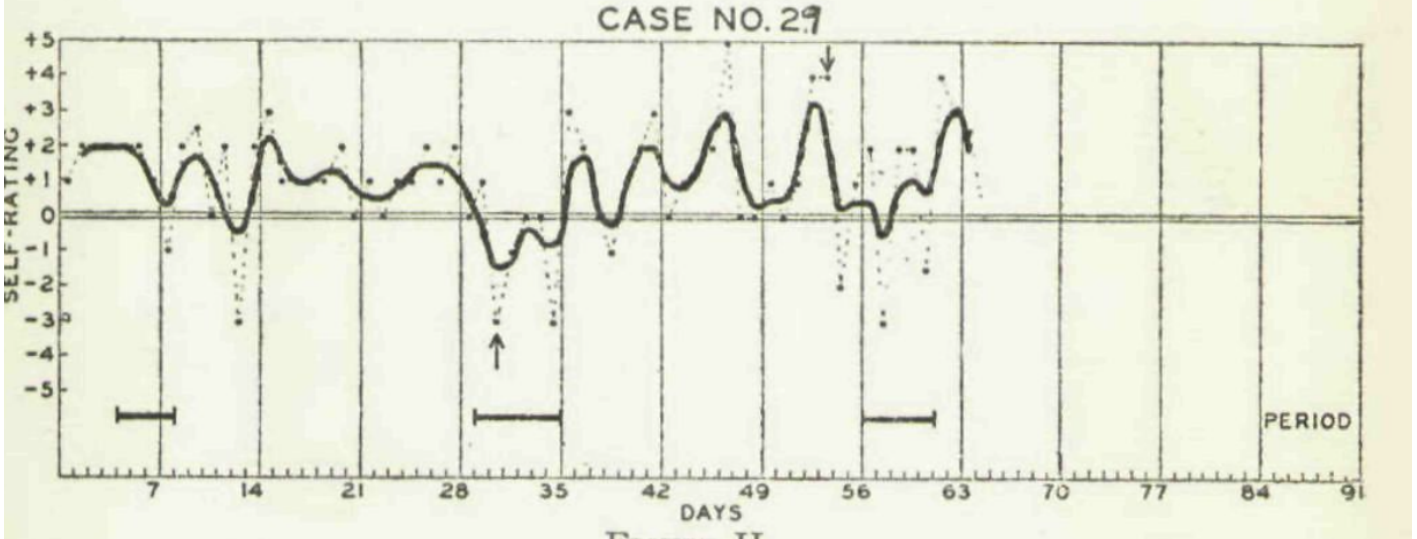
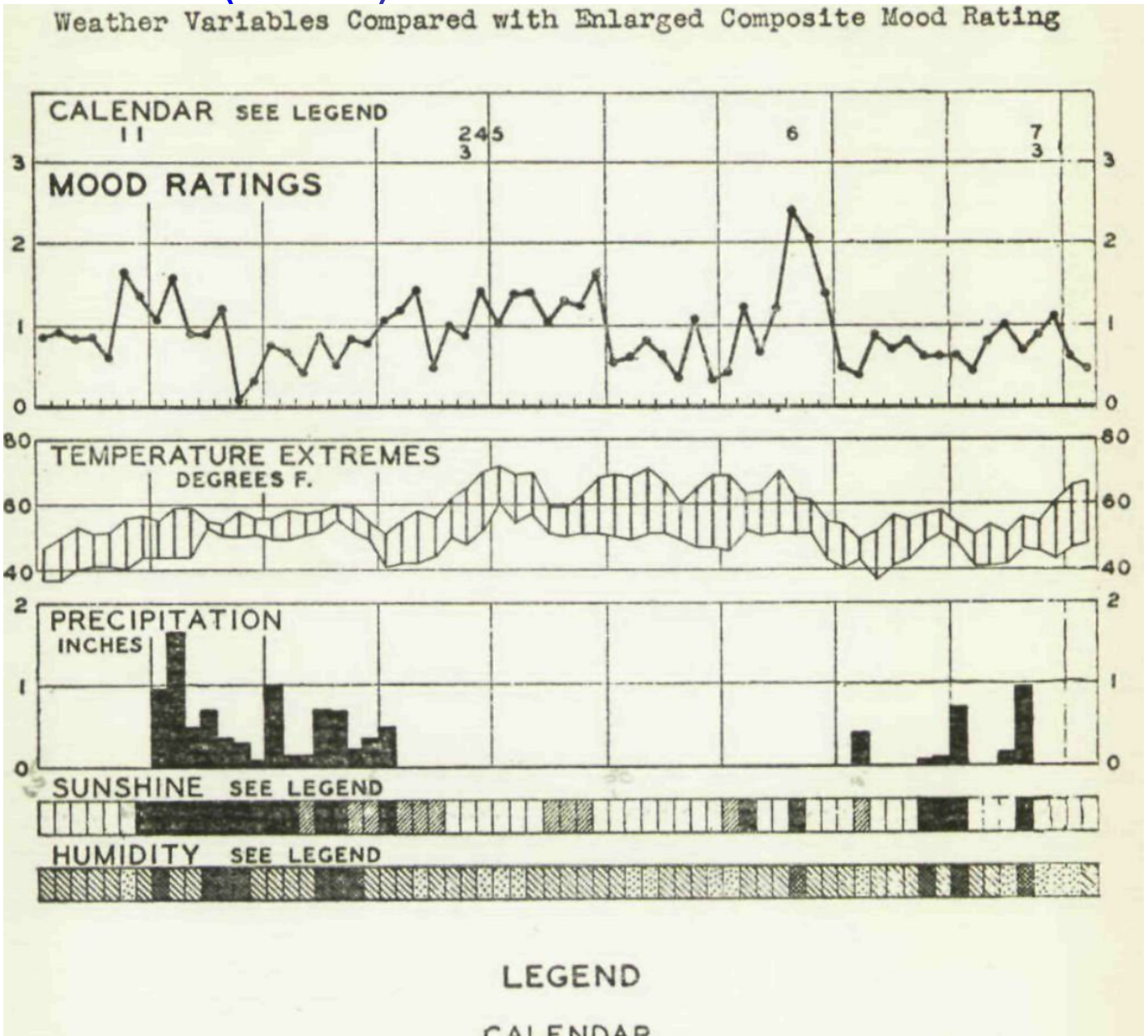


FIGURE I



Johnson (1937) examined weather mood relationship



Two demonstrations of P technique, factoring the within subject data

1. Cattell and Luborksy (1950) analyzed one subject over 54 days
2. Cattell and Cross (1952) measured motivational "ergs" within one subject over 40 days with 2 observations per day.
3. Extensive discussion of within person factors.
4. But this not actually studying dynamic process, merely within subject variation.
5. The results are the same if we randomize the observation order (or, for old timers, if we dropped the deck of data cards).

Motives and behavior

1. As Atkinson and Birch (1970) put it, motives had inertia and persisted until satisfied. They could not be studied without considering their dynamics over time (Zeigarnik, 1927).
2. Just as Berlin waiters could remember what their customers ordered for dinner until they had paid for it and then not be able to recall it, so did children remember the games they had been playing but had not yet finished rather than games that had reached a conclusion (Zeigarnik, 1927).
3. Similar results have been reported for unsolved versus solved anagrams (Baddeley, 1963) and depending upon the task, reflects competing motivations for success and failure avoidance (Atkinson, 1953).
4. Desires persist until satisfied.

