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Znanstveni teoretsko pregledni prispevek

The feeling of doing across levels of analysis – The effects of perceived control on learning

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Abstract: A person's sense of control was initially conceptualized in psychology as either a trait (Rotter, 1966), an attribution style (Weiner, 1979) or self-efficacy belief (Bandura, 1989a). More recent work in social cognition focuses on the process of inferring one's own causality and how the feeling of doing comes about. This investigation centers on a cue based process as leading to the experience of agency. These cues include vision, proprioception, social cues, and action relevant thought (Wegner & Sparrow, 2004). Since the advent of Functional Magnetic Resonance Imaging (fMRI), progress has been made in understanding the neural substrates implicated when one's infers own causality (for review see David, Newen, & Vogeley, 2008). An analysis of the different approaches to studying human agency, reveals their contributions with each level of analysis adding to and refining our understanding of perceived control and its effect on learning.

Keywords: agency, learning, perceived control

Ravni analize občutka »dejavnega sebe« – Vplivi zaznanega nadzora na učenje

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Povzetek: Posameznikov občutek nadzora je bil v psihologiji prvotno konceptualiziran bodisi kot lastnost, atribucijski stil ali prepričanje o lastni samo-učinkovitosti. Novejše raziskave na področju socialne kognicije se osredinjajo na proces oblikovanja lastne vzročnosti in kako se iz te poraja občutek dejavnega sebe. Izhodišče te raziskave so procesi, ki vodijo k izkušnji dejavnega sebe, kot so denimo vizija, propriocepcija, socialni atributi in z dejavostjo povezane misli. Z iznajdbo funkcionalne magnetne resonance (fMRI) je bil dosežen napredek v razumevanju nevronskih substratov, ki implicirajo oblikovanje lastne vzročnosti. Analiza različnih pristopov in metodologije za preučevanje občutka dejavnega sebe kaže na razvoj v smislu širitve in natančnejšega razumevanja zaznanega nadzora in njegovega vpliva na učenje.

Ključne besede: občutek dejavnega sebe, učenje, zaznani nadzor

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Perceived control, and its effect on learning, has been studied using vastly different approaches, which converge on the conclusion that higher perceived control improves learning. With increasing specialization of training in psychology the study of phenomena of interest tends to become fragmented and often does not build on all relevant previous research (Roberts, 2006). To address this issue we propose a review of the literature to date across levels of analysis, bringing together related evidence on the same phenomenon. Specifically, we will review the study of perceived control and its effects on learning.

Perceived personal control has been studied using methods such as self-report questionnaires in large correlational studies, behavioral experiments manipulating perceived level of control, and fMRI and PET techniques that assess the neural correlates of self initiated action. These disparate lines of research of perceived control parallel the trends in the development of social and personality psychology. The observation of broadly defined phenomena, such as worldview, advances towards a more specific analysis of the process that underlies the emergent properties of whole human beings in their context (Mischel, 2004). What these diverse lines of study regarding personal control have in common is the investigation of the perception of *self-initiated*, *purposive*, *unobstructed* action.

The perception of agency is defined here as an inference about the degree to which one exerts a causal influence on an outcome. An ideal agent is perceived to have self-initiated, purposive, independent actions (Gray, Gray, & Wegner, 2007). Furthermore, the sense of authorship is a necessary precondition to the emergence of the self (Wegner, 2008).

An individual's perceived control can be conceptualized and operationalized in at least two ways: a conscious reflection about the self as an agent in one's general social context or as the author of physical actions in one's immediate environment. Philosophers have understood this complexity of the pervasive, but illusive concept of self, as "narrative" and "minimal" self (Gallagher, 2000). Conceptual understanding and reflection are defining features of the narrative self, whereas the minimal self refers to the agency of self in the moment, without the necessity to use any conceptual knowledge. The sense of agency is a complex phenomenon, which relies on many levels of neural processing based in different neural substrates whose interactions are not fully understood (David, Newen, & Vogeley, 2008; Synofzik, Vosgerau, & Newen, 2008).

