

Personality at three levels of abstraction

William Revelle and David Condon
Northwestern University

Department of Psychology
Northwestern University
Evanston, Illinois USA



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Outline

- 1 Personality at multiple levels
 - Four ways of viewing coherence
 - Different levels can be different
- 2 Dynamic models
 - Dynamics of Action
 - Cues, Tendencies, Actions
- 3 Within individual differences
- 4 Between Individual differences
- 5 Group differences
- 6 coda

Personality as coherence over time and space

- 1 Personality is an abstraction used to describe and explain the coherent patterning over time and space of affect, cognition, and desire as they result in behavior for an individual.
 - Reputation: How others see our behavior.
 - Identity: How we interpret our behavior as the result of our affects and our cognitions.
- 2 This unique patterning or individual signature reflects a complex set of dynamic processes that can be described at three levels of analysis: within individuals, between individuals, and between groups of individuals.

Observing and explaining the stream of behavior

- To all observers, the dynamic processes of the stream of feelings, thoughts, motives and behavior show a unique temporal signature for each individual.
- To an individual differences theorist, the how and why individuals differ in their patterns is the domain of study.
- To a biologically minded psychologist, these dynamic processes reflect genetic bases of biological sensitivities to the reinforcement contingencies of the environment.
- To a mathematically oriented psychologist, these dynamic processes may be modeled in terms of the differential equations of the Dynamics of Action.

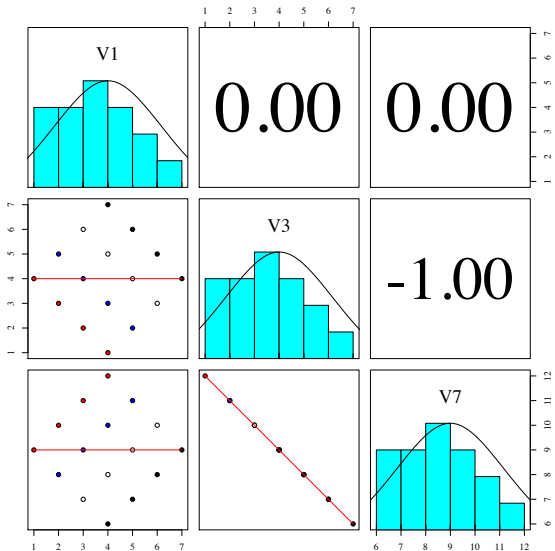
Multilevel analysis can yield surprising results

Although it is well known that the structure within a level does not imply anything about the structure at a different level, this distinction is frequently forgotten.

- ① Various names for the phenomena:
 - Yule-Simpson paradox (Simpson, 1951; Yule, 1903)
 - The fallacy of ecological correlations (Robinson, 1950)
 - The within group–between group problem (Pedhazur, 1997)
 - Ergodicity (Molenaar, 2004)
- ② Observed correlations may be decomposed into within group correlations and between group correlations
 - $r_{xy} = \eta_{x_{wg}} * \eta_{y_{wg}} * r_{xy_{wg}} + \eta_{x_{bg}} * \eta_{y_{bg}} * r_{xy_{bg}}$
 - $r_{xy_{wg}}$ is the within group correlation
 - $r_{xy_{bg}}$ is the between group correlation
 - $\eta_{x_{wg}}$ is correlation of the data with the within group values
 - $\eta_{x_{bg}}$ is correlation of the data with the between group values
- ③ This distinction will be important as we consider models of coherency and differences within-individuals, between-individuals, and between groups of individuals.

Different levels can be different

Observed correlations when $r_{wg} = \pm 1$ and $r_{bg} = \pm 1$



Modeling individual dynamics

Personality is an abstraction used to describe and explain the coherent patterning over time and space of affect, cognition, and desire as they result in behavior for an individual.

- 1 That people change their behavior over situations is obvious.
- 2 That people also change their behavior in the same situation is less obvious, but equally important.
- 3 We need to model the processes that lead to change within and across situations.
- 4 One such model is the Dynamics of Action (Atkinson & Birch, 1970).
- 5 Such dynamic models, assessed at different lengths of time, are useful to understand within individual, between individual, and between group differences.