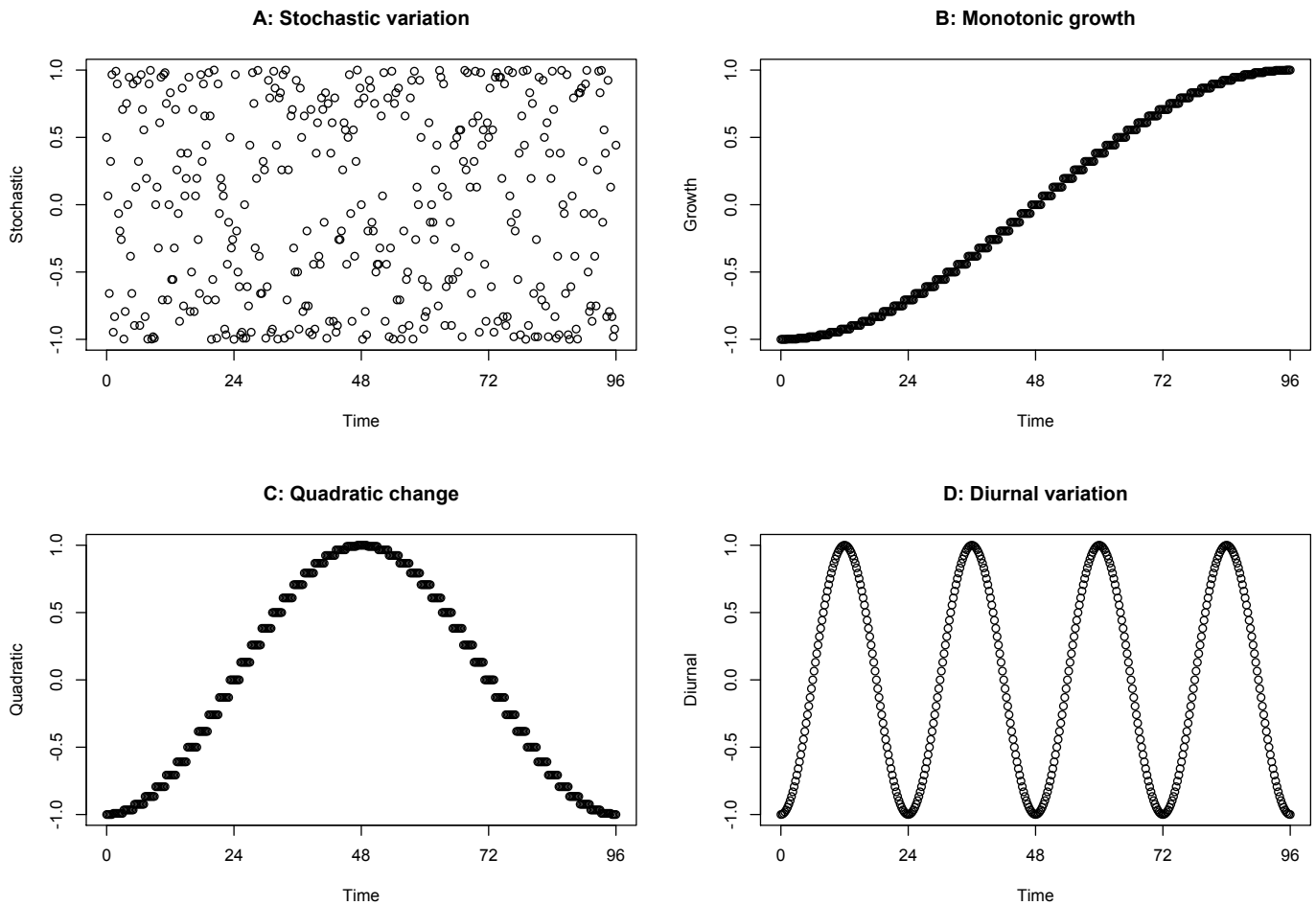
The basic issues of analysis of dynamic systems

1. Inertia of desires and actions.
2. Time as a finite resource and the need to allocate between tasks.
3. Temporal ordering of choice
4. Latency and persistence
5. Change

What is dynamics?

1. Many discussions of “dynamics” discuss Cattell’s data box (Cattell, 1946, 1966) and the need to study variation over time within subjects.
2. Yes, people do vary over time and situations but this is not necessarily dynamic.
3. To be dynamic, time must be included in the model.
4. Stochastic variation is not dynamic.
5. Consider 4 distributions across time with equal variance and equal means.
6. 3 show dynamic variation, one just stochastic variation.

Four kinds of within subject relationships over time



From Revelle and Wilt (2021)

What is a dynamic system?

1. States change over time.
2. States show inertia.
3. Ideally can be modeled:
   - As a box diagram showing the flow of behaviors.
   - As a set of difference or differential equations.
   - Dyanamic SEM can treat lagged data.

Classical dynamic box models

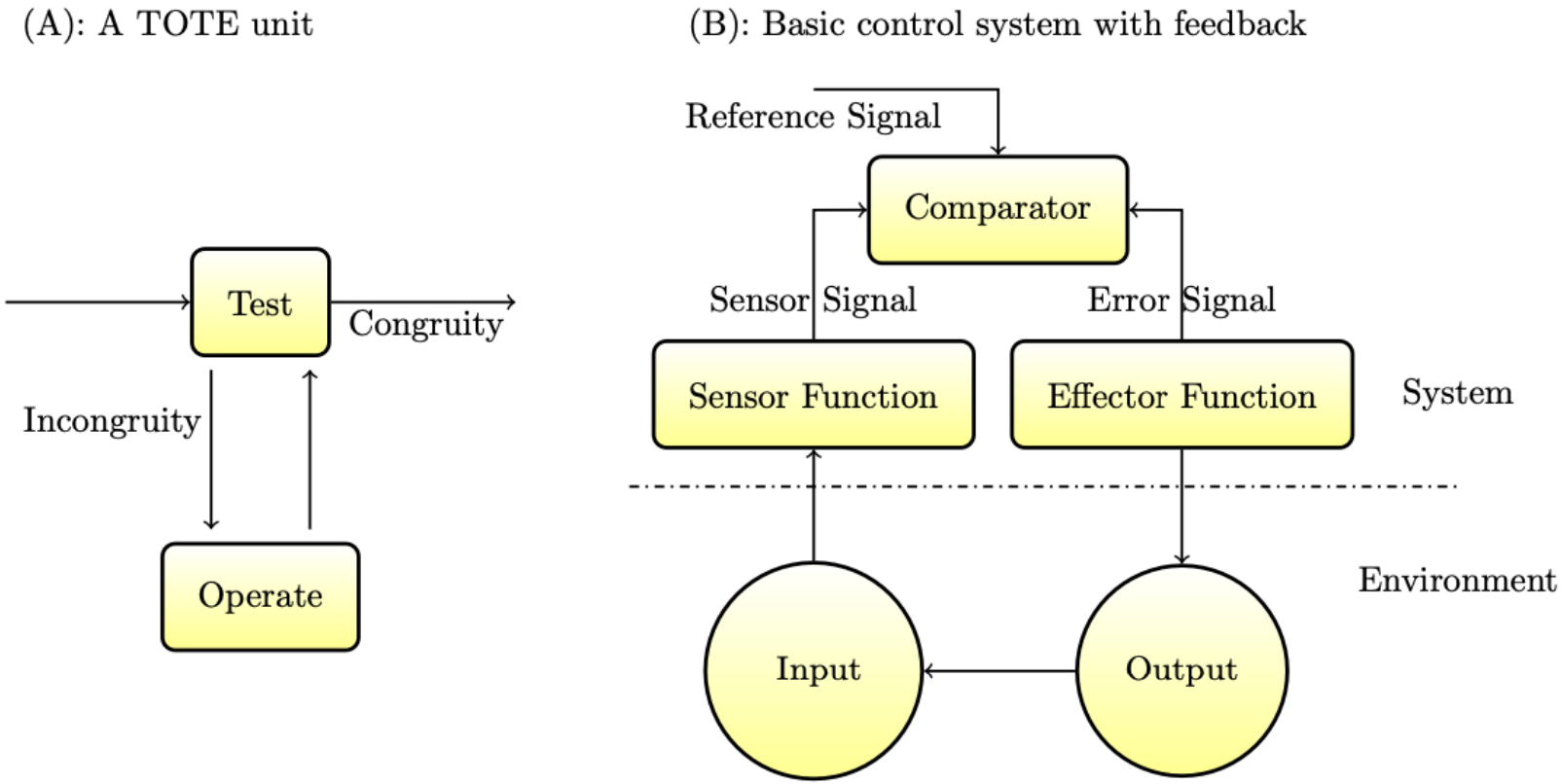


Figure 2. A): The basic Test-Operate-Test-Exit (TOTE) unit from Miller et al. (1960). B) The basic feedback loop with a comparator (adapted from Powers, 1973).

More verbal than formal.

Formal model of dynamics (Atkinson and Birch, 1970)

1. Atkinson (1953) had examined inertia in motivational task extending ideas of Zeigarnik (1927).
2. Feather (1961) showed carry-over of unfulfilled motives.
3. This led to a formal model of motivation: the dynamics of action (DOA) (Atkinson and Birch, 1970)
   - Theory as differential equations combining wants and actions.
   - Hard to understand and difficult to model.
   - Were psychologists ready for differential equations?
4. Predictions from inertial tendencies applied to choice (Revelle and Michaels, 1976) and then formalized by Kuhl and Blankenship (1979).
5. Actions at time t depend upon outcome at time t-1.