Investigations aimed at understanding the neural underpinnings of agency show there are several distinguishable and possibly interrelated levels of agency perception. While this area of research is in its early stages, important distinctions and theoretical framework may help future studies in agency research in general. Synofzik and colleagues (2008) propose a theoretical framework to distinguish and study different levels of sense of agency. Action outcome couplings are the basis of making the agency judgment, but other cues,

like one's beliefs about agency, also impinge on this estimate when it is converted from feeling to judgment. Additionally, in order to attribute responsibility for a performed action, one must understand the intentions involved, and therefore such a judgment would also involve understanding mental states of self and others. At this level of perceiving agency, the actual motor action can be de-coupled from perceived agency.

The basis of perceived control at the first, feeling of agency, level which is a prerequisite for further, more complex inferences of agency, are the perceived couplings of actions and their effects. Their neural correlates are brain regions involved in monitoring visual and motor incongruence in posterior parietal cortex (PPC) (Chaminade & Decety, 2002; Farrer et al., 2003; Farrer et al., 2008; Farrer & Frith, 2002; Fink et al., 1999), cerebellum (Blakemore, Frith, & Wolpert, 2001) and extrastriate body area (EBA; Downing, Jiang, Shuman, & Kanwisher, 2001). When the feeling of agency is transformed into judgments of agency, the dorsolateral prefrontal cortex (DLPFC) is also activated. This area has been implicated in conflict monitoring and detection such as between one's own intended action and the sensory outcome (Fink et al., 1999; Schnell et al., 2007). In order to understand others' goal oriented actions and intentions the same brain areas are activated as when we perform that action ourselves. This network has been termed "mirror neurons" (Rizzolatti, Fadiga, Gallese, & Fogassi, 1996) and their key brain areas are the superior temporal sulcus (STS), parts of the PPC and the ventral premotor cortex (vPMc) (Keysers & Perrett, 2004) and they are thought to encode primarily motor aspects of actions.

In order to achieve a clearer understanding of how perceived control contributes to learning we will broadly categorize the diverse methodological and conceptual approaches outlined above into "narrative" and "minimal" self approaches to the study perceived control and their effects on learning. The purpose of using this distinction here is to organize the review of the disparate literatures. In addition, the practical implications for using the findings in educational settings differ according to the approach taken.

Agency of the Narrative and Minimal Self and Their Effects on Learning – Theoretical Background and Empirical findings

The study of perceived control can be parsed into consciously perceiving oneself as a causal agent within a given social context and one's online active engagement in controlling the task at hand. These lines of study correspond to the ideas of narrative self and minimal self, respectively (Gallagher, 2000). In both cases a person sees oneself as a causal agent, but whereas narrative self involves

semantically mediated representations of the self as a causal agent, minimal self involves controlling one's present actions and outcomes in the immediate moment.

Narrative Self Involvement

In order to study the sense of agency that a "narrative self" as a conceptually mediated sense of self may have, we can look to the chronic dispositions and characteristics of a conceptually mediated self, such as expectations and beliefs about the self and the world. Alternately, we can study factors in the social context that make some concepts relevant to the self more accessible and therefore alter their sense of agency. We will review lines of research that have taken these approaches and the contributions they make to understanding how the sense of agency contributes to learning.

Dispositional Approaches to the Study of Perceived Control

The study of the concepts of learned helplessness and resilience began as an experiment in rat survival skills, and revealed that the degree of control that the rats had learned they would have predicted how well they would cope and how hard they would try to survive until finally giving up (Richter, 1957; Seligman, 1972). This theory was then generalized to humans to predict that low expectations about the controllability of the environment would correlate with depression, while high perceived control over the environment correlates with normal functioning and even resilience. Hence, how actively people engage with an activity and how well they cope with a challenge, depends in part on their expectations about the controllability of the environment, which can lead to increased resilience or learned helplessness and depression. The idea of learned helplessness has spawned a whole movement of positive psychology, attempting to teach optimism and assuming that people can improve their lives by assuming an optimistic attributional style (Seligman, 1977).

