An Integrated Model for Motivation and Self-efficacy in Decision Making (ME-DM)

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Abstract: Presentation of an integrated model for motivation and self-efficacy in decision making (ME-DM) applying a dual process theory mindset

The (ME-DM) model contends that a nonmonotonic and discontinuous function best represents the relationship of "motivation and self-efficacy in decision making". It suggests that there is an optimal range of self-efficacy level (System 2 Focus) and self-efficacy strength (System 1 Focus), where optimal learning and optimal decision making, for important and irrevocable decisions, is most promising. The model explores, how and why we decide in certain situations and how decision making, beliefs and learning are connected.

Keywords: Motivation, Self-efficacy, Expectancy, Decision Making, Decision Avoidance, Self-regulation, Goals, Dual process theory, Triple process theory, Learning, Belief

Acknowledgment: The "ME-DM" model presented here builds essentially on three main areas of research and discovery. 1) Motivational Theory. 2) Goal Setting, Self-Regulation and Self-Efficacy. 3) Dual Process Theory, Judgment and Decision Making (JDM). The references chosen in the article below represent my attempt to express my gratitude for the respective contributions of the authors and researchers listed.

Pre-publication: 19th June 2017, **Publication:** 16th March 2018, www.decisiontiming.com

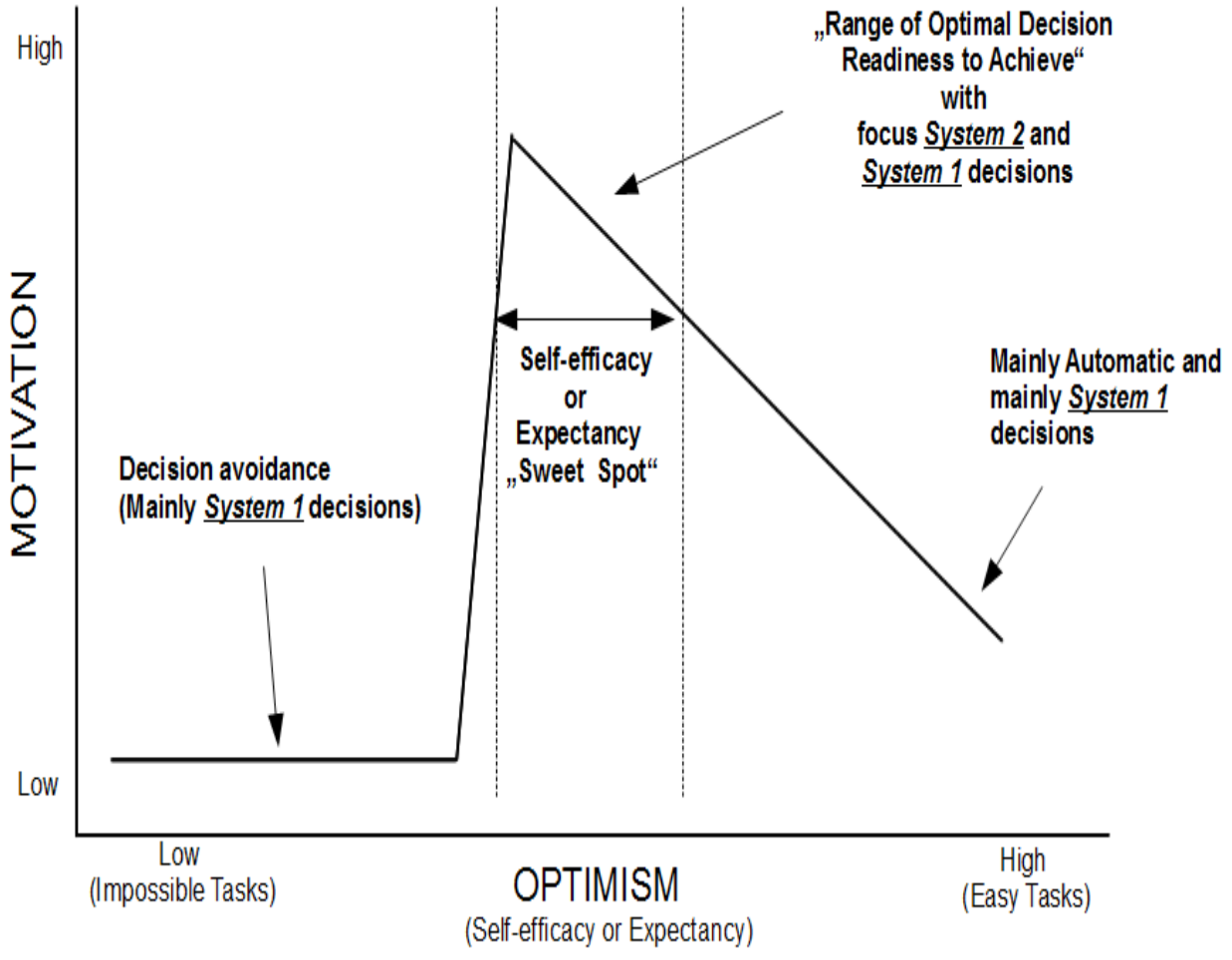


Figure 1: Integrated model for motivation and self-efficacy in decision making (ME-DM), (Schürholz, 2017/2018)

Introduction

The question why we decide not to decide (Anderson, 2003), why we sometimes decide sub-optimally (Tversky & Kahneman, 1974 - Baumeister, 2003 - Ariely, 2008) or why we often decide automatically (Moore & Lowenstein, 2004 - Klein, 2009) has been at the focus of the study of judgment and decision making for many decades.

Faced with this large spectrum of decision behavior and decision quality, two schools "Heuristics and Biases Approach" (Meehl, 1954 - Tversky & Kahneman, 1971) and "Naturalistic Decision Making Approach" (deGroot, 1946/1978 - Chase & Simon, 1973) have formed. You could also call these two intellectual traditions - "models", as Klein (2009) does, when he refers to "the human-as-hazard model... [and] ...the human-as-hero model".

Following the tradition of Kahneman & Klein (2009) in trying to reconcile these two different views, I will present in this article an integrated model for motivation, self-efficacy and decision making that offers the opportunity "to map the boundary conditions that separate true intuitive skill from overconfident and biased impressions".

One area that Kahneman & Klein pointed to namely "task environments of “high-validity” and "zero-validity"" provide a very practical condition for this mapping.

K & K focus on high validity task environments defined by "stable relationships between objectively identifiable cues and subsequent events or between cues and the outcomes of possible actions." They suggest that "medicine and firefighting are practiced in environments of fairly high validity." For zero validity environments, they state that "outcomes are effectively unpredictable". The examples they provide are "predictions of the future value of individual stocks and long-term forecasts of political events".

To be able to map the perspective of the expert onto the perspective of the ordinary decision maker, I will refer to task environments of high-validity as "Easy Tasks" and task environments of zero-validity as "Impossible Tasks".

In acquiring knowledge, experience, skills, methods and tools, the boundaries of what was previously "impossible or easy" of course changes.

The point to note though from the subjective experience of the individual decision maker, there will always be and remain an "impossible and easy decision task environment", while the content and discipline of those environments might change.

This leads me to the general and integrated model for motivation and self-efficacy in decision making (ME-DM) that I am presenting here. Such a model, at an initial stage, to describe a human decision maker, of course, needs to refer to the most basic aspects of the human mind, namely the conscious and unconscious part (see dual process theory below). Generally we just tend to focus on one or the other when it comes to decision making. Here I attempt to focus on both.

Dual process theory

According to (Evans, 2008) the most neutral terms to use for the two different modes of processing in dual process theory are System 1 and System 2 processes (Kahneman & Frederick 2002, Stanovich 1999). Evans concludes: "Almost all authors agree on a distinction between processes that are unconscious, rapid, automatic, and high capacity [System 1], and those that are conscious, slow, and deliberative [System 2]".

"Other recurring themes in the writing of dual-process theorists are that System 1 processes are concrete, contextualized, or domain-specific, whereas System 2 processes are abstract, decontextualized, or domaingeneral." (Evans, 2008)

Authors like (Evans 2006, Klaczynski & Lavallee 2005, Stanovich 1999) "assume that belief-based reasoning is the default to which conscious effortful analytic reasoning in System 2 may be applied to overcome."

(Evans, 2006) proposed "that heuristic responses [System 1] can control behavior directly unless analytic reasoning [System 2] intervenes. In other words, heuristics provide default responses that

may or may not be inhibited and altered by analytic reasoning." This System 2 intervention is more likely according to (Stanovich, 1999) "when individuals have high cognitive ability or a disposition to think reflectively or critically."

By presenting the "Integrated model for motivation, self-efficacy and decision making" (ME-DM) I like to suggest that this System 2 intervention is in fact a function of perceived and chosen task difficulty, context motivation, self-efficacy as well as ease (and capacity) to apply System 2.

The model that describes this function best is the Nonmonotonic and Discontinuous Model of Self-efficacy (Vancouver et al., 2008 - Schürholz, 2017 - Prepublication).

I hope that this model lives up to the challenge posed by (Evans, 2003) to "show how such two distinct systems [System 1 and System 2] interact in one brain and to consider specifically how the conflict and competition between the two systems might be resolved in the control of behaviour."

You should note that it is very likely that in the not so very distant future, we will not only be talking about System 1 and System 2, but presumably also about a distinct System 3, located in and communicating with our second brain, the enteric nervous system (ENS). The changes that I am talking about can be attributed to the findings and influence of what is termed the Microbiome (Gershon, 1998 – Collins, Surette & Bercik, 2012 - Tillisch et al. 2013 - Rao & Gershon, 2016). I like to refer to the functionality of this System 3 as the process of "influencing".