The CTA as a formal model

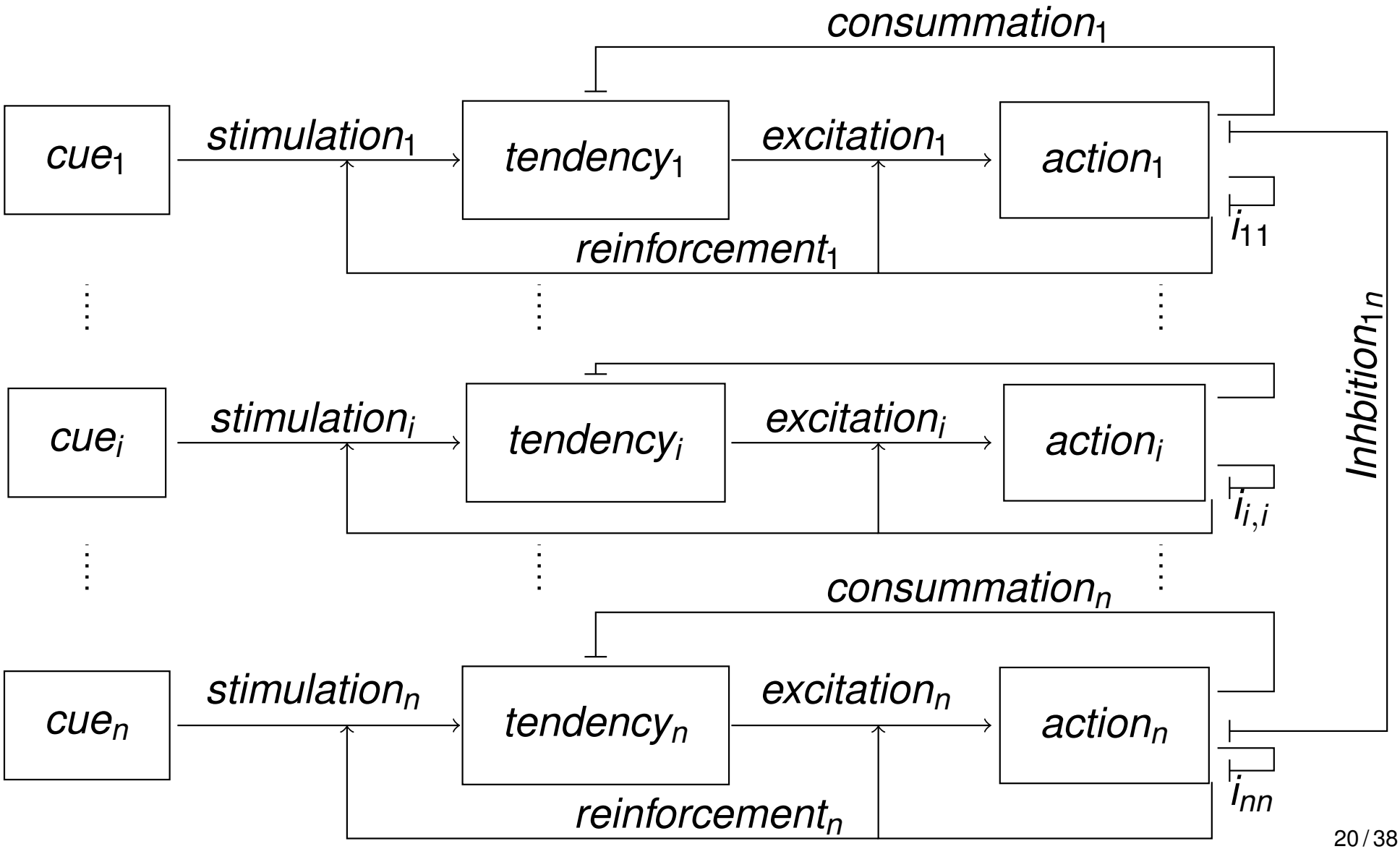
1. The CTA was Inspired by the Dynamics of Action (Atkinson and Birch, 1970) who elaborated on Lewin and Zeigarnik (1927) who introduced inertia into motivational models.
2. First discussed as a reparameterization of DOA (Revelle, 1986) and then elaborated by Revelle and Condon (2015) to apply to within person, between person, and over development.

The CTA as a formal model

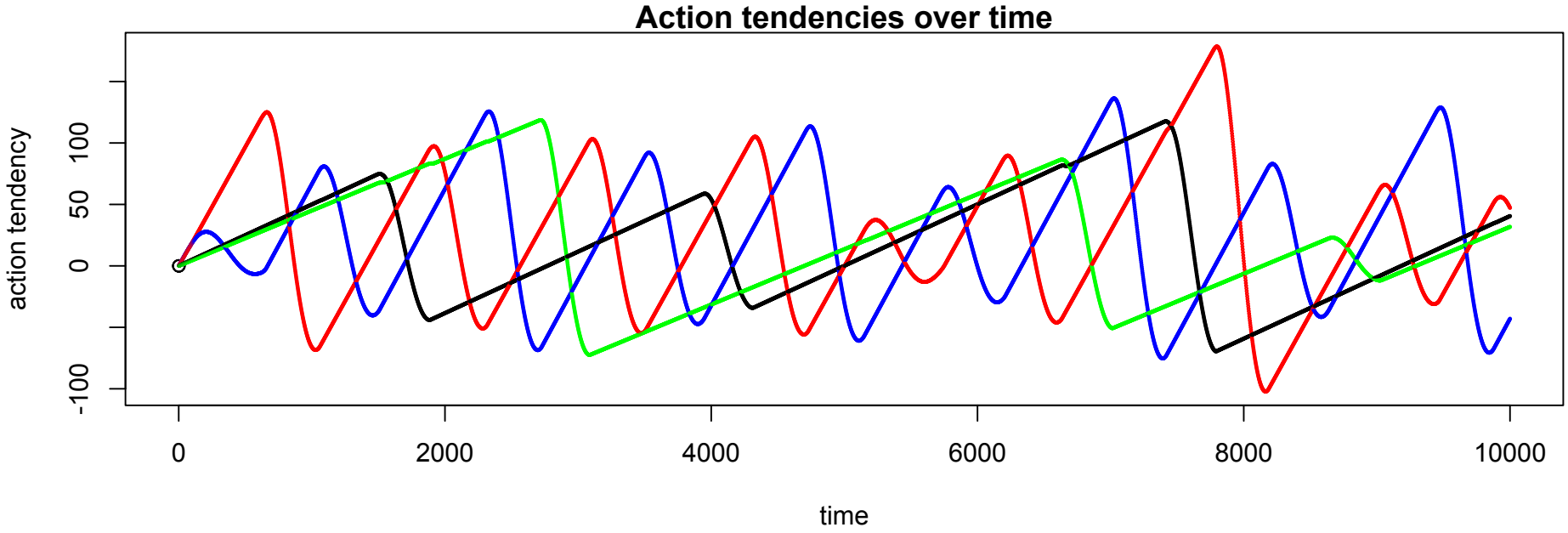
1. Revelle and Condon (2015) showed how the CTA model could model dynamics at three levels of analysis: within individuals (e.g. the rise and fall of emotions), between individuals (talking behavior in groups of individual), and between groups of individuals (choice of college major or occupation).
2. Extended to include Reinforcement Sensitivity Theory by Ashley Brown (Revelle and Brown, 2019).
3. Included as the `cta` and `cta:15` functions in the *psych* package.

