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Toward a Functional View of the P Factor in Psychopathology

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Abstract

Evidence indicates the existence of a superordinate factor of general psychopathology, which has been termed *p*. Among the issues raised by this discovery is whether this factor has substantive meaning or not. This article suggests a functional interpretation of the *p* factor, based in part on a family of dual process models, in which an associative system and a deliberative system compete for influence over action. The associative system is frequently said to be impulsively responsive to emotions. We hypothesize that this impulsive responsiveness to emotion underlies the *p* factor. One benefit of this view is to use the same underlying process variable to account for both internalizing and externalizing vulnerabilities, as well as aspects of thought disorder. Evidence is reviewed linking impulsive reactivity to emotion to the *p* factor, and (separately) to internalizing, externalizing, and thought-disorder symptoms. Alternative interpretations are considered.

Keywords

Impulsiveness; *p* factor; internalizing; externalizing; transdiagnostic

The idea that a diverse array of disorders can be meaningfully grouped within a more limited number of categories has taken deep hold in the recent literature of psychopathology (Achenbach & Edelbrock, 1981; Krueger & Markon, 2006a). Best known are the two broad categories of internalizing disorders and externalizing disorders (Krueger, 1999). More recently researchers have found that thought disorders (or psychosis disorders) also form a coherent category (Caspi et al., 2014; Kotov et al., 2011; Laceulle et al., 2015; Markon, 2010; Wright et al., 2013; Wright & Simms, 2015).

In addition to these categories, several research groups have found compelling evidence for the existence of an even broader superordinate factor of general psychopathology (Caspi et al., 2014; Castellanos-Ryan et al., 2016; Laceulle et al., 2015; Lahey et al., 2012; Lahey et al., 2015; Snyder et al., 2017; Tackett et al., 2013; Waldman et al., 2016), which has been labeled *p* (Caspi et al., 2014). In studies examining this factor, its addition appeared to

improve the fit of the structural models used to organize measures pertaining to psychopathologies captured by internalizing and externalizing categories. The p factor thus is construed as a higher order entity that encompasses and adds to the information provided by externalizing and internalizing categories. In the first study of the p factor to incorporate an index of thought disorder as well (Caspi et al., 2014), the thought-disorder index was also highly correlated with the p factor ($r = .97$).¹

Initial work on the p factor has shown that it replicates across samples and that it is stable over time (Snyder et al., 2017). Discussions have also focused on how to interpret the internalizing and externalizing factors once the variance attributable to the p factor has been extracted (Widiger & Oltmanns, 2017). That is, it is common for correlations between the internalizing and externalizing factors and other measures to weaken appreciably once the p factor has been controlled for, and for the correlations between internalizing and externalizing factors to change markedly, even reversing in sign (Caspi et al., 2014; Laceulle et al., 2015).

There is uniform agreement that an important remaining question is what the meaning of the p factor is. One possibility is that it simply reflects general impairment in functioning, which can follow from disparate problems that need not share anything else with one another. Another possibility is that it has a more substantive meaning (cf. Waldman et al., 2016). If so, what might the substance be? In this article, we suggest a candidate for a substantive meaning for the p factor, and provide some reasons why we think this candidate should be looked at more closely.

How Might the P Factor Reflect Meaningful Functional Variation?

Our candidate hypothesis is grounded conceptually in a consideration of the balance between two modes of functioning (Carver et al., 2008, 2009) which are suggested by a family of dual process models. Such models have resonances in the contrast between id and ego function (Freud, 1962), which Epstein (e.g., 1994) subsequently reframed in terms of experiential and cognitive modes of function. A large family of theories has since arisen that, despite having diverse focuses, share many assumptions (e.g., Derryberry & Rothbart, 1997; Evans & Stanovich, 2013; Kahneman, 2011; Metcalfe & Mischel, 1999; Nigg, 2000; Rothbart, Ellis, Rueda, & Posner, 2003; Strack & Deutsch, 2004; Toates, 2006). We focus here not on a particular theory but on some properties they share.