Dynamics of Action: A theory before its time

- 1 Atkinson & Birch (1970) proposed a motivational model that was both very simple and very complex.
 - A set of simple assumptions such as that motives have inertia and only change if acted upon.
 - Complex in that it required understanding differential equations.
 - Early evidence was supportive but limited to achievement motivation (Revelle & Michaels, 1976; Kuhl & Blankenship, 1979; Atkinson, 1981).
- 2 A reparameterization of the DoA is also very simple but is also less complex.
 - The Cues-Tendencies-Actions (CTA) model (Revelle, 1986) has been discussed before (Revelle, 2012) and is implemented as part of the `psych` package in R.
 - Used in various computer simulations of affective and cognitive behavior (Fua, Horswill, Ortony & Revelle, 2009; Fua, Revelle & Ortony, 2010; Quek & Ortony, 2012).
 - Still requires some understanding of differential equations.

The basic concepts: Cues, Tendencies, and Actions

- ① Environmental Cues evoke action Tendencies
- ② Action Tendencies evoke Actions
- ③ Actions reduce Action Tendencies
- ④ Actions inhibit other Actions

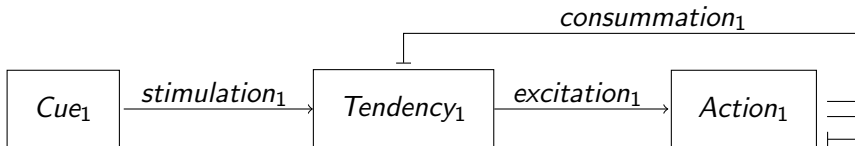
This may be summarized in two differential equations