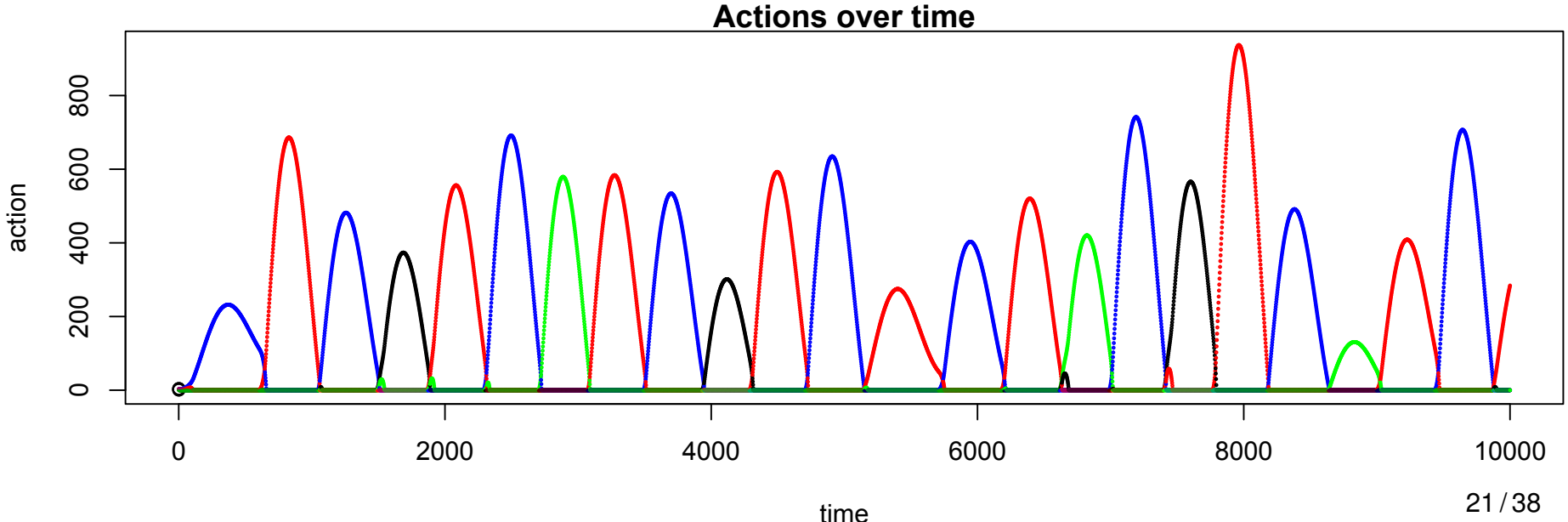
CTA as a simple but general model

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



Simulation of four individuals in a conversation

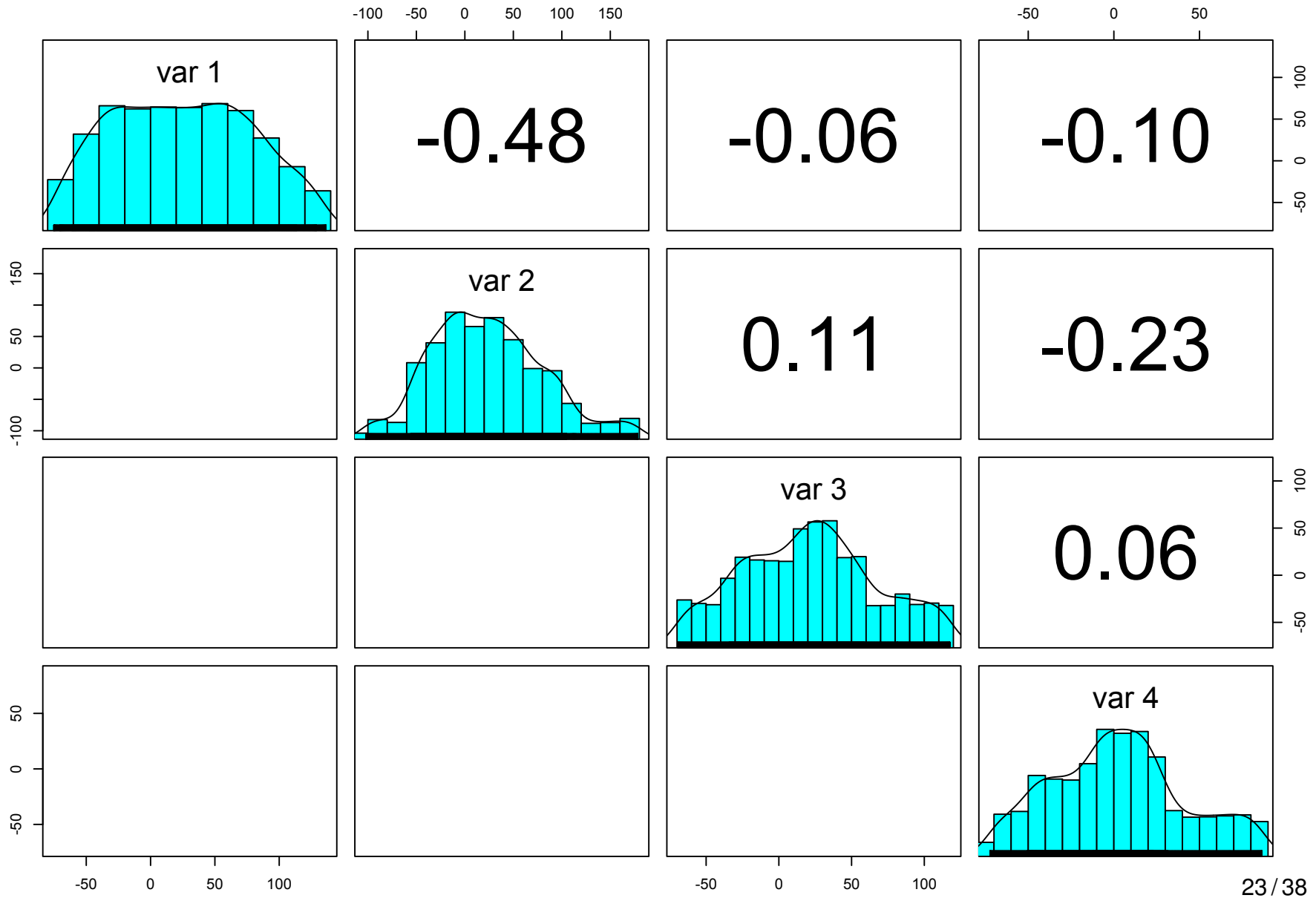




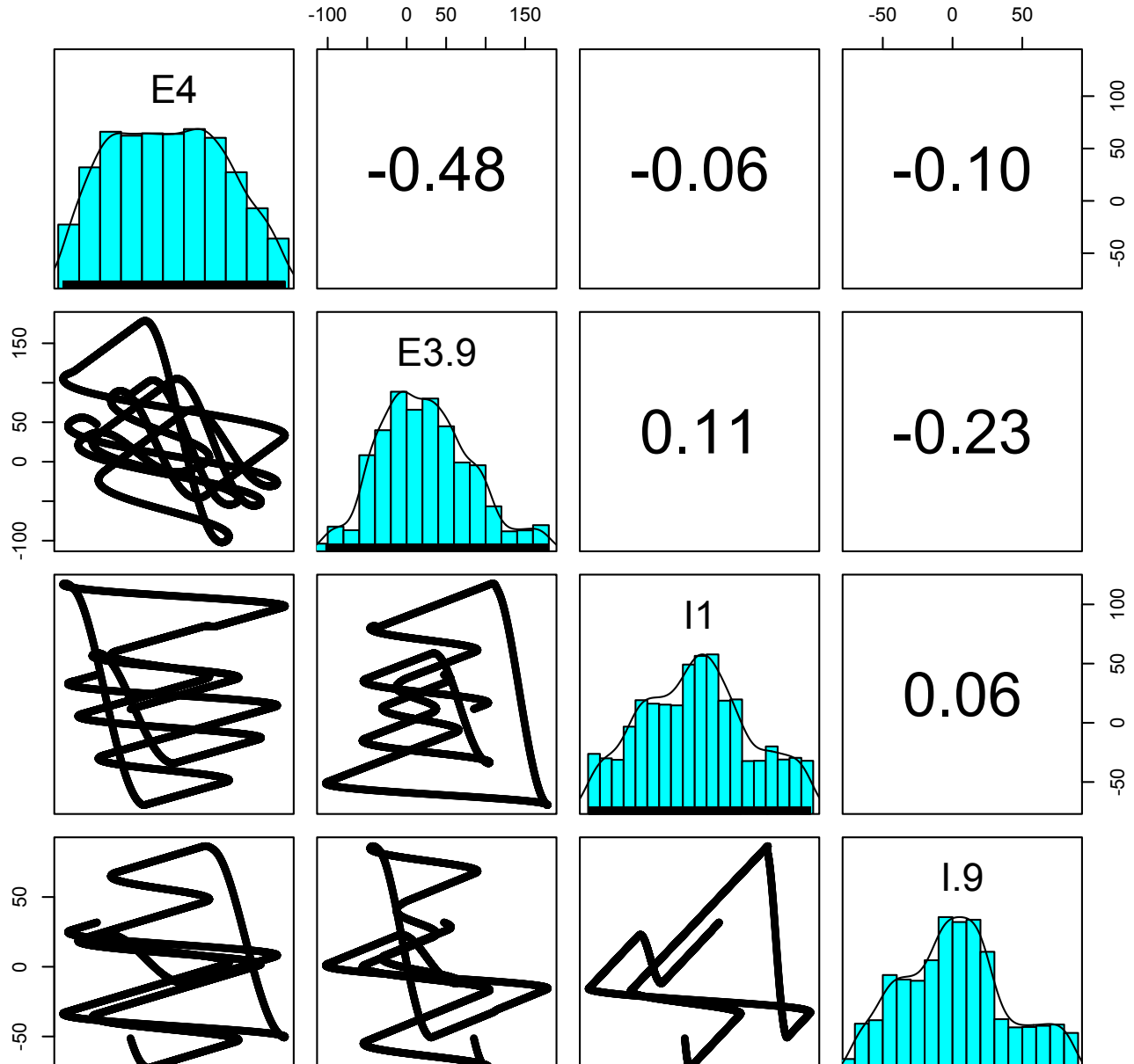
Dynamics are not stochastic

1. Although the desires to talk show a density distribution over time for each simulated participants, the scatter plots show that the talking behavior is not random.