As we have no general understanding of a triple process theory yet though, let us stay with the dual process theory in this paper and for the time being.

Which entity is motivated by which goal?

Before I have a closer look at the Nonmonotonic and Discontinuous Model of Self-efficacy (Vancouver et al., 2008), let me consider first who or what entity is actually taking the decision and what kind of goals this entity might have.

Examining decision making from a dual process perspective means that we have to consider at least two entities that compete and contribute to the decision i.e. System 1 and System 2.

One of the central assumptions of the integrated model for motivation and self-efficacy in decision making (ME-DM) is that the decider perceives the decision task or decision situation in such a way that (s)he will generate commensurate motivation to deal with it appropriately. Another way of putting it from a goal perspective is that the decider allocates respective resources to accomplish those goal intentions. I like to refer to this process as adaptive resource allocation (see also Self-efficacy Strength and Ambiguity below).

Task Motivation and Decision Motivation

In terms of hierarchy or chronology, we act first and decide consciously (with System 2) later. What might sound a little provocative is not so farfetched if we consider the way our brain works and how our organism has formed. Strictly speaking I should say: "First we digest, then we act (process) and then we decide!" Michel Neunlist (Physilogist, Gastroenterologist and Neuroscientiest of the French Institute of Health and Medical Research, Paris) explains that our enteric nervous system (ENS), which he really historically regards as our first brain, was originally formed by simple multicellular organisms from their alimentary canal. From an evolutionary standpoint we can therefore argue that our "head-brain" was developed so that our diet improved. In parallel our eyes and ears developed so that gathering and collecting food became easier. Without this diversification between the (ENS) "the first brain" (historically speaking), and our "head brain" (our second brain), our organism (body) would just focus on digestion, and the allocation of resources, to take in more food and to digest more, rather than consider higher level tasks or conscious decision making.

With our current "head brain" and its dual entities of System 1 and System 2, we can go beyond just digesting and food intake (acting), we can also decide where we go to find more and better food, and of course much beyond that like fly into space, compose an opera or stop the hunger in the world.

In line with this argument, I will therefore assume that "Task Motivation" (System 1 Focus) (digesting/perceiving and acting/processing) always precedes "Decision Motivation" (System 2 Focus in concert with System 1 input). I will also consider that the act of decision making is a

special and unique task for the decider in many aspects. Some of those aspects that make decision making special for the decider are for example its "preparatory nature", the intrinsic ambiguity & uncertainty of outcome, as well as the complexity & interrelatedness of decisions. I will discuss these aspects in more detail with respect to self-efficacy below.

In the following I will therefore develop and discuss "Motivation" or better "Decision Motivation" which is the focus of this integrated model of "ME-DM" (which by the way is the abbreviation for "*M*otivation *E*xpectancy in *D*ecision *M*aking" or "*M*otivation (Self-)*E*fficacy in *D*ecision *M*aking) always from that special and unique perspective of decision making.

Theories of motivation

As (Steel & König, 2006) point out, "there is a superabundance of motivational theories." Across the many disciplines and subdivisions of decision making and motivation, we find for each its own "nomenclature, structure, and etiology." To establish a common ground and to define an explicit perspective, the theories that I will be focusing on, deal with the aspects of goal setting and self-regulation (Austin & Vancouver, 1996 - Latham & Locke, 1991) as well as with the popular concept of self-efficacy (Bandura, 1977, 1982; Gist, 1987; Gist & Mitchell, 1992).

In the different contexts and disciplines, taking psychology and economics as an example, the terms *motivation* and *value* (the two terms I will use in ME-DM) mean something different. In economics *motivation* could equate to *utility* (see Equation 1: Matching Law below). In psychology *motivation* could describe our ability or preparedness to act under certain conditions (see Equation 2: Procrastination Equation below). The same applies to *value*, where in economics we might equate it to reward or payout, in psychology we rather think of goals or desired states.

In the development of ME-DM (and its respective equation, see below) I will allude to both nomenclatures though, in the end, as you will see, I will focus on the psychological one which I believe is more appropriate in this context.

Temporal motivational theory (TMT)

In the article on Integrating Theories of Motivation (Steel & König, 2006) build a temporal motivational theory (TMT) where they referred to four "related understandings of human nature: picoeconomics, expectancy theory, cumulative prospect theory (CPT), and need theory." For simplicity in developing ME-DM, I will build only on two of them, namely picoeconomics and expectancy theory, adding instead, as a third understanding, the procrastination equation (Steel, 2007 & 2011).

The reason why I consider these three theories of behavior over time is because they account, in the least complex way, for decision behavior with respect to changing conditions, i.e. of not deciding (Anderson, 2003), of deciding optimally (or not optimally) or of deciding automatically.

In Picoeconomics (Ainslie, 1992) or Hyperbolic Discounting, Ainslie and Haslam (1992) develop a "theory that helps to account for choice of behavior over time." Put in a simple formula, the Matching Law (Chung & Herrnstein, 1967 - Ainslie, 1992) can be expressed as follows:

$$UTILITY = \frac{RATE * AMOUNT}{DELAY}$$

Where:

UTILITY = preference for a course of action.
AMOUNT = the amount of reward that is received on payout.
RATE = the expectancy the action will lead to the reward (in %).
DELAY = how long, on average, one must wait to receive the payout.

Equation 1: Matching Law

When we apply expectancy theory and the major factors that lead to procrastination (Steel, 2007) to the Matching Law, we get the Procrastination Equation (Steel, 2011) "the result of eight hundred studies plus one":

$$MOTIVATION = \frac{EXPECTANCY * VALUE}{(IMPULSIVENESS * DELAY) + 1}$$

Where:

MOTIVATION = ability or preparedness to act under certain conditions, resource allocation
VALUE = desired state, goal, reward, payout
EXPECTANCY = the assumed likelihood the action will lead to the reward (in %).
DELAY = how long, on average, one must wait to receive the payout.
IMPULSIVENESS = sensitivity to delay

Equation 2: Procrastination Equation

Having established this basic framework and its respective terms, to begin with, I need to have a closer look at the elements of goal setting, self-regulation and self-efficacy to proceed with development of ME-DM and its equation.

Goals

(Austin & Vancouver, 1996) define goals as "internal representations of desired states, where states are broadly construed as outcomes, events, or processes. Internally represented desired states range from biological set points for internal processes (e.g., body temperature) to complex cognitive depictions of desired outcomes (e.g., career success). Likewise, goals span from the moment to a life span and from the neurological to the interpersonal (H. Gardner, 1987 ; Izard, 1993)."

In the context of ME-DM, I like to consider goals as *value* (as defined above in the Procrastination Equation, Equation 2), just like tasks or decision situations that might range from impossible to easy. The important point to note is that I consider and define this *value* initially as something external, something that we observe or start to desire (think of a simple organism that encounters or observes something). By this definition this *value* has to be observed externally (outside of our brain) first, before it can become an "internal representation of a desired state". In the ME-DM Equation I will therefore denote it with VALUE (observed).

This point is very important because it allows us to relate to this VALUE (observed) in different ways depending on whether we are looking from a System 1 perspective, a System 2 perspective or from both at the same time.

Considering our evolution as deciders from simple organisms to the complex homo sapiens sapiens, it makes a lot of sense to me to assume, that in fact outside cues and outside "observed values", influenced who we eventually became and who we are likely to become in the future.

In the context of goals, we can also look at needs or more precisely at need theory (Murray, 1938 - Winter, 1996). Depending on the context or level, we find "primary or viscerogenic [needs], directly related to our biological nature (e.g., the need for food), or ... secondary or psychogenic [need], related to our personality" (Steel & König, 2006).

With respect to higher level decision making the secondary or psychogenic needs shall be of more interest to me in this paper. According to Winter (1996) only three of those (of about twenty) are of major relevance: the need for achievement, the need for affiliation, and the need for power.

As we are looking from a dual process theory perspective, it is very interesting to see that Weinberger and McClelland (1990), for example, "proposed a dual level motivation process in which goals, like need for achievement (nAch), need for power (nPow), and need for affiliation (nAff), are always below consciousness, whereas goals, like achievement value or "produce 20 widgets," are accessible" (Austin & Vancouver, 1996).

Concept Belief Switch (CBS)

For these conscious and subconscious goals (or needs) to form, our brain(s) need to gain or have a concept of those goals or values. "20 widgets" or "1 Million $" for example is a conscious concept that we can all understand and agree upon. "Perfection" or "Telling the truth" are concepts that are much more personal and in many instances below consciousness. They depend very much on our personal experience, related to these concepts or values. I like to contend therefore that motivation relating to those goals, needs, values or concepts very much depends on our understanding, experience or preparedness to buy into them, on a conscious and subconscious level.

As an initial gate, from a concept perspective, I therefore suggest a Concept Belief Switch(CBS) in the ME-DM model and equation that can either be "**1**", meaning we understand, believe or buy into this concept [Value (observed)], or "**0**" that we do not. On a neurological level this would equate to the fact that the associated brain area is either excited (1) or inhibited (0).