The expectation about the controllability of the environment can be translated into the complementary estimate about one's own degree of possible causal influence, which has been studied on a broader level as locus of control (Rotter, 1966). Internal or external locus of control is conceptualized as a latent personality variable with each individual scoring along a continuum between believing that outcomes are contingent on their actions, to believing that all outcomes are dependent upon external forces, like fate, other people, God, etc. In the context of learning and education, correlational studies show that the global dispositional estimate about one's control residing within oneself (internal locus of control) is associated with increased achievement motivation and achievement behaviors. However, the correlations vary widely across studies and a plausible

mechanism has yet to be proposed, even the causal direction cannot be inferred (for a review see Stipek & Weisz, 1981).

Attribution theory (Weiner, 1972, 2000) encompasses the dimension of whether the cause is attributed to be internal or external and also includes two additional dimensions of controllability and stability of the perceived cause. Attributions about the cause of an outcome perceived as success or failure determine one's reaction and future behavior. These attributions affect further achievement related behaviors by changing expectations about future performance and the duration and malleability of those expectations and their impact on one's self esteem. This broad conceptual framework predicts that internal, stable and controllable attributions may be beneficial in the case of academic success (but not failure) in creating positive expectations and self-esteem increments.

In addition to the observational studies conducted by Weiner and colleagues (1972, 2000), a burgeoning recent literature has elaborated on the case of implicit assumptions about one's intelligence and the cognitions and goals that arise in the face of challenge or success as well as ensuing learning outcomes (Dweck, Chiu, & Hong, 1995). Dweck and colleagues have shown that there are two types of learners; people who attribute both success and failure to fixed ability (both "smart" and "dumb") are called entity theorists, contrasted with those who believe effort is key to learn and develop one's ability and skill, called incremental theorists. Entity attribution tends to result in performance goals (rather than learning goals) in a learning environment where evaluation is implied, more negative emotion and less persistence in the face of challenging problems and initial failures (Dweck et al., 1995). Specifically, entity theorists will forgo learning opportunities that could correct their errors (Chiu, Hong, & Dweck, 1997). Recordings of event related potentials associated with error correction suggest that entity theorists display a biased response toward negative feedback and yet subsequent brain activity suggests less conceptual processing and encoding which would be conducive to learning (Mangels, Butterfield, Lamb, Good, & Dweck, 2006).

These attributions are a result of implied theories about one's ability as immutable and outside of one's control (i.e. entity), or malleable with practice (i.e. incremental), thus making one's skills and abilities amenable to personal control. As in other cases presented thus far, we see that a greater sense of control in the face of failure allows for a mastery response instead of disengaging from challenging intellectual tasks. Notably, this approach to the study of perceived control includes both a dispositional and situational dimension: people have beliefs about the nature of intelligence, but those beliefs are malleable with feedback, which enables situational approaches as well and yields the same general conclusions whether the implicit theory of intelligence is measured as a chronic belief or manipulated as part of the experiment (Blackwell, Trzesniewski, & Dweck, 2007).

Self-efficacy captures one's estimated level of confidence that they can perform a task in a given context, defined with varying degrees of specificity (Bandura, 1989b). The estimate of self-efficacy is based in one's beliefs about their ability, past history of successes and failures as well as particular context. In correlational studies, self-reported self-efficacy has positive predictive value for academic success (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996). Indeed, the more specific the domain that self-efficacy is measured for, such as math self-efficacy in comparison to academic achievement self-efficacy, the more predictive the value of the self-report measures used for that domain (Pajares, 1996). This conclusion is in line with the finding that person by situation interactions better predict behavior and bring us closer to the analysis of the process and the mechanism that gives rise to the effect in question (Mischel, 2004; Mischel & Shoda, 1995). Similarly, when self-efficacy is experimentally increased via social comparison to an ostensible competitor that falls behind, performance on the task improves (Bandura & Jourden, 1991). These results indicate that providing relative success feedback boosts performance.