2. The previous simulation showed four individuals differing in their desires to talk, cued by the other individuals.
3. But people take turns.
4. We need to consider not just the within subject density distributions, but also the between subjects covariation.

Density distributions of 2 E and 2 I in conversation



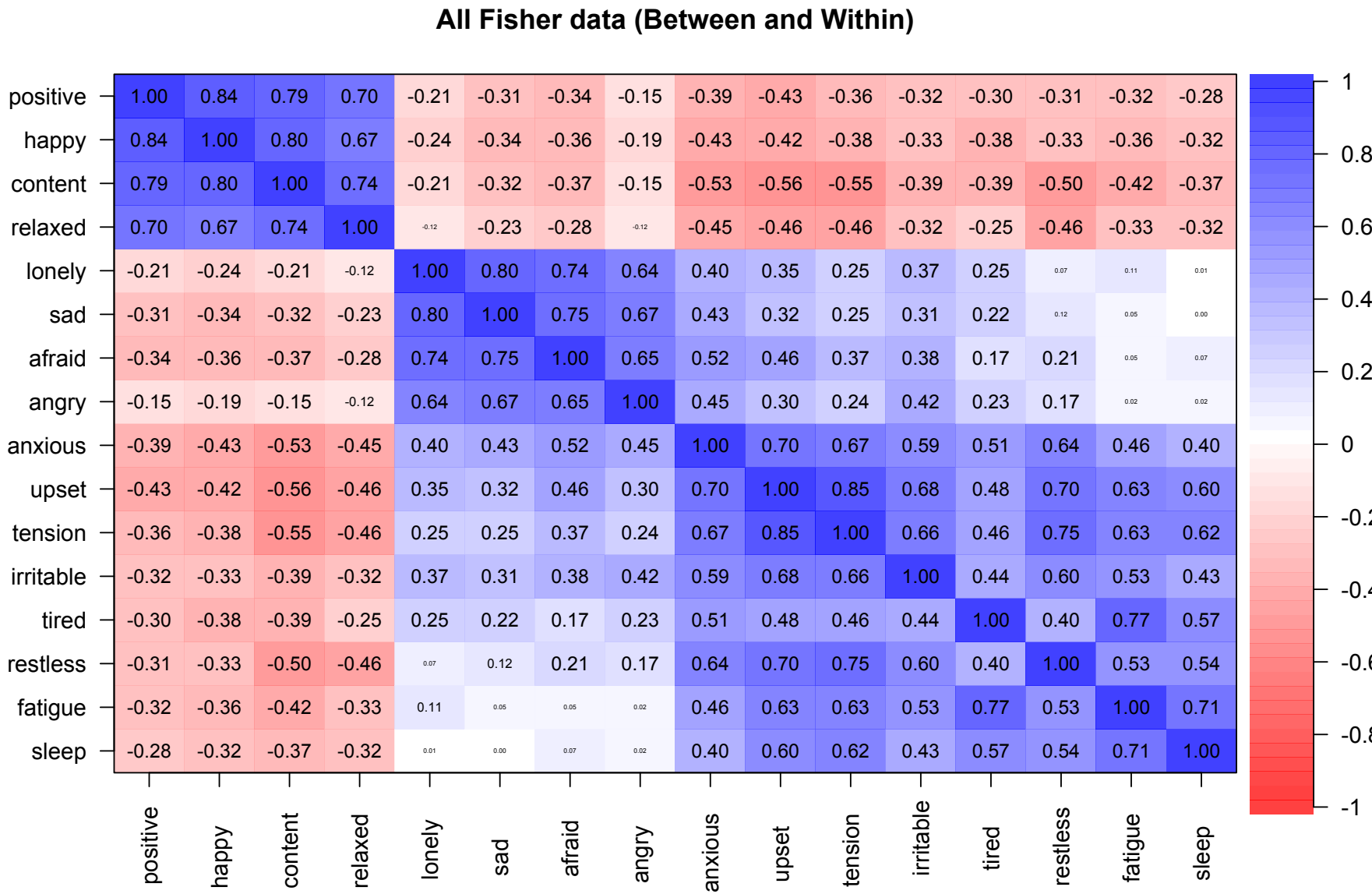
Scatter plot of 2 E and 2 I in conversation



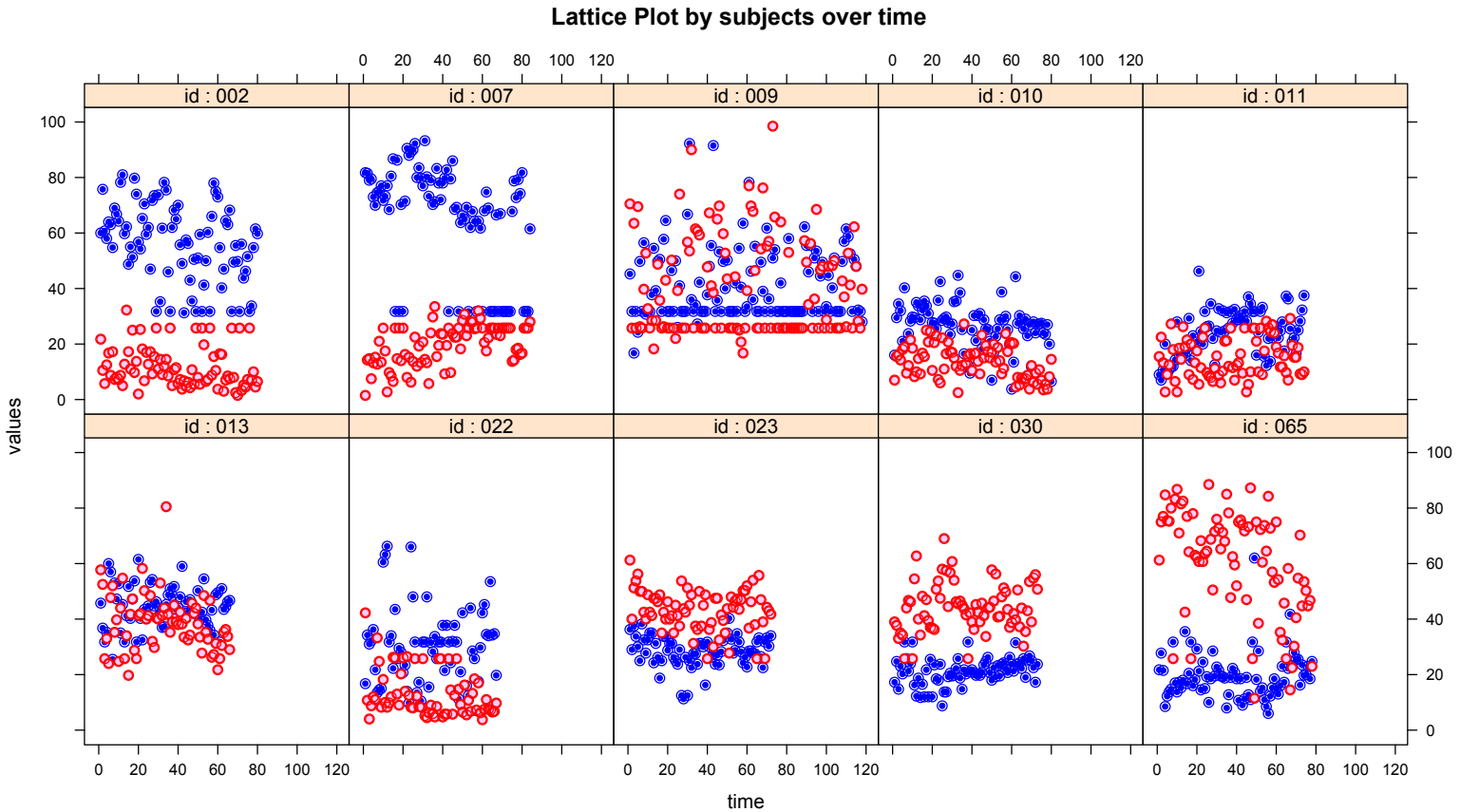
A simple example of within subject variation–the Fisher data set