The degree to which this brain area is eventually excited depends on further variables or moderators in the ME-DM model, one main moderator for System 1 being - SELF-EFFICACY STRENGTH (for definition see Figure 3) - "the extent to which I believe I can produce this VALUE (observed)" , and the main moderator for System 2 - SELF-EFFICACY LEVEL (for definition see Figure 3) which could also be called SELF-KNOWLEDGE or VALUE FIT- "the extent to which I believe this VALUE (observed) is me or mine". Note: SELF-EFFICACY STRENGTH has a large System 1 component, but also a smaller System 2 component. SELF-EFFICACY LEVEL on the other hand, has a much more important System 2 component with a System 1 component also present.

To be able to follow the development of the ME-DM model and equation let me return to "Equation 1: Matching Law" and "Equation 2: Procrastination Equation" discussed earlier(see above).

Mind over Muscle

In very generalized terms we can express both the "Matching Law" and the "Procrastination Equation" in one common form:

$$\text{UTILITY or MOTIVATION} = \frac{\text{MIND}}{\text{BRAIN MUSCLE}} \Leftrightarrow \text{SELF-REGULATION}$$

Where:

MOTIVATION or UTILITY = ability or preparedness to act under certain conditions, preference for a course of action
MIND = considerations of System 1 and System 2 (values, goals, concepts, needs, rewards, expectancy)
BRAIN MUSCLE = resource allocations (time, energy etc.) for MIND required

Equation 3: Mind over Muscle Equation

Note that MIND is here a function of System 1 and System 2. This is important because often MIND is only seen as System 2 and BRAIN MUSCLE is often mistakenly taken as a System 1 equivalent. (This confusion owes probably to an analogy of Freud that describes the ego (acting according to the reality principle) as a rider and the horse as the id (acting according to the pleasure principle)).

This is not what is meant here! MIND here includes all Systems contributions with respect to VALUE (observed) and concept beliefs. BRAIN MUSCLE, on the other hand, refers to all resources allocated to and used by MIND (i.e. System 1 and System 2) according to an "Opportunity Belief Counter" (OBC) a concept that I will explain now. Note also, energy is seen here in the context of impulsiveness, i.e. the energy to act in another context. If this energy to be distracted is small, then the BRAIN MUSCLE required to act in the desired context is also likely to be small, leading to high motivation in the desired context or a high state of self-regulation. The reference to self-regulation shall serve to show that a person with high motivation, is also a person who possesses a high degree of self-regulation or conscious goal control.

Opportunity Belief Counter (OBC)

Whereas the Concept Belief Switch (CBS), already introduced above, is checking whether there is a concept or "internal representation" for the VALUE (observed) available that System 1 and System 2 can refer to, the Opportunity Belief Counter (OBC) counts the hierarchy level of the VALUE (observed) in the working memory. For some researchers (e.g., Bargh, 1989, 1990; Epstein, 1994; Higgins, 1989; Klinger, 1975), the key issue is salience [Observation], availability [Concept], or accessibility [Opportunity] in memory (Kihlstrom, 1987). "For these researchers, many goals may be present, but only a few are activated or cued in working memory. Goals [Values (observed)] that are more salient, available, or accessible may be activated in working memory more easily than other goals [Hierarchy]"(Austin & Vancouver, 1996)

The assumption of this model is that in order for the CBS to be able to switch to "1", there has to be a representation of the goal encoded in secondary memory, i.e. after it has been previously rehearsed in primary memory (Kihlstrom, 1987). The CBS is therefore the "older" and "domain-specific" element whereas the OBC is the "domaingeneral" and more "current" one. The relationship of the two with respect to motivation can be expressed as follows:

$$MOTIVATION_{BS/BC} = \frac{CBS}{OBC + 1}$$

Where:

MOTIVATION (BS/BC) = Relationship of BELIEF SWITCH and BELIEF COUNTER in ME-DM model
CBS = CONCEPT BELIEF SWITCH (which is either „0“ or „1“)
OBC = OPPORTUNITY BELIEF COUNTER (which counts the hierarchy level of belief in working memory where a low value means high priority)

Representation of a "Belief-Controller" (Computing analogy): Relationship of Belief Switch and Belief Counter in ME-DM model

Note the importance and hierarchy consideration of goals [VALUE (observed)] for motivation:

Level 1) or top level for CBS: Is the goal (belief) encoded in secondary memory?
Level 2) or bottom level for OBC: Is the goal (belief) a priority goal with a low OBC (Counter-Value)?

As an analogy to computing we could call the above relationship a simple "Belief-Controller".

Now we can use the very basic architecture of the "Belief-Controller", and we can "assemble" a first and very basic ME-DM Equation by adding the generalized version of the "Matching Law" and the "Procrastination Equation" expressed in the "Mind over Muscle Equation" above, which gives us:

$$MOTIVATION_{DM} = \frac{MIND * CBS}{BRAIN\ MUSCLE * OBC + 1}$$

Where:

MOTIVATION (DM) = MOTIVATION in ME-DM model = ability or preparedness to decide under certain conditions
MIND = considerations of System 1 and System 2 (values, goals, concepts, needs, rewards, expectancy)
BRAIN MUSCLE = resource allocations (time, energy etc.) for MIND required
CBS = CONCEPT BELIEF SWITCH (which is either „0" or „1")
OBC = OPPORTUNITY BELIEF COUNTER (which counts the hierarchy level of belief in working memory where a low value means high priority)

Equation 4: Development Version of ME-DM equation

To clarify: This first and very generalized version of the ME-DM equation shall only serve as a starter to build on. As we apply dual process theory or as our understanding of systems theory (MIND) evolves (say moving from a dual process to a triple process theory) or as our understanding of resource allocation in our brain advances (BRAIN MUSCLE), this basic formula will be modified and assimilate those more complex considerations, as you will see, to some extent, later in this paper.

The Nonmonotonic and Discontinuous Model of Self-efficacy with respect to Decision Making

What is "Self-efficacy"? Self-efficacy is a type of expectancy (Olson, Roese, & Zanna, 1996) related to an individual's belief that he or she can organize and execute the actions necessary to achieve given levels of performance (Bandura, 1977). What is unclear though, under what condition and to what extent, different levels of self-efficacy, effect changes in behavior (Task/Action) and motivation (Resource Allocation). In 2008, (Vancouver et al.) reviewed several possible relationships between self-efficacy and motivation. Focusing on 4 empirical models (Positive Model (Kanfer, 1990 - Beach & Connolly, 2005), Negative Model (observed by Bandura, 1997 - Bandura & Locke, 2003), Inverted-U Model (Atkinson, 1957 - Kanfer & Ackerman, 2004) and Discontinuous Model (Kukla, 1972 - Carver & Scheier, 1998)) they suggested, and eventually confirmed, one integrated model that could reconcile the various empirical models examined, over a wide range of task difficulty. The model they suggest is a Nonmonotonic, Discontinuous Model (see below). I believe this model is particularly relevant to the special and unique task of decision making.

Figure 2: Nonmonotonic and Discontinuous Model of Self-efficacy (Version Schürholz, 2017)

While their model and article has been cited 182 times to date, there is probably still a long way to go until it is generally accepted for most tasks. While it might not apply to all tasks under all circumstances, I believe it is particularly well suited to describe the special motivation and task relationship for decision making. I will briefly point out the elements of their argument (Vancouver et al., 2008) that should be noted for a Nonmonotonic and Discontinuous model:

a) Reasoning by (Kukla, 1972), "Kukla argued that if one felt that success was unachievable, one would not even try. However, if one attributed task performance to one's inputs (i.e., effort and ability), Kukla predicted that one would allocate effort commensurate with one's perceived ability, such that the greater one's perceived ability at the task, the less effort one would exert. That is, individuals would allocate effort to compensate for perceived ability if they thought effort mattered. Thus, Kukla argued that when perceived ability is very low, no motivation is exhibited because one chooses not to engage in the behavior. As perceived ability increases, a sudden jump in motivation occurs because there is now sufficient expected utility in the behavior to make it worth engagement. If engaging, however, the intensity of one's efforts is inversely related to perceived ability because less effort is deemed necessary if ability is high."

b) When the maximum motivation is reached: "However, should one choose to engage, the magnitude of resources allocated drops from its high at this point of discontinuity to lower levels as higher self-efficacy beliefs lead one to anticipate fewer resource needs."

c) Evidence for the model: "Kukla (1972) provided some evidence to support his model, but most of the evidence comes from Brehm and colleagues (i.e., Brehm & Self, 1989; Wright & Brehm, 1989). Specifically, Brehm, working from Kukla's model, developed a theory of energization that articulates a nonmonotonic, discontinuous function for motivation based on the perceived difficulty of the task. Because Brehm's theory conceptualizes motivation as arousal, studies to test energization theory typically examine cardiovascular responses (e.g., heart rate) during impossible, difficult, and easy conditions (Wright, 1996). The research generally has found that heart rate and

systolic blood pressure are highest in the difficult condition and lower in the impossible and easy conditions, thus supporting a nonmonotonic model."

It should be noted at this point that the arguments a) - c) by (Vancouver et al., 2008) only describe strictly speaking the shape of the relationship of arousal to ability (or task difficulty). Whether this also represents the relationship of motivation to self-efficacy very much depends on the definition of self-efficacy. In an exchange of argument between Bandura (2012, 2015) and Vancouver (2012) the question of the properties and definition of self-efficacy and particularly the so-called *negative effect* (the downward slope), were discussed in detail.

