



Emotions as Emergent Phenomena: A Causal Indicator Analysis

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The present paper proposes a theory of emotions as emergent phenomena. It will be argued that emotional experiences are composed of a number of distinct elements that are then synthesized during the act of emoting. A causal indicator model will be presented to demonstrate how to measure emotion thus conceptualized. Unlike classical measurement models which assume that an emotion is an existing entity that causes observed components like subjective feeling, expressive behavior, etc., a causal indicator model assumes that the various components combine together to bring an emotion into existence. This modeling strategy can account for two of the most puzzling observations in emotion research: (1) the lack of correspondence between hypothesized emotion components, and (2) the lack of consistent findings about particular emotions across different research modalities.

Assumptions

- Emotional experience is based on a number of components
- These components combine to produce emotional episodes
 - ◆ prototypical versus non-prototypical
- There are weak correlations between measured components

We begin with three assumptions

1. **Emotional experience is based on a number of components, including frontal and subcortical activation (hippocampus and amygdala), ANS, motor, face, etc.**
2. **These components configure to produce prototypical emotional episodes following Russell and Barrett (1999)** A prototypical emotional episode refers to what most people consider the clearest cases of emotion. It is a complex set of interrelated subevents concerned with a specific object. Fleeing a bear out of terror, fighting someone in rage, and kissing another enraptured in love are intense examples. Milder examples include helping someone out of pity or avoiding a stranger out of apprehension. The object is the person, condition, event, or thing (real or imagined, past, present, or future) that the emotional episode is about (Solomon, 1976) -- one is afraid of, angry with, in love with, or has pity for something.

Prototypical emotional episodes necessarily include all of the following:

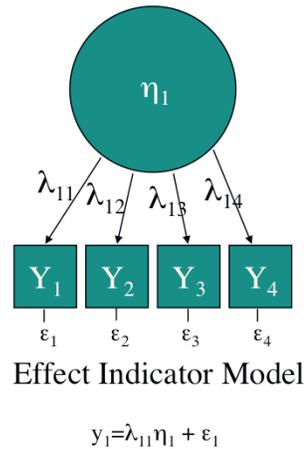
- core affect (pleasure and subjective sense of activation)
- goal directed, overt behavior of the right sort (flight with fear, fight with anger, etc.) in relation to the object; even fleeing a bear involves a sequence of goal-directed behaviors, and therefore prototypical emotional episodes involve plans, although often hastily or ill-conceived.
- attention toward, appraisal of, and attributions to that object; because they are directed at an object, prototypical emotional episodes involve cognitive processes and knowledge; this knowledge exists in the form of cognitive structures for emotion concepts, often called emotion schemas or emotion scripts (Fehr & Russell, 1984; Shaver, Schwartz, Kirson, & O'Connor, 1987). Not only do they should represent the abstract cause of the experience, but they also represent the meaning of the situation to the individual and his or her immediate goals, bodily sensations, expressive modes (i.e., display rules for expression), how the emotion functions interpersonally, and sequences of action to take to enhance or reduce the experience (i.e., plans of emotion management; Mesquita & Fridja, 1992; Shweder, 1993). Discrete emotion labels can be thought of as meaning-laden symbols that are associated with possible objects (abstract situations and other psychological events) that can cause an emotional experience, the relational contexts associated with the experience, and the behavioral repertoire that exists for dealing with the experience and the larger situation. They function like culturally constructed internal guides or working models that facilitate adaptation (Saarni, 1993). This knowledge can be deployed either automatically or deliberately (that is, they can require attention or not). It is the evocation of this knowledge that distinguishes emotional episodes from core affect.
- the experience of oneself as having a specific emotion
- all the neural, chemical and other 'bodily' events underlying these psychological happenings
- It is interesting that what we call prototypical events are actually quite rare. In contrast, non-prototypical cases with one or more element missing or altered are actually more common. It is notable that we typically theorize about and focus our empirical efforts on prototypical emotional episodes, even though the non-prototypical cases are more frequent in our everyday lives. They may be infrequent due to the effects of socialization on limiting emotional expression (people have theorized that emotions are signals for active coping, but yet we socialize our children to limit the expression of emotion in the face, in the voice, in behavior, and if anthropologists like Cathy Lutz are to be believed, we are actually punished for expressing full blown emotions). They may also be infrequent because of the types of objects that elicit emotional episodes in our daily lives.

3. **In general there is a lack of corespondence between measured components of emotional experience (cite Lang, etc.).** Typically we assume that if measures are correlated near zero, then they must measure different things.