1. Aaron Fisher (2015) studied mood with 28 items over 60-120 days
2. We have used these data (for 10 subjects) in a tutorial on dynamics Revelle and Wilt (2019).
3. From the 28 items, we chose a subset to represent positive and negative affect as well as tension/fatique.

Items from Fisher show a clean overall structure



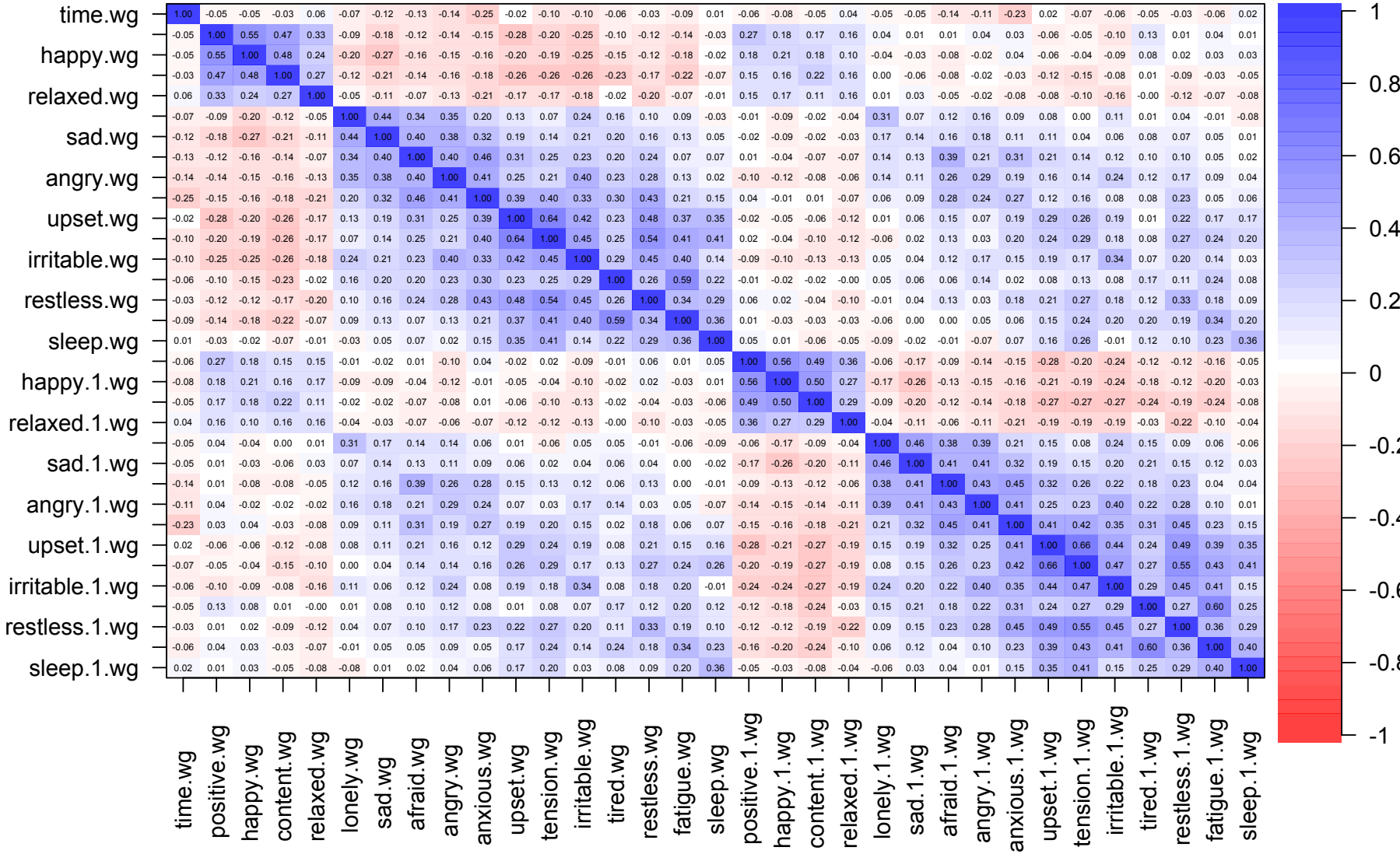
10 subjects over time from Fisher



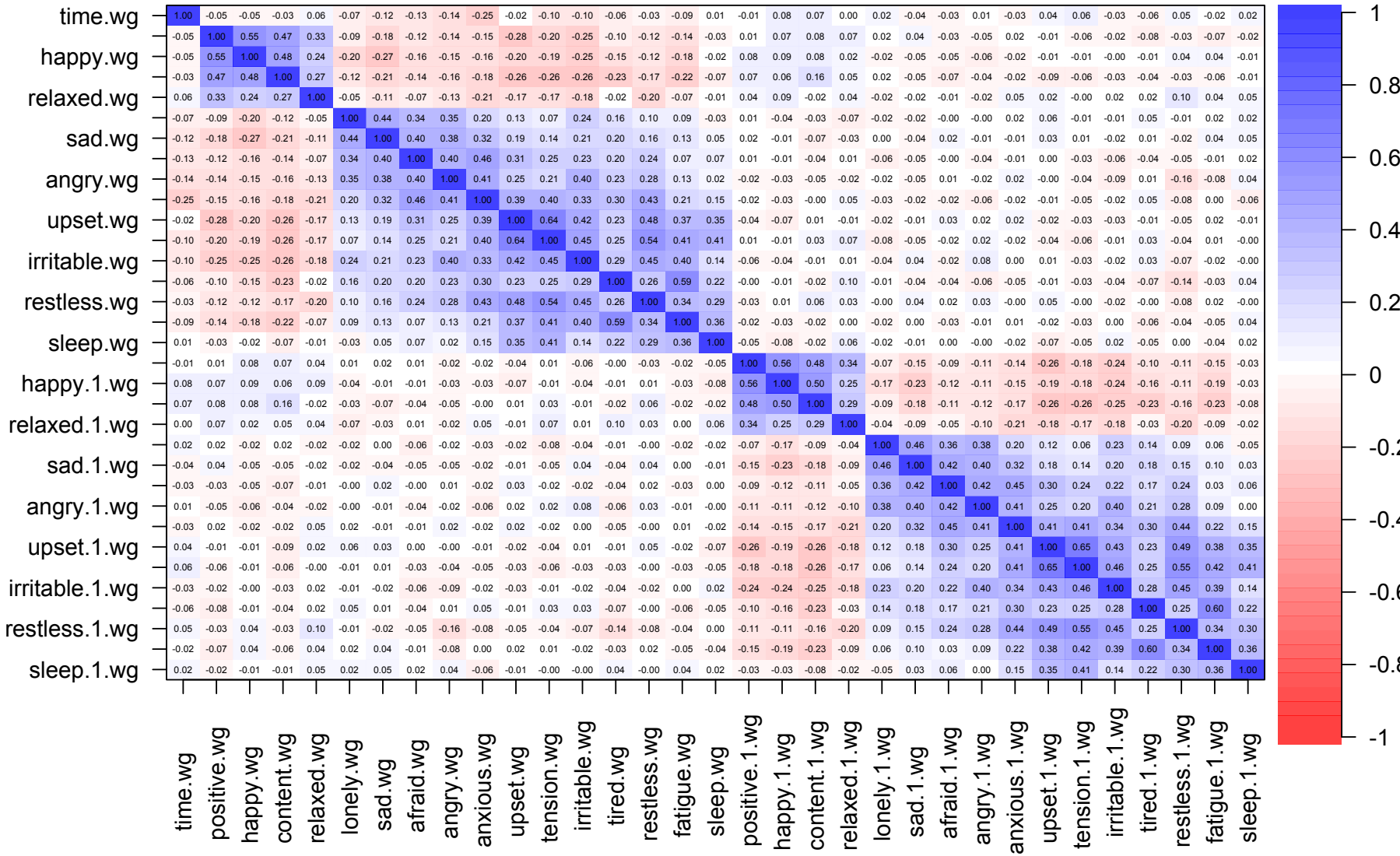
What is a dynamic system?