The main points of the discussion regarding the *negative effect* can possibly be summarized as follows:

- "Because of the multidetermination and contingent nature of everyday life, human behavior is conditionally manifested. Hence, no factor in the social sciences has invariant effects." (Bandura, 2012)
- "Social cognitive theory does not allege an invariant self-efficacy effect. Indeed, it explicitly specifies a variety of conditions under which self-efficacy may be unrelated, or even negatively related, to quality of psychosocial functioning (Bandura, 1997)."(Bandura, 2012)

Those conditions can be:

- Mismatch between assessed self-efficacy and the activity domain (Bandura, 2012)
- Self-efficacy during acquisitional phases (Bandura, 2012)
- Self-efficacy can negatively relate to resource allocation during or while planning for task performance (Vancouver, 2012)
- Self-efficacy on planned and reported study time prior to an exam (Vancouver, 2012)
- Ambiguity about the performance undertakings (Bandura, 2012)
- Situational constraints (Bandura, 2012)
- In performance situations in which misjudgment of capability is inconsequential (Bandura, 2012)
- Miscalibrated self-efficacy (e.g., overconfidence) (Vancouver, 2012)
- Self-efficacy belief may also diverge from action because of genuine faulty self-appraisal. (Bandura, 2012)

The integrating aspect of the discussion between Bandura and Vancouver might be, it "*is not that we make different predictions, but that we have different explanations for the negative effect*" as Vancouver (2012) states.

As far as decision making goes, the discussion of boundary conditions where self-efficacy either relates positively or negatively to this unique task, is particularly applicable. I mentioned above (under Task Motivation and Decision Motivation) that there are three boundary conditions that are especially significant and connected with decision making namely its "*preparatory nature*", the *intrinsic ambiguity & uncertainty of outcome*, as well as the *complexity & interrelatedness of decisions*.

If you have a look at the above arguments of Bandura and Vancouver you can easily identify the relevance of these special conditions (i.e. for acquisitional phases, planning for task performance, overconfidence and situational constraints) thereby strengthening and supporting the application of the Nonmonotonic, Discontinuous Model for the process of decision making.

There are two further studies, that provide evidence for the Nonmonotonic, Discontinuous Model. One is by Schmidt & DeShon (2010) with respect to Ambiguity, and the other by Beck & Schmidt (2012) with respect to Context (Goal Difficulty).

I like to discuss these papers in more detail because they allow to analyze the two dimensions of self-efficacy defined by Bandura & Locke (2003: 96) "*perceived self-efficacy is measured in terms of judgments of personal capabilities and the strength of that belief*" (2003: 96). Vancouver (2012) interprets this definition as follows: "Bandura claims that self-efficacy beliefs can be described in terms of level and strength. Level, also called magnitude, is the primary dimension of self-efficacy, much like goal difficulty is the primary dimension of goals. Bandura often describes it in terms of the level of performance one thinks oneself capable of reaching in a given context. Strength is more

difficult to pin down. It seems strength of belief refers to one's confidence in the belief. That is, strength should predict how well the belief stands up to disconfirming information, similar to the way goal commitment predicts an individual's perseverance in relation to a goal."

Drawing on these two sources I offer a slightly new definition for self-efficacy (see below) where I incorporate dual process theory as well as the moderators of Ambiguity examined by Schmidt & DeShon (2010) and Context (Goal Difficulty) investigated by Beck & Schmidt (2012), see below.

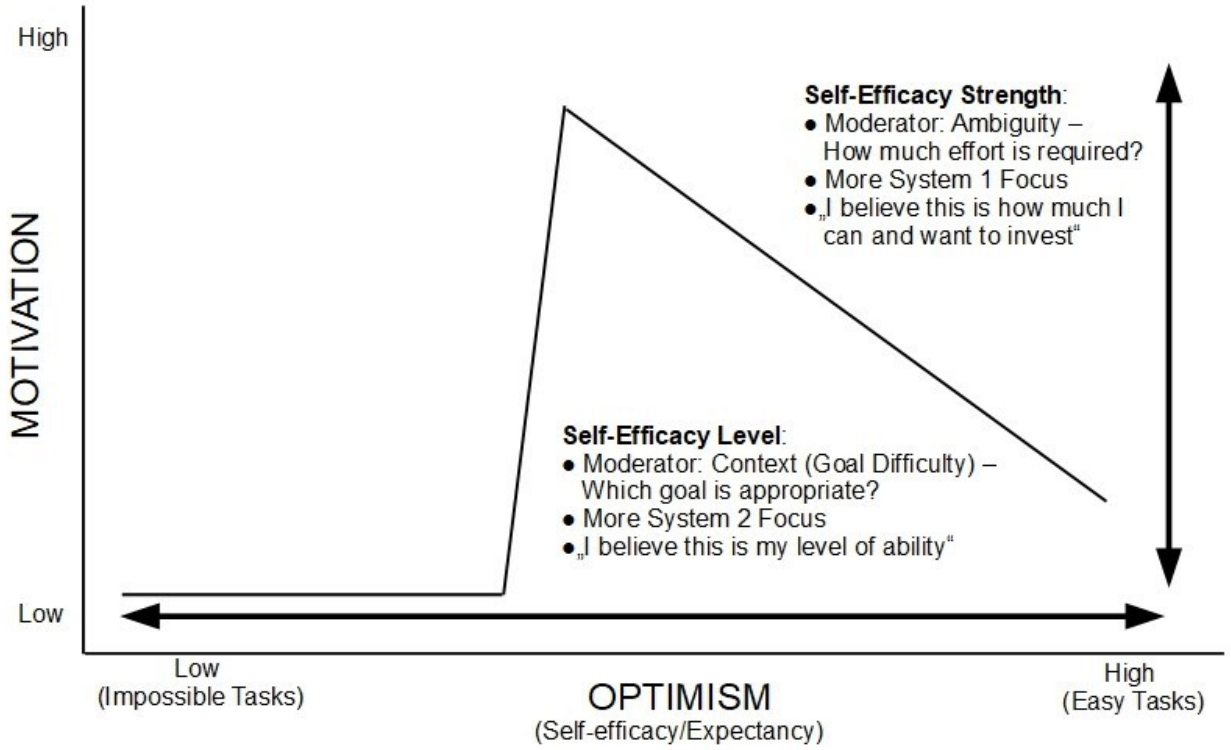


Figure 3: Definition for Self-Efficacy Level and Self-Efficacy Strength (Schürholz, 2017/2018)

As indicated, using the above definition for Self-Efficacy Level and Self-Efficacy Strength I will discuss in more detail the papers of Schmidt & DeShon (2010) and Beck & Schmidt (2012) examining the relationship of motivation (in terms of performance, resource allocation or self-reported effort) to self-efficacy in tasks that can be compared to decision making. The findings and insights generated will be used to further develop and detail the ME-DM equation, as well as to highlight different decision situations of varying decision difficulty.

Self-Efficacy Strength and Ambiguity

Schmidt & DeShon (2010) propose "that, with low levels of ambiguity, self-efficacy [strength] will be positively related to subsequent performance, consistent with much of the existing research. In contrast, with high levels of ambiguity, we posit that self-efficacy [strength] will be negatively related to subsequent performance, thus replicating the findings of Vancouver and colleagues (Vancouver & Kendall, 2006 - Vancouver et al., 2002, 2001)."

According to self-regulation theory (Carver & Scheier, 1998) it is fair to assume that decider will be motivated to invest effort in a goal commensurate to the resources required to achieve that goal. It follows from this assumption that for easy goals few resources will be invested and for achievable and more taxing goals more effort is invested. We can refer to this as an adaptive resource allocation. I like to deduce that this adaptive resource allocation "principle" is in fact mainly a System 1 principle (see Figure 3 above). This is what I like to define as "Self-Efficacy Strength" or "Mainly System 1 Self-Efficacy".

The corresponding principle would be "Self-Efficacy Level" or "Mainly System 2 Self-Efficacy" (discussed below) which I like to express as the simple principle: "*Belief meets reality through action*" which I consider to be quite close in meaning to the original definition of perceived self-

efficacy by Bandura (1977) "*an individual's belief that he or she can organize and execute the actions necessary to achieve given levels of performance*".

The importance and the relevance of the concept of perceived self-efficacy lies, particularly in the context of decision making, in its nature, that it starts with a belief, before we actually know. This is precisely what is happening in a "real decision" (a decision where the consequences of the decision will be only known "after" or "a long time after" the decision has been taken).

This aspect of not knowing or not precisely knowing is also what we find in ambiguous task situations when feedback on effort or performance is either missing or insufficient. Schmidt & DeShon (2010) defined ambiguity in their study as "*a lack of clear, objective information concerning one's true level of performance. In particular, we focus on ambiguity as one is actively engaged in task performance*".

This is what Schmidt & DeShon (2010) found in their study of seventy-three undergraduates using a computerized anagram task, in which participants formed words from groups of five or six scrambled letters: "Self-efficacy [strength] was negatively related to subsequent performance under conditions of high ambiguity but was positively related to performance when performance ambiguity was low."

Their deduction when ambiguity is low: "With sufficient efficacy, goal seekers tend to see a greater likelihood of success, thus providing a likely return on investments of time, effort, and so forth. Similarly, self-efficacy [level] is strongly and positively related to self-set goal levels (e.g., Locke & Latham, 1990), and high self-efficacy [level and strength] is thought to lead individuals to increase the difficulty of their personal goals following success (Bandura, 1997; Tolli & Schmidt, 2008).

Their reasoning when ambiguity is high: "With high ambiguity, self-efficacy [strength] is expected to be negatively related to the amount of effort invested in the task, resulting in lower performance."