Modeling Emotion

■ Classical Measurement Theory

$$\blacklozenge X = T + E$$



This is due to the assumptions associated with classical measurement theory:

$$X = T + e$$

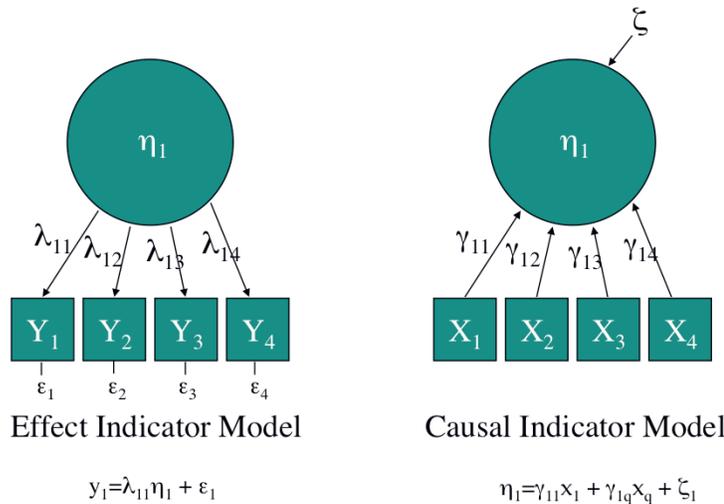
Consider the typ

ical measurement model in latent modeling analyses:

$$y_i = l_{i1}h_1 + e_i$$

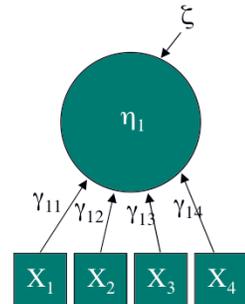
The indicator depends on the latent variable. This is called an effect indicator. The indicators are caused by or an effect of the latent construct. Because all indicators are caused by the same construct, they should be highly correlated.

Measurement Models



Now consider what would happen if the indicators determine the latent variable, rather than vice versa. These indicators are called “causal” indicators, “formative” indicators, or “composite” indicators. The indicators bring the construct into existence. *Use SES example from Bollen and Lenonx 1991). For example, if h_1 is SES, the measured variables might be education, occupational prestige, income, and neighbourhood. According to this model, if income increases, so does SES, even if education, job, and neighborhood stay the same. Similarly, an increase in SES does not require a simultaneous increase in all four indicators. Modeling SES using an effect indicator model would not make much sense. Other examples of causal indicators include life stress (job loss, divorce, recent bodily injury, deal of loved one), accuracy of eye-witness testimony or any memory for that matter (recall of separate characteristics of the accused -- eye color, hair color, height, weight, manner of dress, distinguishing features), and possibly certain types of psychopathology (listed symptoms in the DSM) because in each of these cases there are multiple sources of information that combine additively to produce the construct.

Causal Indicator Models



Causal Indicator Model

$$\eta_1 = \gamma_{11}x_1 + \gamma_{1q}x_q + \zeta_1$$

- Latent construct is a linear combination of its causes
 - ◆ Indicators need not be correlated
 - ◆ Need an external criterion for validity
 - ◆ Construct is defined precisely by indicators

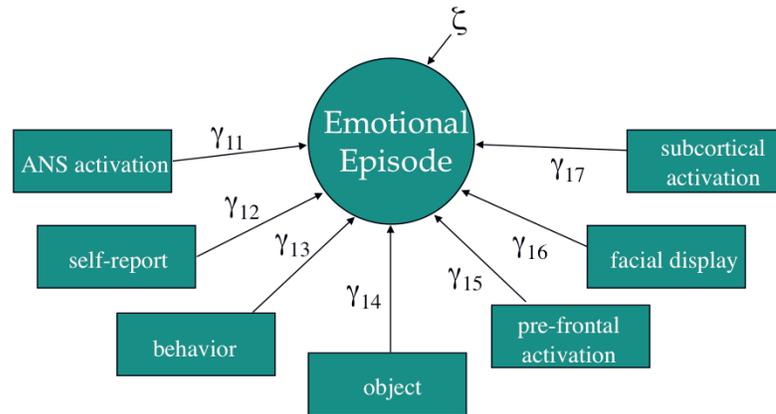
This type of latent construct is a linear combination of its causes (or indicators). This implies three things:

Causal indicators can have positive, negative, or no correlation. In fact, you might argue that having large correlations between indicators in this model is non-optimal, because that would mean that they are contributing redundant variance to the construct. If the indicators are too highly correlated, this creates a multicollinearity problem. One way to consider whether an indicator is important in such a model is whether it has incremental validity.

Because such a latent construct is a linear combination of its causes, its validity cannot be judged from indicator covariances and probably requires an external criterion. (mathematically the causal indicator model alone is underidentified). Only when it is imbedded in a causal model that includes consequences for the latent construct can it be estimated.

Finally, equally reliable effect indicators are interchangeable because they are highly correlated, but this is not so with causal indicators. If each of the original indicators are representative of distinct faces of a construct, then we face dire consequences by removing any one of them, since by doing so we are changing the composition of the latent construct.

Emotional Episodes

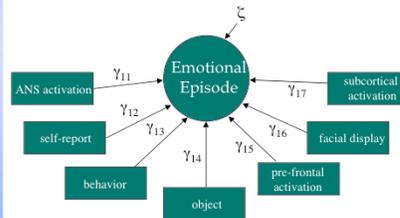


Are emotional episodes best considered using a causal indicator model?