1. The Fisher data set seems to show changes in mean level over time
2. We examine the within subject correlations averaged over time
3. But this correlation does not vary if we randomize the time.
4. Dynamic processes will show inertia (day 1 is more similar to day 2 than to day 22)
5. To show temporal effects it is necessary to show the lagged correlations.
6. But the variation between days could be all situational. Random lags partly address this.

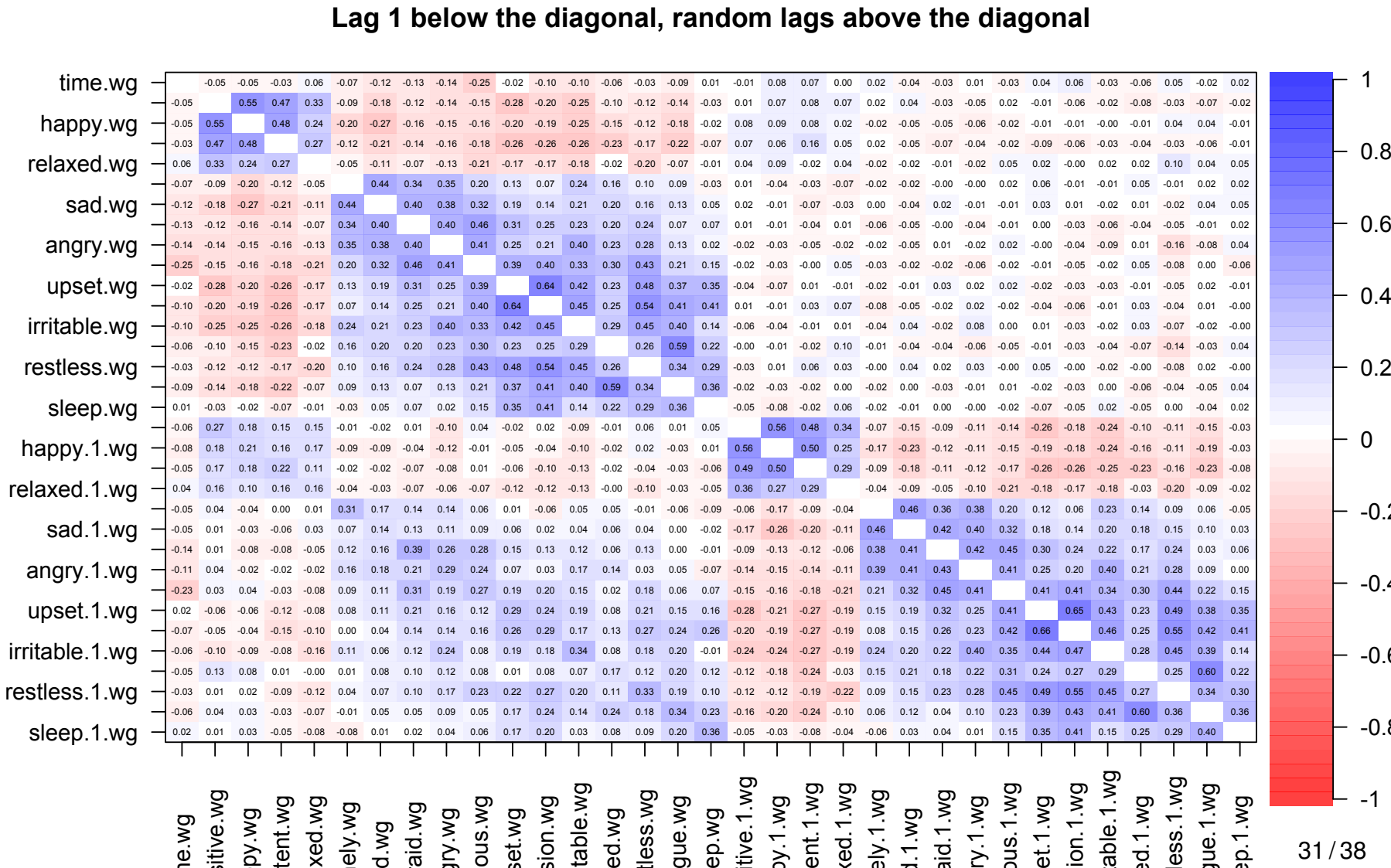
Pooled within subject correlations of Fisher data and lagged one data



Pooled within subject correlations of Fisher data and random lagged data



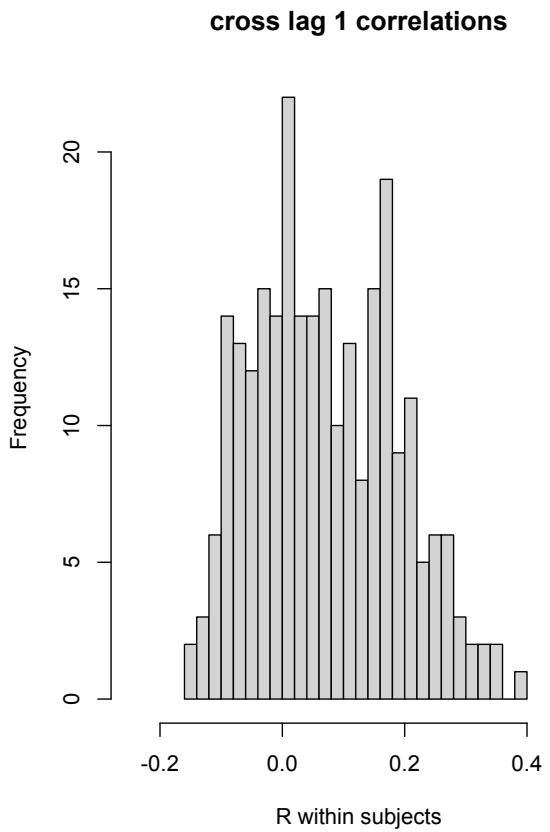
Combine into one graphic. Note that only the lagged correlations differ

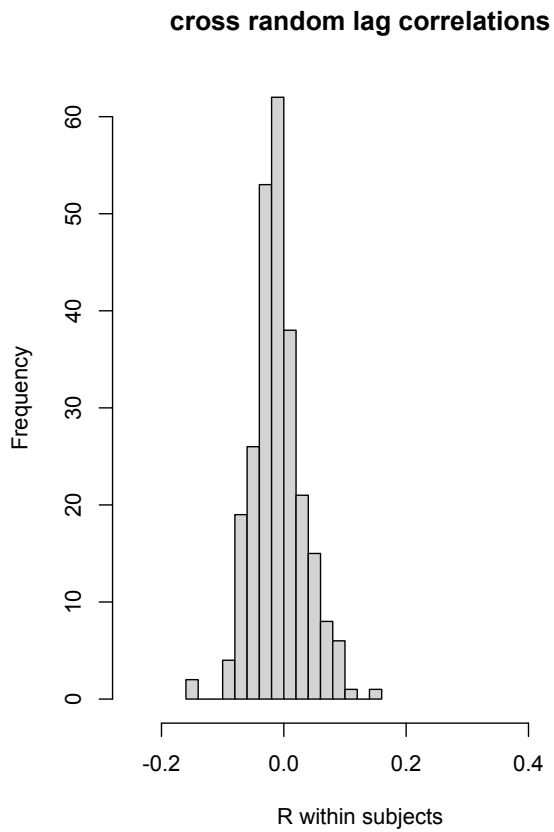


The effect of lags

1. Lagged data compared to randomized lags control for trait effects
2. Is it the lag, or is it the situation?
3. Show the lag1 correlations and compare to random lags.
4. But the lag 1 correlations could reflect inertia of situations