What does that mean for Self-Efficacy Strength, Ambiguity and Decision Motivation?

Let me draw together the elements developed in this paper, up to now, for "Decision Motivation of mainly System 1", the part that I assume is moderated most strongly by ambiguity and that is, according to my definition, closely related to Self-efficacy Strength. The elements considered were developed above under "Temporal Motivational Theory" (TMT), Goals, Concept Belief Switch (CBS), "Mind over Muscle" and the Opportunity Belief Counter (OBC).

This leads to the unconscious or "Mainly System 1 Element" of the ME-DM equation:

$$\text{MOTIVATION}_{\text{DM SYS 1}} = \frac{\text{VALUE}_{\text{OBSERVED}} * \text{SELF- EFFICACY STRENGTH}_{\text{RATE}} * \text{CBS}}{\text{IMPULSIVENESS}_{\text{SYS 1}} * \text{DELAY} * \text{OBC} + 1}$$

Where:

MOTIVATION (DM SYS 1) = Decision Motivation, ability or preparedness of System 1 to decide under certain conditions
VALUE (OBSERVED) = externally observed decision „subject" (value, goal, concept, need, reward, object)
SELF-EFFICACY STRENGTH (RATE) = preparedness to apply a percentage of effort for VALUE (OBSERVED) i.e. the decision
IMPULSIVENESS (SYS 1) = Attractiveness of competing goals with respect to VALUE (OBSERVED)
DELAY = how long, on average, one must wait to make decision or receive the payout (i.e. VALUE (OBSERVED))
CBS = CONCEPT BELIEF SWITCH (which is either „0" or „1")
OBC = OPPORTUNITY BELIEF COUNTER (which counts the hierarchy level of belief in working memory where a low value means high priority)

Equation 5: "Mainly System 1 Element" of the ME-DM equation

By putting Equation 2 and 3 in Equation 4 you essentially get Equation 5. You will notice that I have replaced "Expectancy" from Equation 2 with "Self-efficacy Strength" (here with a mainly System 1 focus) which I believe is by definition the appropriate "expectancy equivalent" on the unconscious System 1 level.

Using the parameter of "performance" (as Schmidt & DeShon (2010) did) as an equivalent for "motivation" we can try to follow their findings by checking Equation 5 to test whether it can confirm and support their relationship found for performance to self-efficacy for varying levels of ambiguity. While decision making was not the primary focus of their study, nonetheless the computerized anagram task they used, should be close enough in general nature to be suitable for such a test. The task certainly incorporates decision making and by definition must have a considerable System 1 component.

While you might think that ambiguity or uncertainty is probably more a System 2 subject, let me show you how much it also bears on System 1 level.

a) Let me start to consider the impact of ambiguity on the "Belief-Controller", the relationship of CBS to OBC. To remind you, the question regarding the CBS is: Is there a concept that System 1 observes and believes needs to be decided (i.e. CBS is either "0" = no concept, or "1" = yes, there is a concept)? In other words: Is the goal (belief) encoded in secondary memory?

For sake of argument let us assume that there is such a concept, otherwise if there would be none, the CBS would be "0", which would also make the whole System 1 contribution to the Decision Motivation "0", i.e. the decider would not be motivated, at all, to consider the decision as one, s(he) could take.

Concerning the "Opportunity Belief Counter" (OBC) we would almost certainly get a high belief counter value (i.e. very low priority in working memory) for high ambiguity goals or decisions because less ambiguous goals would certainly be higher in hierarchy in working memory. In consequence high ambiguity produces high OBC values which in turn reduces the Decision Motivation as OBC values are in the denominator of the equation.

b) The argument of hierarchy in working and secondary memory is certainly also related to experience with the task or decision at hand. Ambiguous tasks and decisions will generally be associated with very little relevant experience for the matter. To receive dependable and precise feedback is also very unlikely in the short term as the task or decision is ambiguous or uncertain by

nature. This factor, of little relevant data available, contributes further to the likelihood that the goal stays low in priority. The longer a goal stays low in priority, the likelier it will be kicked out of working memory, resulting in a decrease of value of the goal or the decision. A "low value" goal will of course also decrease motivation or performance as VALUE (observed) is in the numerator of the equation.

c) A high OBC (i.e. low priority) with a reduced or lower VALUE (observed) will also directly impact on IMPULSIVENESS and SELF-EFFICACY STRENGTH. IMPULSIVENESS will increase, i.e. other goals become more attractive and SELF-EFFICACY STRENGTH will decrease following the principle of adaptive resource allocation for lower value goals. In consequence decision motivation is going to decrease even further when ambiguity is high.

d) If ambiguity on the other hand is low, we can apply the above arguments in the reverse direction. Low ambiguity is likely to be associated with a lower OBC value, i.e. a higher priority goal, which will lead to an increased VALUE (observed), less IMPULSIVENESS and more SELF-EFFICACY STRENGTH applied.

Note, as a first summary: The above test of Equation 5 confirms and supports the results found by Schmidt & DeShon (2010). Moreover Equation 5 shows that just considering the effect of ambiguity on task- or decision motivation, on the unconscious System 1 level, is sufficient to explain its effect on observed behavior in the study.

Self-Efficacy Level and Context (Goal Difficulty)

The paper of Beck & Schmidt (2012) deals with the subject of self-efficacy, resource allocation and goal difficulty. As indicated above, I suggest that goal difficulty is the major moderator for "Self-Efficacy Level" (see Figure 3, above).

Beck & Schmidt (2012) carried out two studies with a a stock prediction task. In study 1, with 85 undergraduates they focused on "context". They found: "The location around which self-efficacy fluctuated determined how participants responded to within-person deviations in self-efficacy. For participants with low average efficacy, an increase resulted in more time spent gathering information before making a decision. The opposite was true for participants with high average self-efficacy; when they experienced an increase in self-efficacy they decreased the time spent gathering information. The results of this study provide support for a non-linear relationship between self-efficacy and resource allocation, whereby individuals use self-efficacy to allocate the appropriate amount of time and effort (i.e., not too little, not too much) to a goal."

The rational and argument of Beck & Schmidt is very similar to (Kukla, 1972) and (Vancouver et al., 2008) see above. The function of resource allocation (read motivation) to self-efficacy that they assumed, is also non-monotonic but not discontinuous as (Vancouver et al., 2008) propose. The function that I advocate (see Figure 1, 2, 3 or 4), in a way, is a compromise or combination of the two. I suggest that there is a discontinuous function present, particularly for a task like decision making which you can consider as a "yes or no" or “all or none” scenario, as Beck & Schmidt call it. On the other hand, I contend, due to preparation time and execution time, the jump is not as instantaneous (or steep) as (Vancouver et al., 2008) submit. I suggest that it is steep but not that steep, so I am closer to Beck & Schmidt in that respect.

In a nutshell the findings of Beck & Schmidt (2012) in their study 1 and their general argument can be summarized as follows: "*In our view the studies reviewed ... [Richard et al., 2006 - Seo & Ilies, 2009 - Vancouver & Kendall, 2006 - Vancouver, Thompson, Tischner, & Putka, 2002 - Vancouver et al., 2001 - Yeo & Neal, 2006 - Schmidt & DeShon, 2009 - (with respect SCT) Bandura, 1997 - Schmidt & DeShon, 2010 - Beck & Schmidt, 2011] illustrate self-efficacy’s role in helping individuals to allocate resources efficiently. It is not adaptive to allocate resources to goals that a person feels they have no chance of achieving, nor is it adaptive to allocate too many resources to goals that can be achieved easily with minimal investment. Thus, we propose that the relationship between self-efficacy and resource allocation is non-linear. We contend that such a perspective may help explain the variable effects of self-efficacy on effort at the within-person level of analysis*."

Having discussed the general shape of the relationship between self-efficacy and resource allocation let me turn to the second study of Beck & Schmidt (2012) on goal choice and goal difficulty which I have defined as the main moderator for Self-Efficacy Level.

In study 2, with 86 undergraduates, they "*extend the underlying logic of our theoretical model by examining the impact of a situational context factor—goal difficulty. Specifically, we test the proposition that increases in self-efficacy result in greater resource allocation among those pursuing a difficult goal, but reduced resource allocation among those pursuing an easy goal. In so doing, we seek highlight self-efficacy's role in the judicious allocation of finite resources, such as time and effort—that is, attempting to allocate sufficient resources for success without squandering resources by allocating more resources than necessary or by pursuing lost causes. From this perspective, we argue that both positive and negative effects of self-efficacy on resource allocation can serve adaptive functions*."

You might have noticed that I have added square brackets, with respect to "self-efficacy", in some of the quotes (in the section on ambiguity above), because I am working with a dual process theory approach which I believe was not the focus of my colleagues. In some instances, I believe, they referred more to a System 1 aspect of "Self-Efficacy", in others more to a System 2 one, without making a distinction. Some confusion is also likely because according to my understanding, Bandura (2012) himself, sees "Self-efficacy" very much as a System 2 phenomenon. I can understand that very well, because as I like to show in the following, the lever for changes in behavior is of course mainly System 2, which in turn also allows us to affect System 1, as I also like to show.

For clarity I therefore suggest three terms: 1) (perceived) "Self-efficacy" with respect to statements referring to observable or observed behavior, 2) "Self-Efficacy Strength" (Mainly System 1 Self-Efficacy) as defined in Figure 3 and Equation 5, and 3) "Self-Efficacy Level" (Mainly System 2 Self-Efficacy) as defined in Figure 3 & 4 and in Equation 6 .