- ① $dT = sC - cA$

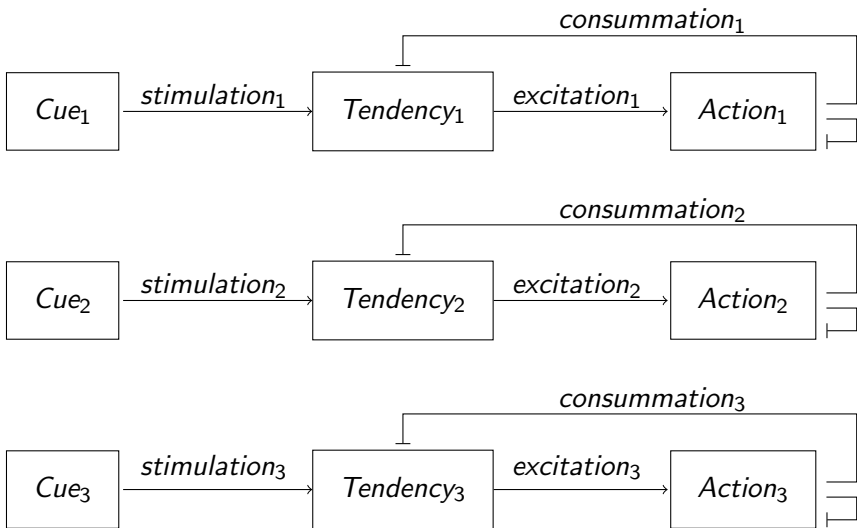
- ② $dA = eT - iA$

- ③ where

- C, T, and A are vectors
- s, e, c and i are matrices of association strength

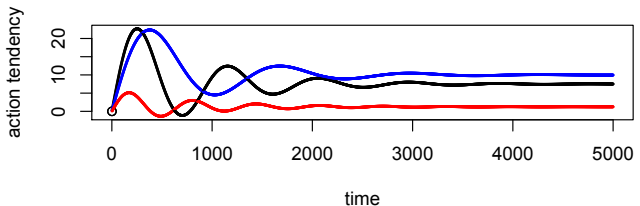


3 Cues, 3 Tendencies, 3 Mutually compatible Actions

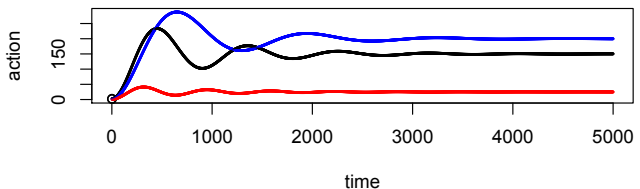


Three compatible behaviors in a constant environment

Action Tendencies over time



Actions over time



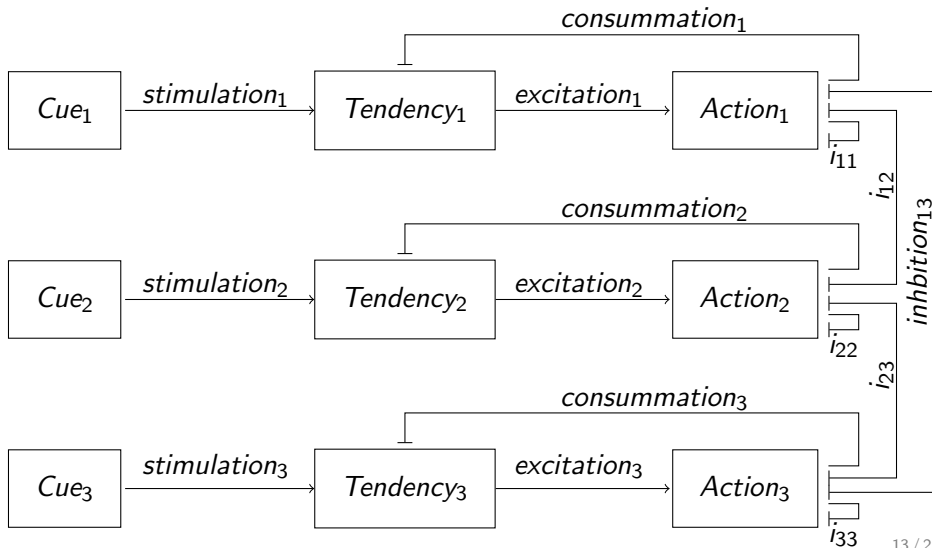
But Actions may inhibit other Actions

- 1 The power of a dynamic model is that it predicts change of behavior even in a constant environment where the instigating cues are not changing.
- 2 With mutually incompatible actions, action tendencies can all be instigated by the environment but only one action will occur at a time.
- 3 Action tendencies resulting in actions will then be reduced while other action tendencies rise.
- 4 This leads to a sequence of actions occurring in series, even though the action tendencies are in parallel

3 Cues, 3 Tendencies, 3 Mutually inhibitory Actions

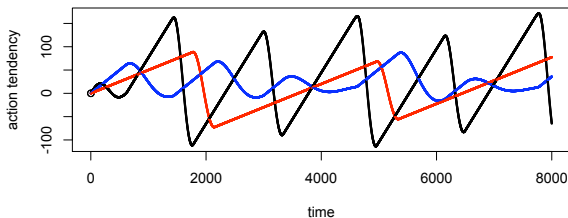
$$dT = sC - cA$$

$$dA = eT - iA$$

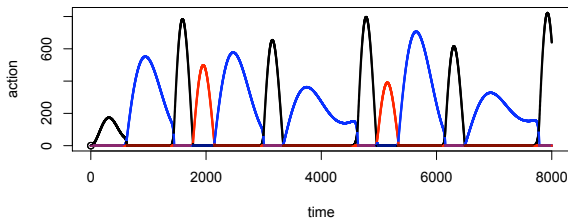


3 incompatible actions in a stable environment

Action Tendencies over time



Actions over time



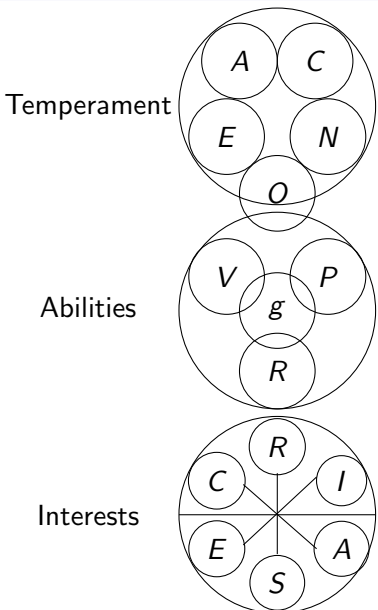
Evidence for dynamic models within individuals – Traits as rates of change in states