Situational Approaches to the Study of Perceived Control

Changing the sense of agency of the narrative self in the present context is the explicit objective of experimental studies aiming to examine the impact of the sense of agency on cognitive functioning. When college students are prompted to think of a time when they were in control of others their executive function improves (specifically, they are better able to inhibit irrelevant information) compared to when they are prompted to think of a time when they were controlled by others (Smith, Jostmann, Galinsky, & van Dijk, 2008). In addition, asking college students to reflect on their agency by answering control related questions before a cued recall task improves their recall when the task is relatively well liked and performance is high, whereas it decreases memory performance when the task is less liked and more difficult (Chatman & Sparrow, 2010).

In order to assess how the sense of control impacts learning we might ask what happens when we make the concepts that have bearing on the idea of control and achievement more accessible in the given situation. Peoples' worldviews about the causes of their actions being external or internal, vary from determinism on one end of the spectrum to self-determination and free will approaches on the other. Whereas a common determinism claim is that all actions and behavior are determined by factors beyond one's own control, like the unconscious or fate, free will approaches emphasize the ability of each individual to control and determine one's actions and outcomes in the world. When study participants read and thought about determinism, which indirectly reduces their own sense of how in control or responsible they are for outcomes, they tended to cheat more when given the chance

(Vohs & Schooler, 2008), whereas thinking about self determination is associated with better work performance (Stillman, Baumeister, & Vohs, 2010).

Just as the previous study likely induces people to think of themselves as less in control outside of conscious awareness, other primes[1] may induce people to feel a lesser or greater sense of agency within a given task context. Activities that participants in experiments perrcieve to be unrelated to the task at hand, such as describing a day in the life of a professor or unscrambling sentences that contain achievement related words improve their performance on general knowledge questions (Dijskterhuis & Van Knippenberg, 1998) and increase persistence in intellectual tasks when they are asked to stop (Bargh, Gollwitzer, Lee-Chai, Barndollar, & Trotschel, 2001), respectively.

Conversely, when stereotypes about a group, of which a person is a member, become salient in a relevant domain they induce decreased performance relative to that person's potential performance had the stereotype not been activated (Steele & Aronson, 1995). This robust effect has repeatedly been documented with various negatively stereotyped groups in the relevant domain such as women in math and sciences (Shih, Pittinsky, & Ambady, 1999; Spencer, Steele, & Quinn, 1999), African-Americans in intelligence tests (Steele & Aronson, 1995), men in social sensitivity (Koenig & Eagly, 2005) Caucasian men in athletics (Stone, 2002), and elderly people in memory tasks (Levy, 1996).

Similarly, the phenomenon of stereotype lift (Walton & Cohen, 2003) empirically demonstrates the performance boost of those groups who are not experiencing negative stereotypes, within the context of another group experiencing negative stereotypes in a given domain. However, it seems that making "positive" stereotypes explicitly salient to people diminishes the comparably small advantage of stereotype lift (Cheryan & Bodenhausen, 2000) while subtle presentation of the comparatively "better than negatively stereotyped group" stereotype improves performance (Shih, Ambady, Richeson, & Fujita, 2002).

While the aforementioned literatures would not purport to study the sense of agency, recent work on the mechanism of stereotype threat effects indicates that tasks tend to be seen as more difficult under stereotype threat and the experienced difficulty is more likely to be attributed to the self (Schmader, Forbes, Zhang, & Mendes, 2009). Therefore, it is likely that the metacognition of agency is involved in the mechanism of both stereotype lift and threat and associated memory performance changes.

[1] Here we define primes as events in a persons' environment whose effect on their behavior they are not aware of, regardless of whether they are presented subliminally or supraliminally (Bargh & Chartrand, 2000)

Minimal Self Involvement

Exercising agency on-line, in the moment, seems to have cognitive consequences that differ from occasions when one perceives actions or observes events that are controlled by others. Self-produced actions are easier to identify, as well as those that are more similar to own actions (Flach, Knoblich, & Prinz, 2004; Repp & Knoblich, 2004). When two people share a task, the mere presence of another person doing their part causes prolonged reaction times compared to when the otherwise identical task is done alone (Sebanz, Knoblich, & Prinz, 2005). This suggests that the participant may be mentally representing the action of the other person.