The distinction is particularly important in the context of goal setting when using a graph that refers to task difficulty and self-efficacy at the same time (see Figure 4 below).

In such a graph task difficulty reduces, as you move to the right, whereas self-efficacy increases, while moving in the same direction.

With such a graph we might incorrectly deduce that low perceived self-efficacy might allow us to deal with difficult tasks. The correct interpretation of course is that low perceived self-efficacy is experienced when a task is difficult or too difficult.

On the other hand, an easy task is experienced with high perceived self-efficacy which does not mean that we need a high perceived self-efficacy for easy tasks.

To prevent this confusion of having to operate with two quantities that increase in opposite directions (in the context of goal setting) I therefore like to consider that Self-Efficacy Level is increasing in the same direction as the goal setting is performed, i.e. from right to left or from easy to more difficult (see Figure 4 below).

With such a definition we can produce the positive and motivational statement that an increase in Self-Efficacy Level goes along with more ambitious goal setting.

(Just as an aside for completeness: Of course it would also be correct to say that increased task difficulty is experienced when perceived self-efficacy is lower(ed), but that does not make for a great motivational concept.)

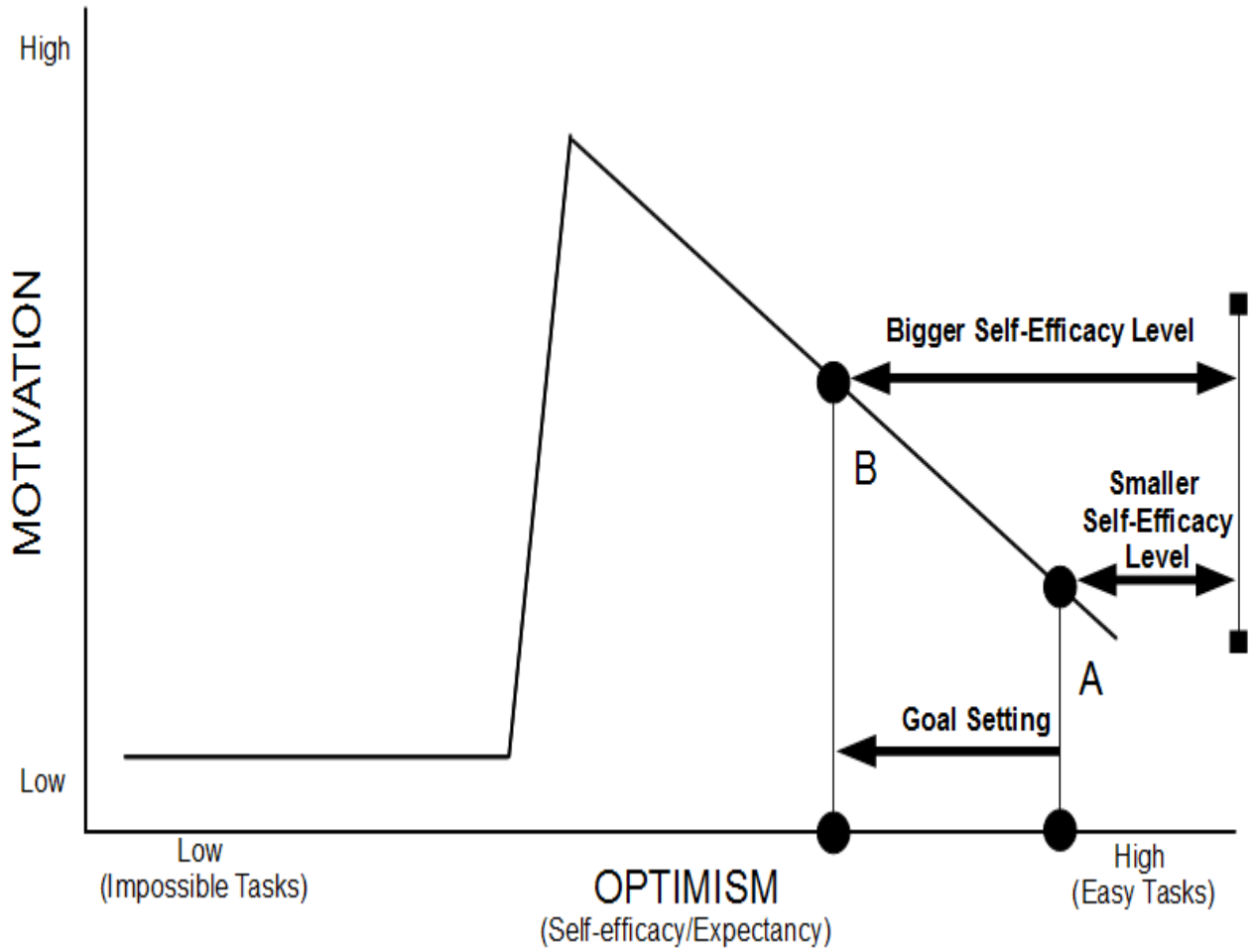


Figure 4: How (+ve) goal setting increases "Self-Efficacy Level"

This short discussion on the difficulty for our mind to consider two quantities that increase in opposite directions gives us some insight of how our mind works. Goals or variables that develop in the same direction can be easily combined whereas those that move in opposite directions pose a real challenge.

What Beck & Schmidt (2012) found in their second study on goal difficulty: "*The results of this study indicate that goal difficulty serves to determine the portion of the efficacy/resource allocation function that is most pertinent for determining resource allocation. Difficult goals appear to accentuate the importance of the upward sloping portion of the function* [left of the maximum for resource allocation],*whereas easy goals appear to accentuate the importance of the downward sloping portion of the function* [right of the maximum for resource allocation]."

What does that mean for Self-efficacy Level, Context (Goal Difficulty) and Decision Motivation?

As a reminder: In my description and development of the Integrated Model for Motivation and Self-efficacy in Decision Making (ME-DM), I set out, by taking a dual process theory perspective, to identify and describe an unconscious System 1 component of Decision Motivation which is related more to Self-efficacy Strength, and a conscious System 2 component of Decision Motivation which is more related to Self-efficacy Level.

Taking the work from Brehm and colleagues (i.e., Brehm & Self, 1989; Wright & Brehm, 1989), in conjunction with Brehm's theory conceptualizing motivation as arousal, physical studies and measurement of heart rate and systolic blood pressure (Wright, 1996) (already mentioned above), provide real and substantial physical evidence for an unconscious component active in the self-efficacy/resource allocation relationship (described by numerous studies above) allowing for a nonmonotonic and discontinuous shape similar to the one in Figure 1, 2, 3 and 4.

For the discussion on Self-efficacy Level and Decision Motivation, I like to focus now more on the conscious goal setting perspective which, by definition, is of course, very much a System 2 activity.

As I like to show, goal setting or goal choice is critical in the process of decision making, not only in the sense of content but more importantly in the sense of decision motivation, to deal with and process that decision appropriately. As Beck & Schmidt (2012) point out, key is "*Location, Location, Location*" and this refers not only to the aspect of within-person self-efficacy but also to the aspect of between-person self-efficacy (an aspect, which could be discussed in another paper.)

Below I define the "More System 2 component" of Decision Motivation, using analogous motivational theory as previously for the "More System 1 Element", in Equation 5.

$$MOTIVATION_{DM\ SYS\ 2} = \frac{VALUE_{OBSERVED} * EXPECTANCY_{RATE} * SELF\text{-}EFFICACY\ LEVEL_{RATE} * CBS}{SELF\ CONTROL\ EFFORT_{SYS\ 2} * LEAD\ TIME * OBC + 1}$$

Where:

MOTIVATION (DM SYS 2) = Decision Motivation, ability or preparedness of System 2 to decide under certain conditions
VALUE (OBSERVED) = externally observed decision „subject" (value, goal, concept, need, reward, object)
EXPECTANCY (RATE) = the assumed likelihood the decision will lead to the reward (i.e. VALUE (OBSERVED)) [in %]
SELF-EFFICACY LEVEL (RATE) = Extent to which the decider believes the goal is appropriate (i.e. the VALUE (OBSERVED)) [in %]
(or alternative for SELF-EFFICACY LEVEL (RATE) <=> SELF KNOWLEDGE or VALUE FIT → „This is me or mine" [in %]
SELF CONTROL EFFORT (SYS 2) = amount of resources allocated in terms of energy to stick with and to advance goal (i.e.VALUE (OBSERVED))
LEAD TIME = how long, on average, one must prepare and wait to make decision or receive the payout (i.e. VALUE (OBSERVED))
CBS = CONCEPT BELIEF SWITCH (which is either „0" or „1")
OBC = OPPORTUNITY BELIEF COUNTER (which counts the hierarchy level of belief in working memory where a low value means high priority)

Equation 6: "More System 2 Element" of the ME-DM equation

You will notice in Equation 6, in comparison with Equation 5, that I exchanged "Impulsiveness" with "Self Control Effort", and "Delay" with "Lead Time". They describe the same function, only that the perspective on the function is different. The perspective I have chosen here in Equation 6, is intended to be more active or deliberate, in line with the concept of self-efficacy and a more conscious System 2 focus.

Furthermore, in line with my argument and definition of "More System 2 Self-Efficacy", I replaced Self-efficacy Strength (More System 1) with Self-efficacy Level (More System 2).

As we have a conscious perspective now, I add the "neutral" term of EXPECTANCY (i.e. the assumed likelihood the decision will lead to the intended outcome), which can of course be a personal estimate, or be provided by external data.