If emotion is indeed an emergent phenomenon, then the measurement models currently in use may be incorrect.

Emotion is like memory (give an example)

Implications



- indicators need not be correlated
- construct validity requires an external criterion
- removing an indicator changes the nature of the measured construct

Consider what would happen if prototypical emotional episodes were represented using a causal indicator model. Multiple sources of information produce the construct (visceral, neurochemical, somatosensory, facial, behavioral, attribution, appraisal, semantic). Those elements can act independently from one another to influence the quality of the phenomenon. They are not necessarily strongly correlated with one another which is consistent with what we know about emotion components.

Conceptualizing emotion using a causal indicator model implies that emotions are not as a small set of discrete, universal entities that are language-free and defined by physiology, but rather, are conceptualized as emergent phenomena -- constructed events. In contrast to reductionistic views that think it most valid or scientific to define an emotion by neurophysiological events. Of course, their are neurophysiological counterparts to emotional experience -- just like there are neurophysiological counterparts to all experience -- experience cannot occur, not can any mental representation exist, without the flow of neurotransmitters. What a causal indicator model suggests, rather, is that neurophysiology may not be the only level of analysis at which to anchor the emotion concept; nor is the appraisal or self-report level. In the broadest context, emotional episodes are experiences that have neurophysiological substrates that are mediated by mental representations (which themselves can also be represented as neurophysiological events) that contain culture-bound emotion knowledge that provides individuals with discrete emotion concepts and their associated scripts. As such, all aspects of the emotional episode must be measured. This requires more detailed theorizing about how an emotional episode might vary with context or person.

As a constructed event, an emotion is not a monolithic entity, but rather is composed of a number of distinct processes. Although different neural structures are associated with different emotion processes, it is unlikely that any one structure (even the amygdala) as the biological "seat" or cause of emotion. Perhaps emotion is more like memory in that different parts of the brain store different aspects of an emotion, and these aspects are in turn linked together when one emotes. Emotional experience, rather than being literal read-outs of the face or the autonomic nervous system or the brain, is better conceptualized as how we experienced those biological events or what they meant to us at a particular time. These experiences, in the context of influences like scripts or goals that are accessible at the time that feelings occur, yield emotion. Thus, from my perspective, emotions, like memories, are constructed at the time that emoting occurs. When we say that we are studying emotion from this perspective, we not studying an emotion as a thing, separate from the experienter.

Because every specific instance of a given affect is constructed each time out of a more basic set of components, and if construction of each instance is molded to its specific circumstances, then the class of all occasions of a given emotion is a heterogeneous cluster. The manifestation of anger on one occasion may not be identical to what it is on another occasion. Right now, we treat (in measurement and theory) all occasions of a given emotion as a homogeneous cluster. This points out the ecological slippage of our research. In theory, a causal indicator model can help rectify this slippage, but in practice, you can extrapolate for yourself what types of measurement problems that arise.

Here are two examples: What constitutes a component of emotional episode and what is an outcome? Need for external criteria force the question of how to parse component processes that occur over time into the event itself and the consequences of the event.

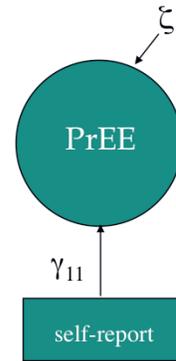
Finally, suggests that emotions are not natural kinds or entities that are inherited and not reducible to anything else psychological. They can be further broken down into elemental parts. What happens when all the components are not measured? If all the relevant elements are not measured each time, then the validity of the resulting construct (that is, how well it represents the psychological reality of the experience) is reduced -- another way to say this is that we have a huge specification error. That is, the error term is very large. As a consequence, it may be difficult to find consistent findings across studies. This situation will be exacerbated if we only measure one or two components of an emotional episode at each instance, and if we allow measurement decisions to be dictated by ease rather than by substantive concerns. In fact, there are no studies that I could identify that actually measured all the components of a prototypical emotional episode.

The situation becomes even more problematic when you consider non-prototypical emotional episodes where all potential components are not present or activated. This leads to the possibility that (1) there is a mismatch between which components are measured and which are actually part of the experience; or, (2) there is a mismatch between how emotion is defined across studies (i.e., which components are measured in a given study), leading again to lack of corresponding findings across studies.

Prototypical Emotional Event

PEE = self-report + behavior + object
+ facial expression + ANS activation
+ subcortical activation
+ prefrontal activation

$$\text{PEE} = \gamma_{11}\text{sr} + \gamma_{12}\text{beh} + \gamma_{13}\text{object} + \gamma_{14}\text{face} + \gamma_{15}\text{ANS} \\ + \gamma_{16}\text{subcort} + \gamma_{17}\text{prefront} + \zeta_1$$



$$\text{PrEE} = \gamma_{11}\text{sr}_1 + \zeta_1$$

Non-Prototypical Episode

- EE = self-report + object + prefrontal activation

$$EE = \gamma_{11}sr + \gamma_{12}object + \gamma_{13}prefront + \zeta_1$$

