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Is attention sort of out of focus?

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A commentary on

Advancing understanding of executive function impairments and psychopathology: Bridging the gap between clinical and cognitive approaches

by Snyder, H.R., Miyake, A., & Hankin, B. L. (2015). *Frontiers in Psychology*, 6:328. doi: 10.3389/fpsyg.2015.00328”

Of critical importance for clinical psychological science is why do people differ in their very ability to govern and regulate their thoughts and behaviors? This concern speaks to the paramount nature of executive function (EF) that encompasses a set of general-purpose cognitive control mechanisms regulating lower-level processes and, in turn, enabling self-regulation and self-directed behavior toward a goal (Banisch, 2009). Consequently, EF has been shown to have far-reaching implications for nearly all of our daily activities. At a theoretical level, EF is best characterized as consisting of separable but related processes, with both unique and shared individual differences (Miyake & Friedman, 2012). This unity/diversity model focuses on three aspects of EF, namely updating working memory, shifting, and inhibition, as well as on a common unitary EF ability which spans these components and is posited to be the ability to actively maintain task goals and to use this information to provide top-down support for task-relevant responses (Miyake & Friedman, 2012).

We are thankful to Snyder et al. (2015) for recently engaging in a much-needed comprehensive narrative review about the EF impairments in psychopathology. In their review, they concluded that most psychopathological conditions are associated with fairly uniform deficits in EF tasks, and advocated that this pattern of findings cements the view that there are broad and transdiagnostic

impairments in the unitary component of EF, rather than impairments in a few individual specific aspects of EF.

Theoretically, Snyder et al. (2015) also upheld that their conclusions do conform to others who posited impairments in the functioning of attentional networks in psychopathology (e.g., Maurage et al., 2014; Orellana et al., 2012; Pacheco-Unguetti et al., 2011). According to the attentional networks approach (Petersen & Posner, 2012; Posner & Rothbart, 2007), attentional system can be subdivided into three functionally and anatomically independent networks, namely *alerting* (allowing to achieve and maintain a state of alertness), *orienting* (allowing to select sensory information by engaging, disengaging or shifting attention from one stimulus to another), and *executive* (involving the top-down control of attention to resolve response conflicts). Because the notion of “executive network of attention” is defined as similarly to common EF, Snyder et al. (2015) argued that psychopathology should thus predominantly be associated with impairment in this network, but neither with the alerting nor the orienting ones. Strikingly, based on this rationale, they also adjudicated that EF impairments in psychopathology are unlikely to reflect lower-level attentional difficulties. We argue that these conclusions are unjustified.

First, a strict reading of their account is at odds with previous evidence of alerting and orienting networks impairments in a wide range of distinct psychopathological conditions (e.g., Fan et al., 2012; Heeren et al., 2015; Kheen et al., 2011; Lundervold et al., 2011). Moreover, strong associations between the efficiency of these two networks and several key transdiagnostic processes have been recently portrayed. However, they were mostly devoid of any relation vis-à-vis the executive network. For instance, the efficiency of the orienting network predicts

the intensity of ruminative thinking (Pêcher et al., 2011; Tortella-Feliu et al., 2014), which is an established transdiagnostic process involved in the maintenance of several psychopathological conditions (Mansell et al., 2009). Besides, enhanced alerting network functioning is predictive of a greater risk of suppressing distress-related cognitions (Tortella-Feliu et al., 2014), which is known as a maladaptive emotion-regulation strategy (Magee et al., 2012). Finally, situational anxiety and distressing feelings were associated with both alerting (Pacheco-Unguetti et al., 2010) and orienting networks efficiency (Moriya & Tanno, 2009), but not with the executive one. We are thus encouraging researchers to dig far beyond a mere diagnostic-based group-comparison approach to grasp the very nature of the connections among EF, attentional networks, and psychopathology.