Please note the alternative description of "SELF KNOWLEDGE" or "VALUE FIT" for Self-efficacy Level. The idea of this alternative is that goals or values are not something objective out there but something we identify with, to some extent or not. We do not only learn about these values through experience, but we also become those values. In the same way as we can state that we are the product of our decisions, we can also identify in the brain new and growing networks of neural connection that are associated with those new and repeated decisions.

For clarity and completeness let me have a look at the full ME-DM equation now:

$$MOTIVATION_{DM} = MOTIVATION_{DM\ SYS\ 1} + MOTIVATION_{DM\ SYS\ 2}$$

$$= \frac{VALUE_{OBSERVED} * SELF\text{-}EFFICACY\ STRENGTH_{RATE} * CBS}{IMPULSIVENESS_{SYS\ 1} * DELAY * OBC + 1}$$

$$+ \frac{VALUE_{OBSERVED} * EXPECTANCY_{RATE} * SELF\text{-}EFFICACY\ LEVEL_{RATE} * CBS}{SELF\ CONTROL\ EFFORT_{SYS\ 2} * LEAD\ TIME * OBC + 1}$$

Where:

MOTIVATION (DM) = Decision Motivation, ability or preparedness of decider (whole System) to decide under certain conditions
MOTIVATION (DM SYS 1) = Decision Motivation, ability or preparedness of System 1 to decide under certain conditions
MOTIVATION (DM SYS 2) = Decision Motivation, ability or preparedness of System 2 to decide under certain conditions
VALUE (OBSERVED) = externally observed decision „subject" (value, goal, concept, need, reward, object)
SELF-EFFICACY STRENGTH (RATE) = preparedness to apply a percentage of effort for VALUE (OBSERVED) i.e. the decision
IMPULSIVENESS (SYS 1) = Attractiveness of competing goals with respect to VALUE (OBSERVED)
DELAY = how long, on average, one must wait to make decision or receive the payout (i.e. VALUE (OBSERVED))
CBS = CONCEPT BELIEF SWITCH (which is either „0" or „1")
OBC = OPPORTUNITY BELIEF COUNTER (which counts the hierarchy level of belief in working memory where a low value means high priority)
EXPECTANCY (RATE) = the assumed likelihood the decision will lead to the reward (i.e. VALUE (OBSERVED)) [in %]
SELF-EFFICACY LEVEL (RATE) = Extent to which the decider believes the goal is appropriate (i.e. the VALUE (OBSERVED)) [in %]
(or alternative for SELF-EFFICACY LEVEL (RATE) <=> SELF KNOWLEDGE or VALUE FIT → „This is me or mine" [in %]
SELF CONTROL EFFORT (SYS 2) = amount of resources allocated in terms of energy to stick with and to advance goal (i.e.VALUE (OBSERVED))
LEAD TIME = how long, on average, one must prepare and wait to make decision or receive the payout (i.e. VALUE (OBSERVED))

Equation 7: ME-DM equation for dual process theory

The ME-DM equation as a guide, The Nonmonotonic and Discontinuous Model as a map

Having developed the ME-DM equation for dual process theory, and collected much evidence for the Non monotonic and Discontinuous Model, you might ask yourself what you can do with it. The ME-DM equation is structured a little bit like a book. You have the short version (the simple top-line) of Equation 7, which serves like the index to the book, and you have the content with the respective chapters, sections and notes (in the written-out or detailed form) below. Having been introduced to the theory, logic and backbone of the equation, we can now test and analyze different decision situations and challenges. The Nonmonotonic and Discontinuous Model shall serve us as the map and give orientation to identify the critical areas and turning points.

What is the purpose of this exercise?

In their 2010 paper Schmidt & DeShon state "*Unfortunately, little is known about when or why the negative self-efficacy effect may occur*." I believe with the Nonmonotonic and Discontinuous Model [When] and with the ME-DM equation for dual process theory [Why] some important and relevant answers can now be presented.

Ability to match "System 1 Self-Efficacy" with "System 2 Self-Efficacy"

For a successful decision we need the right amounts of "System 1 Self-Efficacy" and "System 2 Self-Efficacy" or, in other words, the right "Self-efficacy Strength" (More System 1) with the right "Self-efficacy Level" (More System 2). Those two principles incorporate the elements of "*assuming or believing that we can*" perform a certain task or decide something [More System 1 Self-Efficacy (Strength)], and the element of "*data maturity and validity*" or "*self-knowledge*" [More System 2 Self-Efficacy (Level)].

Key of what is right and astute, I like to contend, is the appropriate use of System 2 in connection with the fitting choice of goal or decision difficulty.

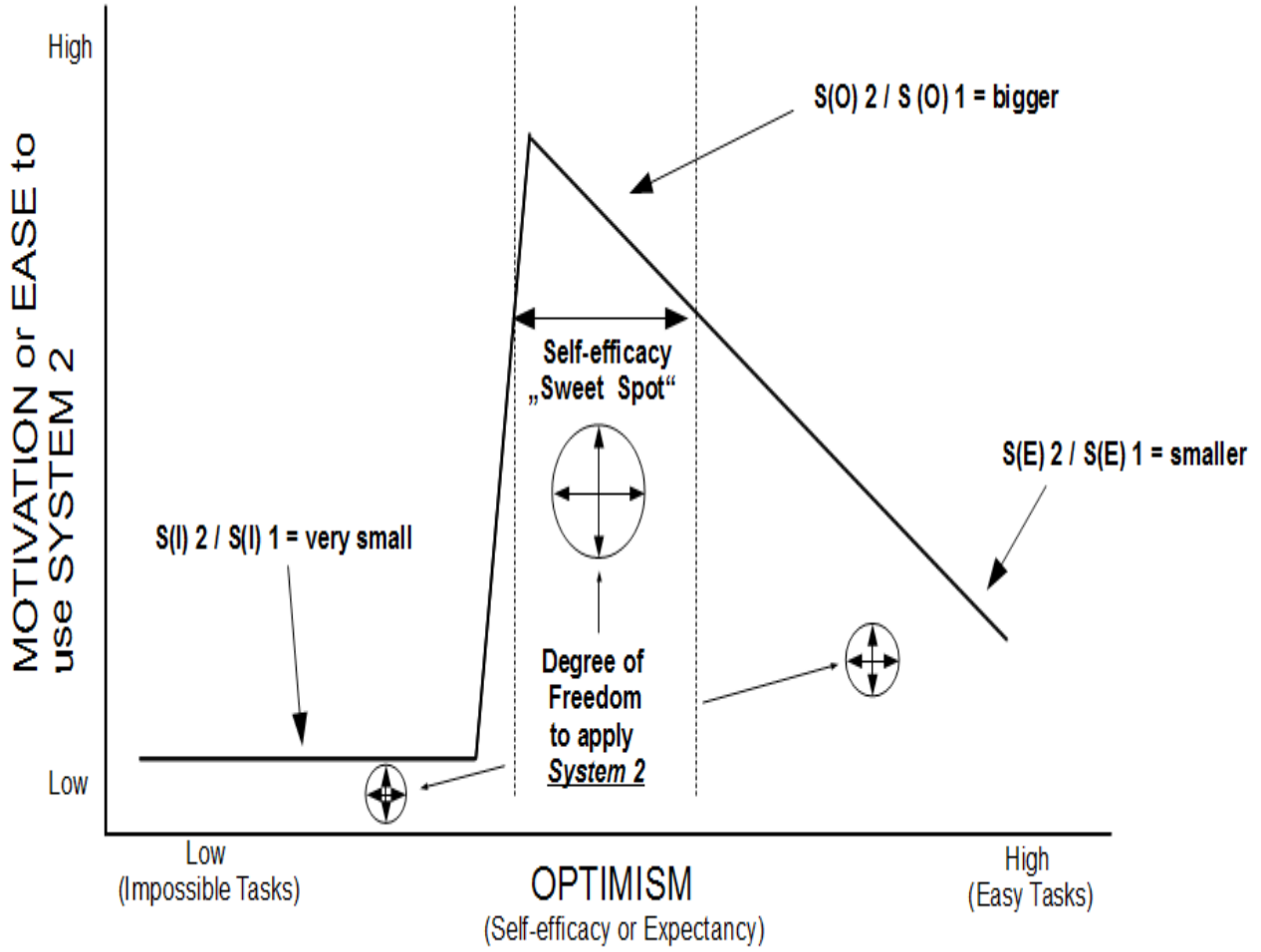
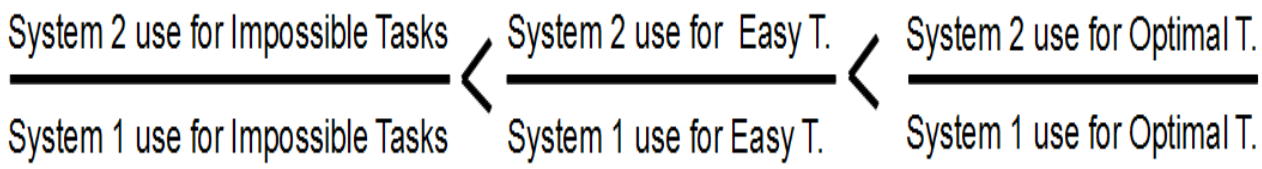


Figure 5: Ease to use System 2 with respect to perceived self-efficacy (level & strength) (Schürholz, 2017/2018) where S(I) refers to Systems use for (Impossible Tasks), S(O) to Systems use for (Optimal Tasks) and S(E) to Systems use for (Easy Tasks)

As you can see in Figure 5, I like to propose that the motivation or ease to apply System 2 in decision making is in fact mirrored by the general self-efficacy/resource allocation relationship found by (Kukla, 1972 - Brehm & Self, 1989 - Wright & Brehm, 1989 - Wright, 1996 - Vancouver et al., 2008 - Schmidt & DeShon, 2010 - Beck & Schmidt, 2012). As we have no exact way of measuring the real magnitude of System 2 Activity (for level & strength) to System 1 Activity (for level and strength) for a given situation (yet), I like to suggest that we can at least put the ratios for those activities in comparison for varying degrees of task- or decision difficulty

where these ratios:



Ratios of System 2 to System 1 for varying task difficulty

would match the theoretical model.