The cross lag corretations show some structure





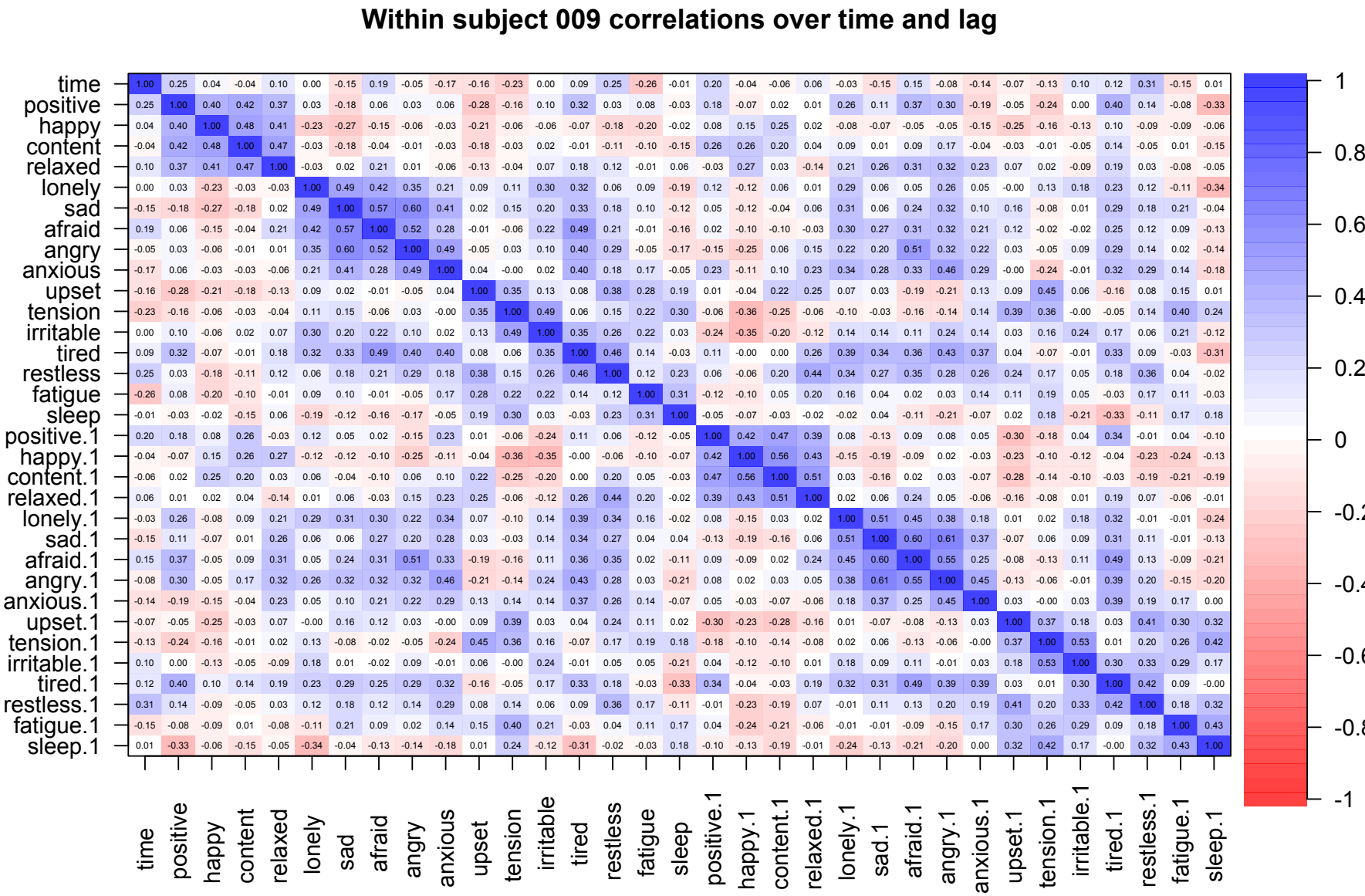
Dynamics at the subject level

1. Examine the within person standard deviation of the correlations.

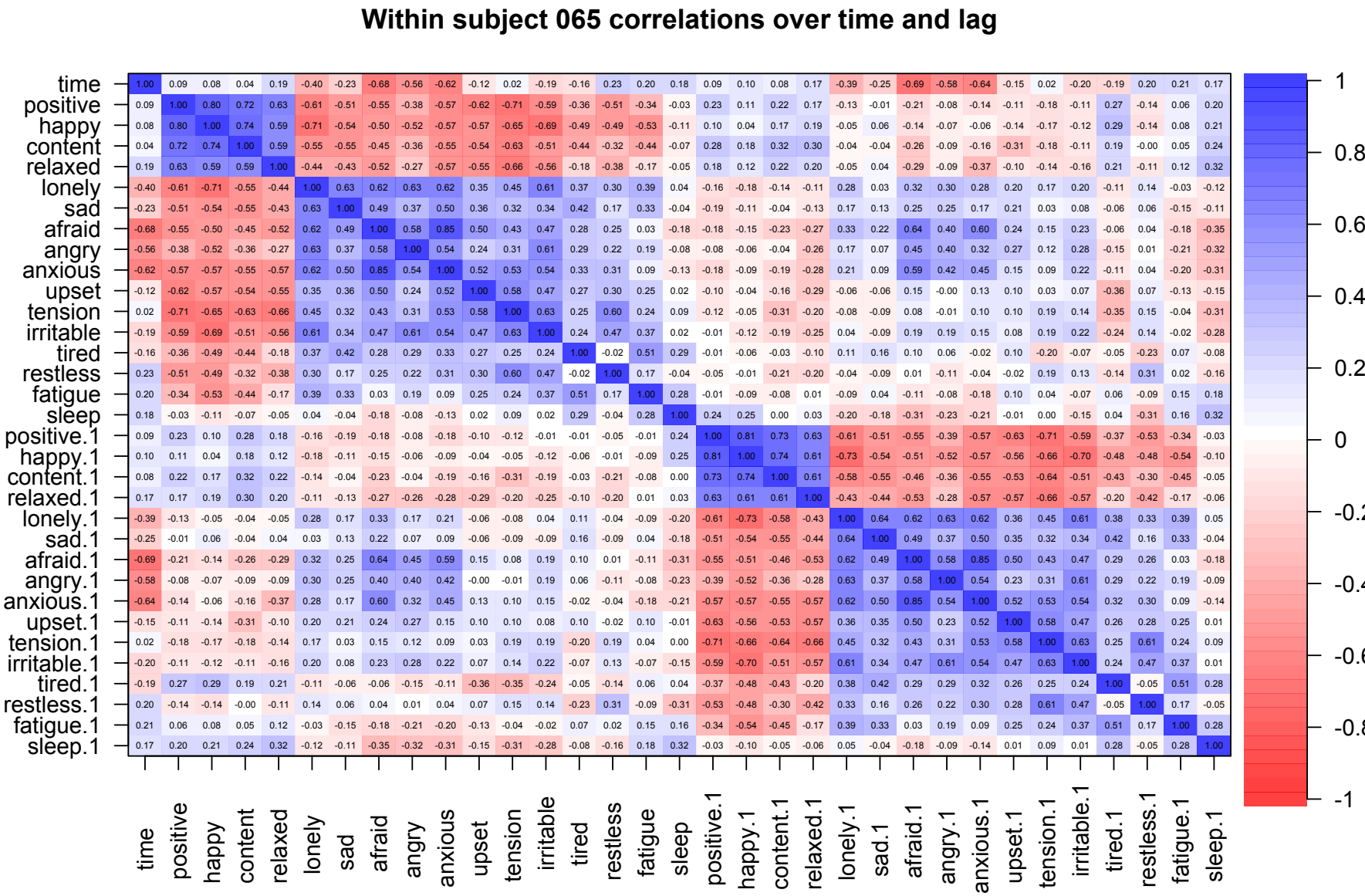
002	007	009	010	011	013	022	023	030	065
0.23	0.28	0.20	0.27	0.27	0.24	0.28	0.22	0.33	0.35

2. Show the participants with the least (09) and most (065) variance of correlations.

Within subject correlations for subject 009



Within subject correlations for subject 065



Summary

1. People change over time and space.
2. We need to go beyond simply saying people differ across situations and within situations.
3. We can model the change process by considering the inertia of affect, cognition, and desires.

Thank you

Thanks to Markus Quirin for organizing this syposium.
Slides will be available at http://personality-project.org/sapa by Sunday.

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