The theories assume that one mode is associative and quick; it is sometimes referred to as being *reflexive*. It is characterized by many theorists as being the more basic, and as being especially responsive to emotions (e.g., Metcalfe & Mischel, 1999; Strack & Deutsch, 2004). Sometimes the term model-free learning is used to refer to the way in which this mode of function acquires information over time, reflecting the idea that its learning follows from an accumulation of associations (e.g., Daw, Niv, & Dayan, 2005; Dayan, 2008; Dolan

¹Recent work has established at least two other candidate spectrum factors at this level of abstraction: detachment and antagonism (Kotov et al., 2017). At least the latter of these is readily addressed from the viewpoint taken here. However, because this article focuses on the p factor per se, and it has not yet been linked to these spectrum factors, we limit ourselves here to the three factors described in the main text.

& Dayan, 2013; Otto, Gershman, Markman, & Daw, 2013; Walsh & Anderson, 2014). Functioning in this mode may be said to reflect habits (e.g., Ouellette & Wood, 1998) or responsiveness to cues of the moment that trigger automatic responses.

The other mode of processing is slower, and it functions by applying rules or mental models to situations as they are identified. This mode, sometimes referred to as *reflective*, or *deliberative*, entails taking more information into account before action selection, or basing action selection on a broader array of considerations. The term model-based learning is sometimes applied to the way in which this mode acquires information over time, reflecting the idea that it is creating and refining a model of the reality it is inhabiting (Daw et al., 2005; Otto et al., 2013). There is evidence that, in learning, the two processing modes use different aspects of the available information (Rudman, Phelan, & Heppen, 2007). Functioning in the reflective mode is sometimes said to represent the carrying out of intentions (Ouellette & Wood, 1998). This mode requires more resources than the reflexive one, and thus is less efficient.

Dual process models generally assume that both modes of functioning operate continuously, if cognitive capacity is available and the requisite skills are adequately developed. Each exerts an influence, and they compete with one another (Buckholz, 2015; Daw, Niv, & Dayan, 2005). However, several kinds of influences can affect the result of that competition. Situations vary in the extent to which they allow the reflective mode to exert its influence, by restricting access to needed resources (e.g., because of sleep deprivation, cognitive load, intoxication, or time pressure). Persons also vary in the extent to which, or ease with which, the reflective mode is deployed as an influence on behavior, given individual differences in cognitive capacities and skills. We focus here on the role played by individual differences.

Although descriptions of dual process models tend to sound as though the reflective or deliberative mode is preferable (and we will sound that way in much of what follows), it is not necessarily the case that one mode is intrinsically more adaptive than the other. Both modes have value in the appropriate contexts (Block & Block, 1980; Bocanegra & Hommel, 2014; Otto, Gershman, Markman, & Daw, 2013). For example, model-free functioning is more adaptive than is model-based functioning in environments that are unpredictable (e.g., Tops, Boksem, Luu, & Tucker, 2010), and where the future availability of resources is unknown (e.g., Del Giudice, 2014). The reflexive mode brings a spontaneity to a person's experience that can be desirable.

The two modes of functioning have been characterized in various ways, but (as noted above) a conceptual element that is widely shared among theories is the idea that the reflexive mode is particularly reactive to emotions. Emotions are widely understood to be closely linked to emotion-specific behaviors (Frijda, 1986). Most emotions could even be said to trigger specific categories of action, in the absence of constraint over the reaction. Although impulsive reactivity to emotions is not the only property of the reflexive system, it is a property that has many implications for psychopathology, and it is this property on which we focus here.

In brief, we suggest that persons whose functioning is relatively dominated by the reflexive system are more vulnerable to psychopathology than persons whose functioning is more influenced by the reflective system. More specifically, we suggest that persons who are by disposition (meaning by their genetics, neurobiology, temperament, and personality) *highly reactive to emotions* are more vulnerable to psychopathology than are those who are less reactive to emotions (Carver et al., 2008, 2009). (We are by no means the first ones to have reached more or less this conclusion—see, e.g., Depue, 1995; Depue & Spoont, 1986; Johnson-Laird, Mancini, & Gangemi, 2006; Spoont, 1992).

