

# Commentary: What's in a word (or words) – on the relations among self-regulation, self-control, executive functioning, effortful control, cognitive control, impulsivity, risk-taking, and inhibition for developmental psychopathology – reflections on Nigg (2017)

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As noted by Nigg in his very thoughtful and valuable article, although the topic of self-regulation plays a central role in psychology today, discussion of this construct is characterized by definitional and conceptual confusion. Nigg's article is an important contribution to the field due to his clear differentiation of constructs and his attempt to establish a standard terminology for the field. Nigg also moves the field forward through his in-depth analysis of the role of different types of self-regulatory processes in certain psychological symptoms and psychopathology.

Nigg's model highlights the fundamental distinction between top-down and bottom-up regulatory processes, integrating and extending ideas from earlier papers by numerous individuals (e.g. Carver, Eisenberg, Gross, Michel, Rothbart, to name a few), including Nigg himself. He also drew a distinction between self-regulation involving extrinsic and intrinsic regulatory/controlling processes, which has not always been done, and which I believe is critical for clarity (Eisenberg & Spinrad, 2004). In addition, Nigg analyzes the relation of self-regulation to executive functioning (EF), a topic of recent interest (e.g. Eisenberg & Zhou, 2016), and discusses relations of EF to a number of other constructs used in the literature on self-regulation.

As a researcher studying self-regulation, I see considerable merit in Nigg's arguments and am even willing to change some of my own terminology to concur with his suggested terminology. For example, I previously used the term 'self-regulation' to refer to what Nigg refers to as top-down self-regulation or effortful control (EC) and used reactive control to refer to some of the bottom-up processes that Nigg includes in 'self-regulation'. In contrast, Nigg defines self-regulation as including both top-down and bottom-up processes, although, as already mentioned, he also noted that these two types of processes should be differentiated. As I have said in the past, it is the distinction, not the semantic label, that is critical, so it

behooves researchers (including me) to use a common terminology.

Nigg views EC as 'a dispositional trait-level representation that represents the tendency to be able to employ top-down control to self-regulate. It is seen as emerging from one aspect of EF or cognitive control, executive attention, but also, with development including other capabilities...When cognitive control is used in the service of SR, that essentially is effortful control' (Table 1, p. 3). In text, Nigg further argued that working memory is likely a part of EC because it often loads empirically with measures of EC.

I agree that EF and EC are overlapping constructs, although, as noted by Nigg, EFs, as cognitive operations, are available for purposes other than self-regulation. However, I would quibble about a couple of specific issues made by Nigg regarding EC. First, I have difficulty viewing working memory as EC or, for that matter, top-down self-regulation (Eisenberg & Zhou, 2016). Yes, working memory obviously contributes to the successful functioning of these capacities. However, with regard to EC, working memory is generally not viewed as part of temperament (or personality) and EC is, by definition, temperamental self-regulation (Rothbart & Bates, 2006). In addition, although it is easy to see how aspects of EC (or top-down self-regulation) such as managing attention or effortfully inhibiting and activating nondominant behaviors directly affect the modulation of emotion, cognition, and behavior, working memory is a more distal process, as well as a more general process involved in much of cognition and behavior involving cognition. Thus, it can be debated whether working memory is a core, intrinsic component of EC or top-down self-regulation, even if it loads with measures of EC empirically. An empirical association between working memory and EC/top-down self-regulation does not necessarily indicate that they are the same construct; general intelligence, for example, or some indices of

socioemotional competence, likely also load empirically with EC but are not part of EC.

Another argument by Nigg is that planning is not part of EC, although it is specified in Rothbart and Bates (2006) definition of EC. Nigg's contention is that planning is an example of higher level EF, and 'By its link with basic temperament traits, EC excludes complex cognitions and strategies' (p. 9), which are aspects of higher-level EF. Nigg suggests that planning is related to EC only because of its shared involvement of executive attention.

However, it is debatable whether all planning reflects high-level EF (or EC). It might be productive when thinking about planning to consider the important distinction between the application of planning to issues in the immediate context versus with regard to the future. Nigg discussed the usefulness of considering the time frame, arguing that, 'Medium and longer time frames involve high-level EF (strategies and planning) in the face of future conflict or to prepare for future challenge. The long-term future (beyond hours) is largely the domain of higher order EF' (p. 14). As was recognized by Nigg in Table 5, it is clear that even preschool children can plan to some degree, at least in the immediate context, on tasks such as the Tower of London. However, planning on such tasks does not pertain to the longer term future (beyond a few hours), despite the fact that planning is designated as pertaining to the future in Nigg's Table 5. I would suggest that planning in the present or short-term, as assessed by some planning measures used with young children, is part of EC, whereas planning over the longer term is in the domain of higher level EF.