The study of mirror neurons which are activated when primates and humans both observe and perform a self-initiated purposive (i.e. agentic) motor action (Rizzolatti, Fadiga, Gallese, & Fogassi, 1996), along with a burgeoning literature (for reviews see Gallese, Keysers, & Rizzolatti, 2004; Keysers & Gazzola, 2007; Rizzolatti & Craighero, 2004; Van Overwalle & Baetens, 2009) since this discovery also suggests that perception of others' action and own action have common neural substrates. In addition, peoples mirror neurons show increased activation for actions they are expert at performing (Calvo-Merino, Glaser, Grezes, Passingham, & Haggard, 2005).

Arguably, perception and action are intimately related and they subserve social interactions where one of the key distinctions is who is performing the actions observed (Knoblich & Sebanz, 2006). Considerably more subtle cues like going first or second in an otherwise independent task changes the sense of agency (Wegner & Sparrow, 2007) as well as brain activation (Chaminade & Decety, 2002). The sense that one is the author of their actions relies on an inference process that includes multiple types of cues, like bodily and sensory cues, environment orientation, action consequences action relevant thought and social cues (Wegner & Sparrow, 2004). The key principles for inferring agency are the same ones we may use to infer the causality of external events: priority (cause before the effect), consistency (of cause and effect) and exclusivity (absence of other possible causes) (Wegner & Wheatley, 1999). When people are provided illusory choice in a learning task they produce better recall than in the no choice condition and their recall decreases when the computer makes choices for them (therefore violating the exclusivity principle) in an otherwise equivalent task. Additionally, participants' estimates of agency follow the same pattern (Chatman & Sparrow, in prep), indicating that the two may be causally related.

Providing people the opportunity to evaluate and select produces a sense of agency of a minimal self. When choosing, a person is actively engaged with the task in a way that affords higher perceived control. Therefore, researchers have studied the effects of providing a choice, whether de facto or illusory, to unwitting

experiment participants (Cloutier & Macrae, 2008; Cordova & Lepper, 1996; Iyengar & Lepper, 1999; Takahashi, 1991; Watanabe & Soraci, 2004) and showing that it enhances learning.

The items that are chosen from a set are better remembered (Perlmutter, Scharff, Karsh, & Monty, 1980; Takahashi, 1991; Watanabe, 2001), even when preference is controlled for (Watanabe, 2001; Watanabe & Soraci, 2004) by allowing choice only insomuch as the participant selects the correct answer on a multiple choice test (Roediger & Marsh, 2005).

When children are allowed to make choices their motivation is enhanced and they learn more from an educational activity (Cordova & Lepper, 1996). Recent studies (Cloutier & Macrae, 2008; Cunningham, Turk, Macdonald, & Macrae, 2008; Kesebir & Oishi, 2010; Turk, Cunningham, & Macrae, 2008) show that memory enhancement occurs when information is incidentally associated with oneself via incidental choice or transient ownership. In a study of the self-reference effect (Rogers, Kuiper, & Kirker, 1977), Cloutier and Macrae (2008) find that when information is actively chosen, and only then viewed in relation to oneself, that information is remembered better than assigned information. Interestingly, the brain regions that are preferentially activated in the agentic self reference condition positively predict the memory enhancement obtained on the recall task, while relating information to oneself produces memory benefits, but the activation of the brain regions involved does not predict the obtained memory enhancement (Powell, Macrae, Cloutier, Metcalfe, & Mitchell, 2010).

However, it seems that providing choice doesn't have the same effect across cultures (Iyengar & Lepper, 1999). For East-Asian children, motivation and learning was enhanced when their mothers chose, compared to when they chose themselves, or when an out-group member chose. It is hypothesized that their concept of self includes close others (Markus & Kitayama, 1991), and therefore we should expect them to have an enhanced sense of agency when close others choose for them. While what has been termed choice-based processing (Cloutier & Macrae, 2008) does provide benefits in memory in US college students, there seem to be other ways of exercising one's agency. Therefore, we argue that it is not choice per se that causes the memorial benefits, but the perceived exercise of volitional control, or agency.