Note that this hypothesis does not focus on any particular psychopathology or predict any specific reaction. It simply asserts that being highly reactive to emotions can set a person up for difficulties. What kinds of difficulties emerge will depend entirely on other factors. Figure 1 illustrates one such other factor and how it might moderate the consequences of being reactive to emotion. It shows a dimension of incentive sensitivity, crossed by a dimension of control over reactions to emotions. People who have a very sensitive incentive-approach system and are also highly reactive to emotions are likely to act frequently in ways that are triggered by incentive-related emotions. These people can be expected to take things that don't belong to them, seek extreme sensations, and engage in various kinds of antisocial behavior, including impulsive aggression (Carver & Miller, 2006). In contrast—but fully consistent with the hypothesis—a person who has a blunted approach system and who also is highly reactive to emotions is likely to act frequently in ways that fit emotions that are associated with blunted approach: behavioral passivity and lack of pursuit of incentives (Figure 1).^{2, 3}

Parallel arguments can be made about the threat system as a moderator (not shown): A person with a sensitive threat system and who also is highly reactive to emotions is likely to act frequently in ways that are triggered by the emotions associated with threat: fear and avoidance, mixed with rash actions intended to bypass the fear. A person with a blunted threat system and who also is highly reactive to emotions is likely to act frequently in ways that fit emotions related to the absence of threat: boldness and recklessness.

It is also important to understand what this logic says about people who have combinations of sensitivities other than those. Having a sensitive approach system, a sensitive avoidance system, a blunted approach system, or a blunted threat system, should confer far less vulnerability in a person who is not strongly reactive to the emotions following from the operation of those systems (i.e., being high on the y axis of Figure 1). In the same way, having strong reactivity to emotions should not play an important role in a person who is not very prone to experiencing intense emotions by virtue of having threat and incentive systems that are of intermediate sensitivity (i.e., being in the middle of the x axis, Figure 1).

²Whether such a passive response is contextually adaptive is a separate question. As noted earlier, each mode of functioning in dual process models is generally held to be better suited to certain kinds of environments than the other. Indeed, it has been argued that symptoms of depression, in particular, are adaptive responses to circumstances in which reinforcers are unavailable (e.g., Gilbert, 1992; Nesse, 2000).

³We note that this structure also accounts for the observed reversal in sign of the association between internalizing and externalizing once *p* is extracted. That is, although both internalizing and externalizing involve elevated reactivity to emotion, the two are opposite to each other with respect to incentive sensitivity.

In the following, we use the terms reactive and impulsive to refer to elevated responsivity to emotion. This use of the term impulsive is grounded in the idea that the response (cognitive or behavioral) is relatively immediate and not reflected upon—triggered rather than decided. This use of the term may strike some as counterintuitive, in that we apply it to impulsive inaction (as in the case of depression and passive avoidance) as well as to impulsive action (as in the case of impulsive aggression or acting out). In all cases, though, the responses share the properties of being quick, not well thought out, and—given the contexts in which they occur—maladaptively over-reactive.

Is Poorly Constrained Reaction to Emotion Trans-Diagnostic?

Is there any evidence to support this candidate hypothesis? Several articles on the p factor have linked it to negative emotionality (Caspi et al., 2014). Our view is that that is not the really important link, however. Several articles have also linked the p factor to various indicators of poor constraint and impulsivity (Caspi et al., 2014; Castellanos-Ryan et al., 2016). Growing evidence links it to problems with response inhibition, a specific aspect of executive control that has close conceptual and empirical ties to impulsivity (Caspi et al., 2014; Castellanos-Ryan et al., 2016; Martel et al., 2017). The p factor has also been linked to both low agreeableness and low conscientiousness (Caspi et al., 2014; Castellanos-Ryan et al., 2016), both of which, in turn, have been linked in previous work to impulsive responsivity to emotion (Carver et al., 2008). That is, disagreeableness appears to reflect an impulsive failure to take one's social matrix into account in one's behavior; low conscientiousness reflects an impulsive failure to take broad life considerations into account. The majority of these published associations for p are consistent with a general tendency to react impulsively.