Second, because psychopathology is associated with impairments in the executive network of attention, Snyder et al. (2015) argued that this suggests that EF deficits are not due to lower-level attentional difficulties. We believe this inference is too strong. Indeed, there are several publications evidencing lower-level attentional processes impairments (e.g., perceptual processes) across several distinct psychopathological conditions, including autism (e.g., Behrmann et al., 2006), social anxiety (e.g., Peschard et al., 2013; Rossignol et al., 2012), schizophrenia (e.g., Silverstein et al., 2014), depression (e.g., Desseilles et al., 2009), and addictions (D'Hondt et al., 2014). Although we agree that uncertainty still abounds regarding the elusive connections between lower- and higher-level processes, one cannot rule out the possibility, as recently suggested (e.g., Noël et al., 2013; Peschard & Philippot, 2015), that these interactions do play key roles in the maintenance of psychopathology.

Altogether, although we agree with Snyder et al. (2015) that an audit of EF impairments in psychopathology is timely, our commentary challenges their claim that psychopathology is typically associated with impaired executive network of attention. It also calls for a reconsideration of the role of attention, including lower-level processes, in the conceptualization of EF impairments in psychopathology. Yet it remains to be seen whether a unified theory of the interactions between attentional networks and both diverse and unitary executive components can be achieved, even beyond the case of psychopathology. On the other hand, at a methodological level, extant procedures often used for assessing the structures of EF, such as exploratory and confirmatory factor analyses, are insufficiently robust to delve into the communalities shared by attentional and executive processes. New methods for conceptualizing psychological phenomena as networks of interacting processes, rather than indicators of a latent common variable, have emerged (e.g., Borsboom & Cramer, 2013). Since these methods have more robust validity vis-à-vis construct simulation models that mimic network dynamic of psychological phenomena (e.g., Schmittmann et al., 2013), reasonable next steps would thus be their application for reliably modeling common jointures of attentional networks, EF, and psychopathology.

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Authors’ contribution

Alexandre Heeren had the initial ideas and wrote the first draft of the manuscript. All authors then revised the manuscript critically and contributed to and have approved the final manuscript

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References

- Banisch, M.T. (2009). Executive Function: The search for an integrated account. *Current Directions in Psychological Sciences*, 18: 89-94.
- Behrmann, M., Thomas, C., & Humphreys, K. (2006). Seeing it differently: Visual processing in autism. *Trends in Cognitive Sciences*, 10: 258-263.
- Borsboom, D., & Cramer, A.O.J. (2013). Network analysis: An integrative approach to the structure of psychopathology. *Annual Review of Clinical Psychology*, 9: 91-121.
- Desseilles, M., Balteau, E., Sterpenich, V., Dang-Vu, T. T., Darsaud, A., Vandewalle, G., Albouy, G., Salmon, E., Peters, F., Schmidt, C., Schabus, M., Gais, S., Degueldre, C., Phillips, C., Luxen, A., Ansseau, M., Maquet, P. & Schwartz, S. (2009). Abnormal neural filtering of irrelevant visual information in depression. *The Journal of Neuroscience*, 29: 1395-13403.
- D'Hondt, F., Lepore, F., & Maurage, P. (2014). Are visual impairments responsible for emotion decoding deficits in alcohol-dependence? *Frontiers in Human Neuroscience*, 8 :128.
- Fan, J., Bernardi, S., Dam, N.T., Anagnostou, E., Gu, X., Martin, L., Park, Y., Kolevzon, A., Soorya, L., Grodberg, D., Hollander, E., & Hof, P.R. (2012). Functional deficits of the attentional networks in autism. *Brain and Behavior*, 2: 647-660.