Outside of making a choice, enacting action verbs can allow for greater engagement in the task at hand (Cohen, 1981, 1989). Enacting action verbs rather than reading them off a list allows for a more long lasting memory of what was done and this phenomenon is known as the enactment effect. Additionally, generating answers (Slamecka & Graf, 1978) rather than having them provided by the instructor results in better long term memory.

As we've noted above, even completing a multiple choice test has been shown to be a better tool for learning than restudying. The now well documented testing

effect (Roediger & Karpicke, 2006), is the phenomenon that taking a test improves memory for the material more than if the students were to restudy the material twice before the second (criterion) test. In addition, when the format of the test requires students to generate what they know (essay or short answer) rather than recognize the right answer (multiple choice) the learning benefits are considerably greater. This relative advantage of tests that require greater engagement also points to a positive association of minimal self agency and learning.

Implications for Best Practices for Enhancing Learning

In the following section, implications for educational practice will be elaborated based on the findings presented in the previous section, following the same organization of material. The subheadings will refer to the same sources and findings and extrapolate them to possible uses in a learning setting, particularly in an education, classroom setting.

Narrative Self Involvement and Perceived Control – Implications for Learning

Dispositional Studies - Implications for Learning

Collectively, these findings suggest that increased perceived control may cause better academic performance, but making conclusions about causes of effects from observed correlations would be premature. Most of the studies conducted here rely on correlations and such studies do not rule out a possible third variable that may be causing both performance and perceived control boosts or a reverse causal pattern where performing better actually causes increased self-efficacy. Most of the approaches to control and learning outlined in this section have emphasized a chronic orientation, style or characteristic that individuals possess to varying degrees and therefore may lead the reader to conclude that these characteristics are not amenable to interventions. However, the goal of most of these approaches has been to increase perceived control and potentially performance.

Positive performance feedback relative to competitors has been shown to increase performance (Bandura & Jourden, 1991). However, when this happens outside of laboratory settings it is quite likely that another person will be on the negative end of that comparison and that their performance will be negatively affected.

In addition, the quality of the feedback, whether it is positive or negative about a person's performance is of the utmost importance. Studies providing feedback that supports effort and not an innate ability view (Mueller & Dweck, 1998). For example, praise or critique associated with the amount of effort and time that a student put into completing an assignment, particularly a challenging one, results in greater persistence when faced with an intellectual challenge, more

positive emotion after failure and fewer negative attributions of one's own ability. The studies that demonstrate the benefits of effort-focused feedback were conducted in a naturalistic classroom setting show that when provided consistent effort supportive feedback (in contrast to feedback about immutable ability such as "smart" or "dull") or providing information about ability as an acquired skill (Blackwell, Trzesniewski, & Dweck, 2007; Mueller & Dweck, 1998).

Situational Studies – Implications for Learning

The situatonal approach to the study of percieved control is fruitful for those who would benefit from specific interventions that would allow increased sense of agency and prevent decreased sense of agency. Cues in the environment that trigger a greater sense of agency like stereotypes that imply high ability, reminiscing of times when a person felt powerful and semantic achivement related cues in the environment enhance performance in intellectual tasks, as shown in studies of perceived control and learning, stereotype and achievement motivation priming described above.

However, many other cues like negative stereotypes and reminiscing of when one felt powerless are likely to decrease performance below the level of those individuals' capabilities. In order to reduce the negative effects of stereotype threat, one can referame the tasks that are meant to be diagnostic of one's ability explicitly as non-diagnostic (Steele & Aronson, 1995), or state that no group differences have been found or that the test is fair for a given group (Spencer et al., 1999), even if it is considered diagnostic (eg. "gender-fair" Good, Aronson, & Harder, 2008). In addition to the absence of threatening cues for one's self identity and efficacy in the task, it is important to ensure that the social environment does not contain cues that would signal to a person that their group is likely not capable to the same degree, marginalized and segregated (Purdie-Vaughns, Steele, Davies, Ditlmann, & Crosby, 2008). Other ways to ameliorate such threat are explict discussion and knowledge of stereotype threat phenomenon (Johns, Schmader, & Martens, 2005) as understanding stereotype threat seems to be instrumental in preventing its' deleterious effects. Understanding stereotype threat allows learners to attribute the difficulty, arousal and subjectively experienced axiety to a cause other than self. Other strategies of external attribution of arousal such as introducing another external source of arousal (Ben-Zeev, Fein, & Inzlicht, 2005), explaining arousal and anxiety as a common part of the academic struggle (Good, Aronson, & Inzlicht, 2003) as well as emphasizing that anxiety during a test can be positive and not detrimental (Johns, Inzlicht, & Schmader, 2008). Self-affirmation, operationalized as a simple essay expressing important values unrelated to the domain where performance is under threat (Garcia, Purdie-Vaughns, & Apfel, 2009; Purdie-Vaughns & Cohen, 2009) has been shown to improve school performance and grades in the long term. In addition, school interventions that improve the sense