Internalizing, Externalizing, and Thought Disorders

These findings regarding the p factor converge with findings of recent meta-analyses of the separate categories of internalizing and externalizing disorders, which indicate that deficits on behavioral measures of response inhibition characterize both of those classes of problems (Wright, Lipszyc, Dupuis, Thayaparajah, & Schachar, 2014). Although this evidence does not address the p factor per se, it appears certain that a correlate of both internalizing and externalizing must necessarily also be a correlate of p. Mean effect sizes in major depressive disorder (MDD) and addiction were $g = .28$ and $.31$, respectively (Wright et al., 2014). A larger meta-analysis of 113 studies of MDD ($N=7,707$) found an effect size of $d = .58$ for problems in inhibition (Snyder, 2013). Impaired response inhibition has also been related robustly to externalizing disorders in another study (effect size, $r = .47$)—significantly more so than other executive function deficits such as working memory updating and shifting (Young, Friedman, Miyake, Willcutt, Corley, Haberstick, & Hewitt, 2009).

We noted earlier that Caspi et al. (2014) examined a psychosis factor, which comprised obsessive compulsive disorder⁴, bipolar disorder, and schizophrenia, and that this psychosis factor was particularly closely tethered to the p factor. The Wright et al. (2014) meta-analysis suggested that response inhibition deficits were as large or larger for these three psychosis syndromes, compared to internalizing and externalizing syndromes. Effect sizes

for obsessive compulsive disorder, bipolar disorder, and schizophrenia were $g = .37$, $.52$, and $.33$, respectively.

Indeed, other research suggests that deficits in response inhibition may be tied to the vulnerability to psychotic disorders. For example, persons with bipolar disorder display deficits in executive control even after remission (Kurtz & Gerraty, 2009). In one meta-analysis comparing relatives of persons with bipolar disorder versus controls, response inhibition (measured by the Stroop Task) had the largest effect size ($d = .51$ in 6 studies; Bora, Yucel, & Pantelis, 2009) in distinguishing between the groups. In schizophrenia, deficits in executive control are robust even at the time of the first episode (Mesholam-Gately, Giuliano, Goff, Faraone, & Seidman, 2009), and a range of neurocognitive deficits are well-documented in unaffected family members (Agnew-Blais & Seidman, 2013). Similar findings have emerged for OCD (Abramovitch, Abramowitz, Mittelman, 2013). Considering these findings jointly, it has been argued that neurocognitive deficits should be considered as widely present across the psychosis spectrum disorders (Bora, Yucel, & Pantelis, 2010).

Much of the evidence just reviewed comes from studies of response inhibition in a relatively general sense. Further evidence also links the more-specific property of emotion-triggered impulsiveness to both internalizing and externalizing symptoms and—increasingly—thought disorders. This further evidence comes from research in which impulsive reactivity to emotions was assessed by self-report measures of impulsive reactions to negative emotions (Negative Urgency; Whiteside, & Lynam, 2001), measures of impulsive reactions to positive emotions (Positive Urgency; Cyders & Smith, 2008; Cyders, Smith et al., 2007), and measures of impulsive reactions to emotions that do not reference emotional valence (Carver et al., 2011). All of these have been used in an increasingly substantial literature to explore the role of impulsive responses to emotions in psychopathology.

Findings indicate associations between these measures of emotion-related impulsivity and both internalizing and externalizing syndromes (Berg et al., 2015; Carver, Johnson, & Joormann, 2013; Fischer, Smith, & Cyders, 2008; Johnson, Carver, & Joormann, 2013), bipolar disorder (Muhtadie, Johnson, Carver, Gotlib, 2014), schizophrenia (Hoptman, 2014), OCD (Cogle, Timpano, & Goetz, 2012), and related OC-spectrum conditions (Timpano et al., 2013). Though the large literature focuses primarily on adults, links of urgency measures with both internalizing and externalizing conditions have similarly been observed among youth (Smith, Guller, & Zapolski, 2013). Relevant to the argument that the p factor may represent a functional property, measures of urgency relate to diverse problem behaviors, including anger, aggression, suicidal ideation, suicidal action (Auerbach, Stewart, & Johnson, 2016; Johnson, Carver, & Joormann, 2013), and dysregulated eating (Anestis et al., 2009; Fischer et al., 2008; Timpano, Carver, & Johnson, 2017).