- 1 Original model and evidence is summarized in Atkinson & Birch (1970)
 - Predictions for the motivational response to task difficulty derived from Atkinson & Birch (1970) were discussed in Revelle & Michaels (1976) in terms of inertial properties of motivation.
 - Further improvements by Kuhl & Blankenship (1979) who added the full DoA dynamics.
- 2 Reparameterization of DoA into CTA by Revelle (1986) and some evidence reviewed in Revelle (2012)
 - Gilboa & Revelle (1994) showed individual differences in decay rates of anxiety on an emotional “Stroop” task.
 - Smillie, Cooper, Wilt & Revelle (2012) show how the trait tendency for positive affect is actually a sensitivity to cues for reward.

Dynamic models can be applied to differences between individuals

- ① Within individuals, the basic parameters are rates of change
 - Growth of action tendencies
 - Decay of action tendencies
 - Set of mutually incompatible activities
- ② Between individuals, we notice differences in time spent doing various activities
 - We do not observe growth rates, but we do observe frequencies, latencies, and persistence
 - How we spend our time, what is the patterning of our behaviors, our feelings, and our thoughts

Traditional model of Temperament, Abilities, and Interests



Temperament

2- 5 dimensions reflecting individual differences in Affect, Behavior, Cognition, Desire

Ability

- ① g
- ② $gf g_c$

Interests

2 broad dimensions organizing 6-8 specific interests

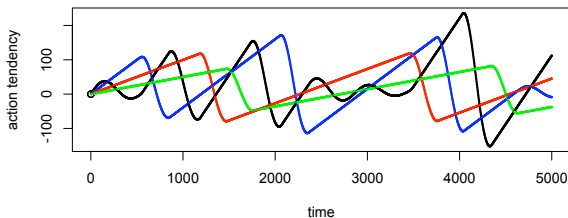
- ① People vs. Things
- ② Facts vs Ideas

Social behavior can also be modeled using the CTA

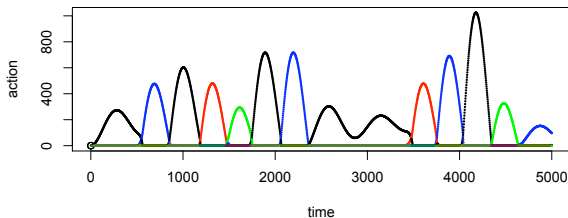
- ① TAI applied to social behavior is typically seen as an example of extraversion.
- ② Social interaction can be modeled using the CTA model. The desire (action tendency) of four people reflects their interest in talking and when one person is talking, that inhibits the others.
 - Consider 4 individuals with different sensitivities (growth rates) to cues for talking.
 - One person talking inhibits the others.
- ③ Desires to talk run off in parallel, but behaviors are sequential
 - Differences in growth rates result in differences in latency and persistence
- ④ Note that one person talks frequently while another is much less involved.