of belonging of minority students who are at risk for perceiving common difficulties that come with adjustment to college as signals that they don't belong in their academic environment alleviate stereotype threat effects (Cohen, Garcia, Purdie-Vaughns, Apfel, & Brzustoski, 2009).

Beliefs about one's ability put forth by Dweck and colleagues (1995) are considered to be chronic and learned, domain specific, but also malleable. Thus, incremental view of intelligence has been shown to buffer individuals from the deleterious effects of stereotype threat, both by measuring people's beliefs (Sawyer & Hollis-Sawyer, 2005) and maniupulating beliefs about intelligence using an instructional video , an essay writing task (Goff, Steele, & Davies, 2008) or the the views communicated to adolescents by older mentor peers (Good et al., 2003).

Finally, some educational environments emphasize personal responsibility of the student for their learning and thus make considering one's own responsibility more frequently liklely. It is important to understand the consequences of that environment for the learning process. According to a recent study (Chatman & Sparrow, in prep) explicitly and frequently adressing questions of personal agency and control can increase or decrease recall performance depending on whether the task is liked or disliked, easy or difficult.

Minimal Self Involvement – Implications for Learning

Diverse lines of research presented in this section show that active engagement with the task at hand and the material to be learned produces improvements in memory. Engagement with the material has been induced by means of providing people a chance to choose, evaluate and select what is relevant to them and making those choices has a positive effect on memory above and beyond peoples' preferences for the chosen material itself (people may choose what they prefer or know better). It is important to note that it is the learners' perception of choice and agency that matters, even if that choice is made between options that are assigned by other people in their social environment. Conversely, when other people choose for them students in Western cultures may disengage from the material. Therefore, when other agents make their presence salient and make the choices for the learners, learning will be decreased and the learners will sometimes report being distracted and frustrated.

Agentic engagement in tasks can be achieved by enacting materials to be learned that are suitable for this purpose in a given learning setting. Alternately, generating answers to questions rather than receiving prepared answers or simply "knowledge" will improve learning in the long term. Testing can be used as a good tool to improve learning and the more open ended formats of tests that allow the learner to express (generate) their knowledge will enhance learning more, while timely feedback will correct any possible mistakes that a student may produce (Kang,

McDermott, & Roediger, 2007). These learning benefits, termed the testing effect, have been used in classroom interventions and studies have shown that frequent, low stakes tests work best, but the additional benefits gained from testing tend to decrease after the third test per semester (McDaniel, Roediger, & McDermott, 2007).

Concluding remarks

Across disparate levels of analysis reviewed here studies using different methodologies point to the positive effects of an increased the sense of personal control on learning. Different approaches used to understand the effects of perceived control on learning build on one another and enhance our understanding of the kind of cognitive processing that occurs when people perceive a high sense of agency. The refinement of this understanding in turn allows us to make more precise recommendations about the best ways to engage people in the learning process by enhancing their sense of agency.

Given the increased specialization of fields that constitute psychology and increased specialization of the training that the psychologists who participate in it receive, it seems necessary to provide venues for increased communication and integration of different levels of analysis and sub-disciplines engaged in the phenomena of interest. Future research on this topic would benefit from explicitly addressing the level of theoretical analysis of the phenomenon of agency as well as learning, which is being studied. This would allow integrating the work into a broader framework and open possibilities to study the interaction between different levels of perceived agency and learning.

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