⁴Although Caspi et al. (2014) found that OCD loaded on the thought disorder factor, we should note that this placement has not always been supported. Other studies have found that OCD falls within the internalizing factor and clusters together with the anxious-misery disorders, including depression and generalized anxiety (e.g., Wittchen, Beesdo-Baum, Gloster, Höfler, Klotsche, Lieb, et al., 2009; Cox, Clara, Hills, & Sareen, 2010).

Earlier work found that some aspects of disinhibition related to externalizing but not internalizing disorders (Kreuger & Markon, 2006), leading to the more general inference among many people that impulsiveness was unimportant to internalizing. However, the accuracy of that conclusion seems to depend greatly on what form of disinhibition is being examined. The rapidly growing literature on emotion-related impulsivity seems to indicate that this aspect is highly relevant for externalizing, internalizing, and psychosis syndromes.

It should be acknowledged that a substantial portion of this literature is cross-sectional. A concern is that the influence may run the other way: that experience of psychiatric symptoms might lead people to endorse problems with emotion-triggered impulsivity. However, longitudinal research also suggests that measures of emotion-related impulsivity can predict the onset and progression of symptoms. That is, these studies indicate that measures of urgency predict risky sexual behavior, illegal drug use (Zapolski, Cyders, & Smith, 2009), smoking initiation (Doran et al., 2013; Guller, Zapolski, & Smith, 2015), difficulty with smoking cessation (Hooper & Carver, 2016), alcohol use problems (Kaiser, Bonsu, Charnigo, Milich, & Lynam, 2016; Lopez-Vergara, Spillane, Merrill, & Jackson, 2016; Riley, Rukavina, & Smith, 2016; Settles, Zapolski, & Smith, 2014), bulimic symptoms (Guller et al., 2015; Pearson & Smith, 2015) and lifetime number of suicide attempts (Anestis & Joiner, 2011). Urgency at age 10 has been found to predict suicide attempt by age 25 (Kasen, Cohen, & Chen, 2011), and Urgency measured at entrance to college predicted the initiation of NSSI during college (Riley, Combs, Jordan, & Smith, 2015). Urgency also predicts greater daily symptoms of PTSD (Gaher et al., 2014).

We should emphasize that poor constraint in the presence of emotion appears to be the critical issue here, rather than the intensity of the emotional response per se (cf. our earlier mention of negative emotionality as a candidate variable). That is, at least some previous work has found that persons with emotion-related impulsivity do not have elevated subjective or psychophysiological responses to standardized stimuli (Johnson, Tharp, et al., 2016). There is also evidence that impulsive responses to emotion are more predictive of psychopathology than are tendencies to be emotional per se (Kaiser, Milich, Lynam, & Charnigo, 2012; Settles, Fischer, Cyders, et al., 2012).

One more issue about impulsive reaction to emotion is that this property can be manifested in several ways, yielding differential symptom profiles. Specifically, a tendency toward impulsive speech and action in response to emotions has been differentiated from a tendency toward cognitive impulsiveness in response to (mostly negative) emotions—for example, rumination after a negative event, or reflexively generalizing from a negative event to the broader sense of self-worth (Carver et al., 2011). Reports of cognitive impulsiveness in reaction to emotion relate more strongly to internalizing syndromes than do other aspects of impulsiveness; reports of behavioral impulsiveness in reaction to emotion relate more strongly to externalizing disorders than do other aspects of impulsiveness (Johnson, Carver, & Joormann, 2013; Johnson, Tharp, Peckham, Carver, & Haase, in press).

Other Questions: Self-Control and Model Free Functioning

The preceding section emphasized the role of lack of control over responses to emotion. Some of the evidence described there was quite specific to measures of that property; some of it was more general (difficulties with response inhibition). An important question is whether the findings we reviewed simply indicate that lack of self-control, or lack of cognitive control more generally, is what underlies psychopathology (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Moffitt, Poulton, & Caspi, 2013; Sharma, Markon, & Clark, 2014). Tentatively, the answer seems to be no. Thus far, the evidence does not indicate that all aspects of cognitive control relate equally well to psychopathology. That is, the meta-analytic findings discussed earlier indicate that links with psychopathology from impulsivity that is not emotion-related are less robust than those from emotion-related impulsivity (Berg et al., 2015; Fischer et al., 2008). This conclusion is, of course, quite tentative at this point.