Simulation of 4 individuals differing in their excitation of a tendency

Action Tendencies over time



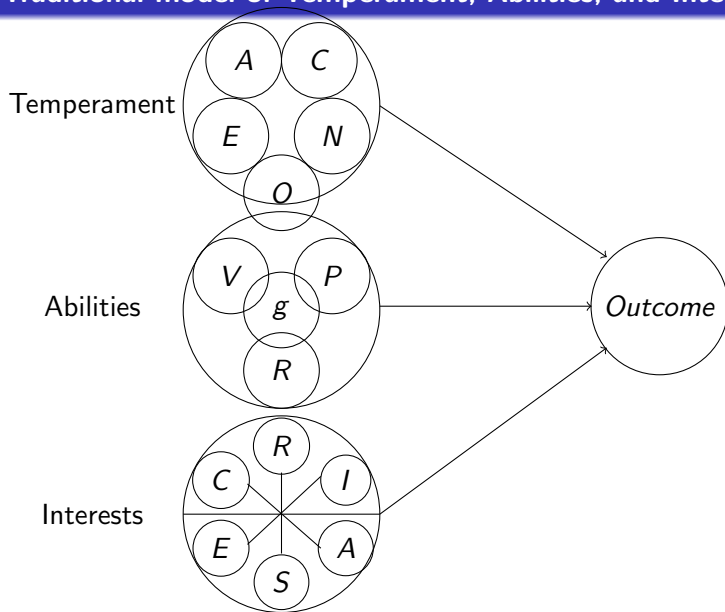
Actions over time



Dynamic models at a longer span may also be applied to group differences

- 1 Over a longer time period, people gravitate to certain college majors, occupations, or ways of behaving
- 2 These choices are themselves mutually incompatible
- 3 Trait constellations define different choice of occupational or choice

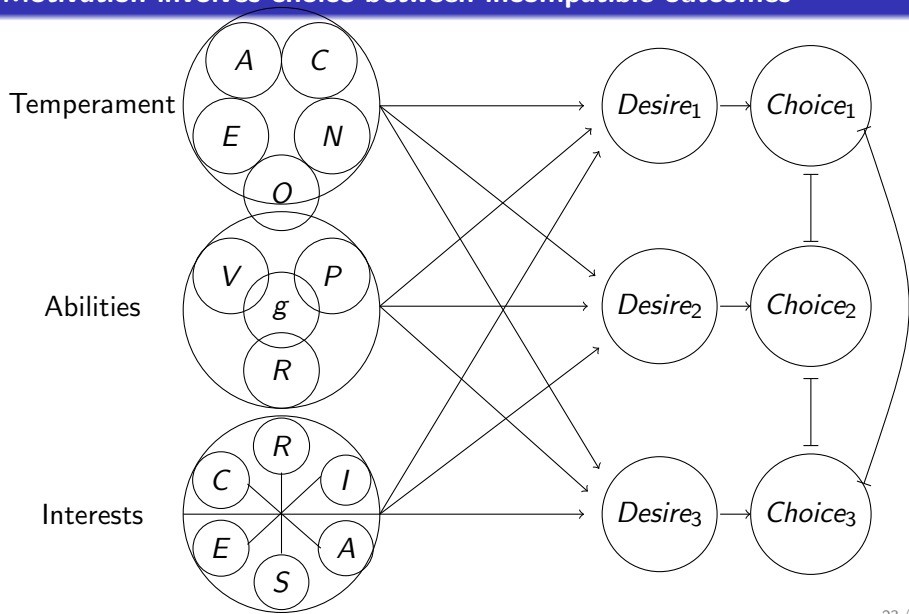
Traditional model of Temperament, Abilities, and Interests



Motivation involves choice

- 1 Motivational models emphasize intensity as well as direction
 - Performance models emphasize efficiency in any one task
 - How many resources are available for a particular task
- 2 Direction of behavior (aka resource allocation) emphasizes choice
 - Dynamic models of choice (the Dynamics of Action) from Atkinson & Birch (1970) or a reparameterization (the Cues-Tendency-Action model) by Revelle (1986) emphasize that behaviors inhibit each other.
 - For computer simulations of choice behavior using the Cues-Tendency-Action (CTA) model see Fua et al. (2009, 2010)

Motivation involves choice between incompatible outcomes



Temperament, Abilities and Interests and the CTA

- 1 Traditional analysis of three separate components of personality (TAI)
 - Temperament
 - Abilities
 - Interests
- 2 In a dynamic model, TAI variables are seen as sensitivities to environmental cues that act upon desires (action tendencies) and upon subsequent choice.
 - Stimulation of Cues upon Tendencies
 - Excitation of Tendencies upon Actions
 - Consummation of Tendencies due to Actions
 - Mutual inhibitions between Actions

- 1 Personality needs to be conceived at multiple temporal durations
 - Short term – seconds to days
 - Mid term – days to months
 - Long term – years
- 2 Dynamic models at multiple levels
 - different predictions at different temporal durations
- 3 It is time for theorists of personality and individual differences to realize the power of formal models implemented in open source software.

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