- Heeren, A., Maurage, P., & Philippot, P. (2015). Revisiting attentional processing of non-emotional cues in social anxiety: A specific impairment for the orienting network of attention. *Psychiatry Research*, 228: 136-142.
- Keehn, B., Müller, R.A., & Townsend, J. (2013). Atypical attentional networks and the emergence of autism. *Neuroscience and Biobehavioral Reviews*, 37: 164-183.
- Lundervold, A.J., Adolfsdottir, S., Halleland, H., Halmøy, A., Plessen, K., & Haavik, J. (2011). Attentional network test in adults with ADHD – The impact of affective fluctuations. *Behavioral and brain functions*, 7:27.
- Magee, J.C., Harden, K.P., & Teachman, B.A. (2012). Psychopathology and thought suppression: A quantitative review. *Clinical Psychology Review*, 32, 189-201.
- Mansell, W., Harvey, A., Watkins, E., & Shafran, R. (2009). Conceptual foundations of the transdiagnostic approach to CBT. *Journal of Cognitive Psychotherapy: An International Quarterly*, 23, 6-19.
- Maurage, P., de Timary, P., Billieux, J., Collignon, M., Heeren, A. (2014). Attentional alterations in alcohol dependence are underpinned by specific executive controls deficits. *Alcoholism: Clinical and Experimental Research*, 38: 20105-20112.
- Miyake, A., & Friedman, N.P. (2012). The nature and organization of individual differences in executive functions: Four general conclusions. *Current Directions in Psychological Sciences*, 21: 8-14.
- Moriya J, & Tanno, Y. (2009). Dysfunction of attentional networks for non-emotional processing in negative affect. *Cognition & Emotion*, 23: 1090-1105

- Noël, X., Brevers, D., & Bechara, A. (2013). A triadic neurocognitive approach to addiction for clinical interventions. *Frontiers in Psychiatry*, 4:179.
- Orellana, G., Slachevsky, A., & Peña, M. (2012). Executive attention impairment in first-episode schizophrenia. *BMC Psychiatry*, 12, 154.
- Pacheco-Unguetti, A.P., Acosta, A., Callejas, A., & Lupiáñez, J. (2010). Attention and Anxiety: Different attentional functioning under state and trait anxiety. *Psychological Science*, 21 : 298-304.
- Pacheco-Unguetti, A.P., Acosta, A., Marqués, E., & Lupiáñez, J. (2011). Alterations of the attentional networks in patients with anxiety disorders. *Journal of Anxiety Disorders*, 25: 888-895.
- Pêcher, C., Quaireau, C., Lemerrier, C., & Cellier, J.-M. (2011) The effects of inattention on selective attention: How sadness and ruminations alter attention functions evaluated with the Attention Network Test. *European Review of Applied Psychology*, 61,43-50.
- Peschard, V. & Philippot, P. (2015). Social anxiety and information processing biases: An integrated theoretical perspective. *Cognition & Emotion*, in press.
- Peschard, V., Philippot, P., Joassin, F., & Rossignol, M. (2013). The impact of the stimulus features and task instructions on facial processing in social anxiety: An ERP investigation. *Biological Psychology*, 93: 88-96.
- Petersen, S.E., & Posner, M.I. (2012). The attention system of the human brain: 20 years after. *Annual Review of Neuroscience*, 35: 73-89.

- Posner, M.I., & Rothbart, M.K. (2007). Research on attention networks as a model for the integration of psychological science. *Annual Review of Psychology*, 58:1–23.
- Rossignol, M., Campanella, S., Maurage, P., Heeren, A., Falbo, L., Philippot, P. (2012). Enhanced perceptual responses during visual processing of facial stimuli in young socially anxious individuals. *Neuroscience Letters*, 526: 68-73.
- Schmittmann, V.D., Cramer, A.O.J., Waldorp, L.J., Epskamp, S., Kievit, R.A., & Borsboom, D. (2013). Deconstructing the construct: A network perspective on psychological phenomena. *New Ideas in Psychology*, 31: 43-53.
- Silverstein, S.M., Keane, B.P., Papathomas, T.V., Lathrop, K.L., Kourtev, H., Feigenson, K., Roché, M.W., Wang, Y., Mikkilineni, D., & Paterno, D. (2014). *PLOS ONE*, 9, 12:e114642.
- Snyder, H.R., Miyake, A., & Hankin, B. L. (2015). Advancing understanding of executive function impairments and psychopathology: Bridging the gap between clinical and cognitive approaches *Frontiers in Psychology*, 6:328. doi: 10.3389/fpsyg.2015.00328”.
- Tortella-Feliu, M. Morillas-Romero, A., Balle, M., Bornas, X., Llabrès, J., & Pacheco-Unguetti, A.P. (2014). Attentional control, attentional network functioning, and emotion regulation styles. *Cognition & Emotion*, 28: 769-780.