A second issue follows from the origins of our own interest in this variable. We came to a focus on reactivity to emotion partly via an interest in dual process models, in which reactivity to emotion plays an important role. However, we should be quite clear that the role of differential reactivity to emotion is not the only important feature of such models. We noted earlier a distinction between model-based and model-free learning. Model-free learning, which plays a role in our candidate hypothesis, presumably is the method of encoding associations between emotions and actions by classical and instrumental conditioning. But model-free learning also encodes a great many associations that do not involve emotions. A reasonable question is whether the vulnerability factor is really the tendency to be biased toward model-free functioning more generally—to behave in a manner that is dictated too much by habit (Gillan et al., 2011; Gillan & Robbins, 2014; Gillan et al., 2016; Morris et al., 2016; Ouellette & Wood, 1998; Watson, Wiers, Hommel, & de Wit, 2014; Wood & Neal, 2007; Wood & Runger, 2016; Worbe, Savulich, de Wit, Fernandez-Egea, & Robbins, 2015). Consistent with that possibility are findings from Maddox and colleagues (2017), who related the serotonin transporter polymorphism (previously linked to emotion-triggered impulsivity, Carver et al., 2011) to a general bias toward model-free functioning. More information on this particular question is obviously needed.

Conclusion

The idea of identifying core functional mechanisms that increase vulnerability to psychopathology in a very broad way is an exciting one. It would open doors for rethinking both etiological mechanisms and commonalities in treatment approaches. In the development of such models, however, there is a need to understand how a shared vulnerability can be expressed in distinctly different symptom profiles, ultimately resulting in the observation of a p factor that crosses most or all of psychopathology. We believe that a close consideration of the consequences of poor constraint over reactions to emotion may do so. In part for this reason we believe that this is an important variable for further scrutiny.

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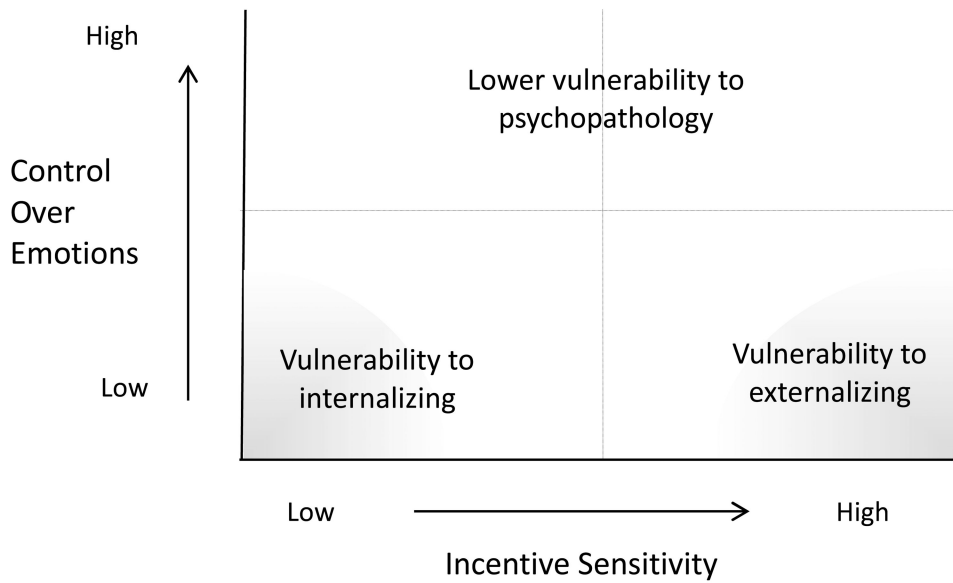


Figure 1.

A dimension of incentive sensitivity crossed by a dimension of control over emotions versus reflexive reacting to emotions. Vulnerability to internalizing symptoms emerges from the combination of low incentive sensitivity and low control over emotions. Vulnerability to externalizing symptoms emerges from the combination of high incentive sensitivity and low control over emotions. (A dimension of threat sensitivity is also relevant, but is omitted for clarity; see text.)