In addition, individual differences reflected in the basic skills that comprise EC can be viewed as the building blocks of the more complex EC skills. Similarly, Diamond (2013) depicted lower level executive functions (working memory, inhibitory control, and cognitive flexibility) as contributing to higher level executive functions (i.e. reasoning, problem solving, planning). Just as temperament is seen as feeding into personality, EC feeds into, and is the core of, higher levels aspects of EF/top-down self-regulation. So I am not sure it makes sense to confine EC to simply lower level skills.

An issue I believe deserves further thought is whether top-down self-regulatory operations that become relatively automatic should be considered top-down, bottom-up, or intersecting. As noted by Nigg, 'top-down operations can be automatized for particular contexts (e.g. due to learning...)' (p. 6). In the online appendix, he further noted that, 'The psychological literature admits of a range of seemingly "higher order" mental operations that can be carried out without awareness'. It may be that Type II processes include operations always available to consciousness, without being an immediate focus of attention and 'nonconscious' (p. 1 of online appendix).

For some time (e.g. Eisenberg, Hofer, Sulik, & Spinrad, 2014), we have argued that it is the ease with which one can switch from an automatic to a voluntary mode of functioning that is critical to the distinction between top-down and bottom-up (or effortful vs. reactive) processes. An operation that is initially clearly effortful/top-down, and over time becomes semi-automatic but very easily can shift back into an effortful mode when adaptive, is different from one that is consistently automatized or difficult to effortfully manage. In other words, perhaps automaticity is not critical for defining top-down versus bottom-up EF/self-regulatory processes; rather, it is whether voluntary top-down self-regulation can be easily reinstated when it is adaptive to do so. In any case, additional discussion is merited regarding the validity of considering automaticity as a defining feature differentiating top-down from bottom-up self-regulation.

Nigg, on p. 12, emphasized the importance of considering flexibility when thinking about self-regulation: 'Note that impulsivity and risk-taking are only related to failed SR (self-regulation) if a modifier is attached, such as "inflexible". Deciding to go with the flow at a party may be impulsive without reflecting an SR failure, in that it may lead to adaptive optimization of state to context. It is crucial to clarify, in research and in the clinic, the difference between a behavior (selecting the immediate reward, or selecting the option with the biggest potential downside), and an inflexible application of that behavior. The latter is probably maladaptive on average; but can be adaptive in particular niches or contexts.' He further noted that, 'However, flexibility is a feature needing more study' (p. 3 of online appendix).

The issue of flexibility in self-regulation does merit more attention and is relevant to the association between self-regulation and personality trait of ego resiliency (Block & Kremen, 1996). For some time, my colleagues and I have been arguing that EC/top-down self-regulation is usually adaptive because it can be deliberately turned on or off as needed in specific situations (i.e. it is flexible); individuals who can turn off their top-down self-regulation when the situation does not call for it and, consequently, can be relatively flexible and spontaneous, are likely to be high in personality resiliency; and inflexible overcontrol (a bottom-up type of regulation) is related to low resiliency. In multiple studies, we have found that EC is positively, linearly related to ego resiliency (e.g. Eisenberg, Spinrad, & Morris, 2002). Moreover, we have found that elementary school children's impulsivity is positively related, and/or has a quadratic relation, to resiliency. With regard to the quadratic relation, low impulsivity was associated with low resiliency – likely because it reflected rigid overcontrol – whereas moderate and high impulsivity were equally positively related to resiliency. Thus,

in younger school children, EC/top-down self-regulation might contribute to resiliency, whereas lack of spontaneity and reactive overcontrol (as assessed by very low impulsivity) undermines it. Similarly, cognitive flexibility, an aspect of EF, is likely to predict personality resiliency, although we are unsure if this relation has been examined.

In summary, Nigg's excellent contribution will undoubtedly be quite generative in terms of conceptual and empirical advances and highlighting important questions to address. Moreover, it can bring some order to thinking and labeling in the field of self-regulation. This paper should become a classic reference.

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