Goals or decisions can be impossible or easy tasks, or as I like to propose should be structured, sub-divided and/or grouped, in such a way that they pose a reasonable, realistic, moderate and yet positive challenge.

I am talking here not about any kind of decision, but about the important, irrevocable and complex ones that reach the attention of our System 2.

As you can see in Figure 5 above, I have defined a self-efficacy "sweet-spot" where the motivation and ease to use System 2 is greatest. In this area the degree of freedom to take, change or optimize your decision is also greatest. We have the largest self-efficacy strength at this point allowing us to allocate the maximum amount of resources in terms of effort, concentration and time. As tasks or decisions get easier, fewer resources of System 2 will be made available. On the other end of the spectrum where decisions are really hard to impossible, the least amount of System 2 resources are supplied, judging by results and studies that support the Nonmonotonic and Discontinuous Model.

To enter and use this self-efficacy "sweet-spot" we need to find and build contexts of low ambiguity, good feedback and moderate, yet challenging task- and decision difficulty. At this point "System 1 Self-Efficacy" and "System 2 Self-Efficacy" are optimally matched.

If the two are mismatched (i.e. high ambiguity, no or poor feedback) you will experience a less favourable relationship between decision motivation and self-efficacy. In consequence you will then either not decide at all (decision avoidance) or you will decide automatically with very little or no System 2 input. In the latter case, you might also encounter the phenomenon of *substitution* (Kahneman & Frederick, 2002), where you substitute a difficult question/decision with an easier and less relevant one, often without noticing.

To briefly summarize: The above overall picture corresponds to the conditions described and listed above by Bandura (2012) and Vancouver (2012), namely for acquisitional phases, for high ambiguity, while planning for task performance, with overconfidence or with situational constraints.

Putting everything developed up to this point to the test:

Let me analyze, in the following, three different situations of goal choice with respect to self-efficacy level (i.e. Case 1) To **left** of the sweet-spot, Case 2) **In** the sweet spot and Case 3) To the **right** of the sweet-spot) using the ME-DM equation as a guide, and the Nonmonotonic and Discontinuous Model as a map, to check the main aspects of this paper.

Three constellations of "System 1 Self-Efficacy" and "System 2 Self-Efficacy" for three different levels of decision difficulty

Case 1) Inappropriate (too ambitious) conscious (System 2) goal with **low** self-efficacy level (located left to the left of the sweet-spot)

Let us consider position A in Figure 6 below. Here we have a decider with a low or small self-efficacy level. The goal, value or decision (s)he considers is impossible for her to reach. With the chosen goal (task difficulty) at point A, (s)he will have low decision motivation ie. few resources allocated to try and reach that goal or decision. Hence (s)he will hardly try, if at all, to reach that decision or goal. With no decision and very little effort, (s)he will have no to very little feedback to judge her self-efficacy level appropriately. (S)he will display (at that point A) what is known in the literature as decision avoidance (Anderson, 2003): "Decision avoidance manifests itself as a tendency to avoid making a choice by postponing it or by seeking an easy way out that involves no

action or no change. This concept is derived from the earlier notion of a decision attitude: “the desire to make or avoid decisions, independent of any consequence that they achieve” (Beattie, Baron, Hershey, & Spranca, 1994, pp. 129– 130)."

Anderson considers four phenomena as particularly relevant to the concept of decision avoidance : 1) Status quo bias (Samuelson & Zeckhauser, 1988), 2) Omission bias (Ritov & Baron, 1992), 3) Inaction inertia (Tykocinski, Pittman, & Tuttle, 1995), 4) Choice deferral (Dhar, 1996)

The phenomenon of decision avoidance, i.e. not acting, resisting or deferring change, does not only have to occur when we face impossible tasks or decisions. It can also occur, at the other end of the spectrum, when decisions and tasks are very easy. Here the problem is not caused by a lack of ability but usually due to a lack of concentration and due too many choices that we face at the same time. I will discuss this constellation under Case 3) "Low fit" conscious (System 2) goal with high self-efficacy level.

Here under Case 1) Inappropriate (too ambitious) conscious (System 2) goal with low self-efficacy level, we do not have the "luxury problem" of too much choice. Our problem or challenge is about ability and goal-fixation. In this constellation (for an inappropriate (too ambitious) goal) deciders will insist to stick with the impossible goal. The apparent attractiveness of the chosen high value goal at point A beats opportunity and reason. Instead, it would be much better for the decider to engage in an active "ability and goal management process" and identify point B in Figure 6 as the much more appropriate goal or decision choice. Here motivation and expectancy would be considerably higher, though the individual would have to face up to the fact that the goal is less attractive and, at this moment in time, the self-efficacy level is still small.

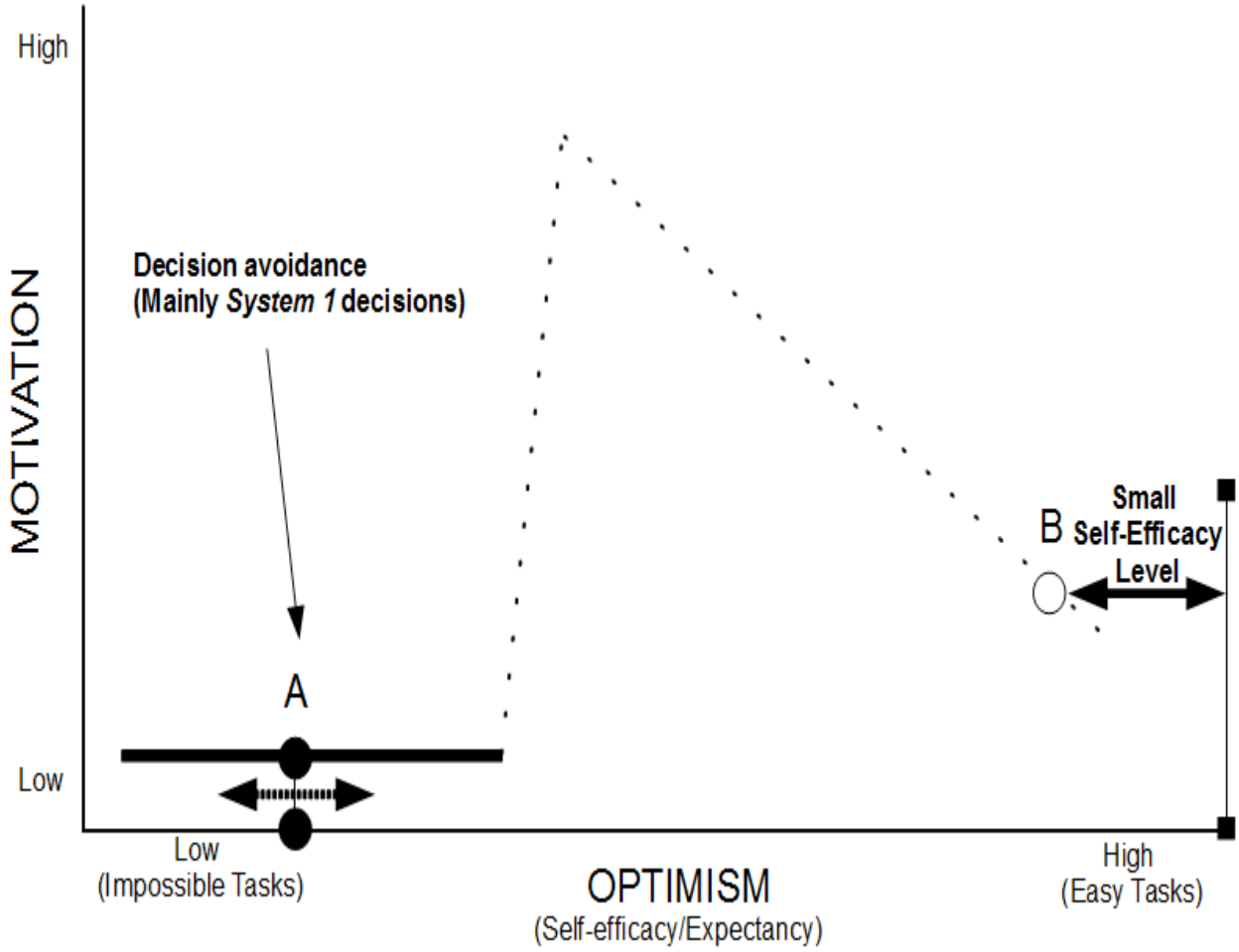


Figure 6: Low Decision Motivation, Low Effort, No Decision and No Feedback at Point A

Let me consider what the ME-DM equation would look like for an inappropriate (too ambitious) (System 2) i.e. conscious goal with low self-efficacy level at point A:

$$MOTIVATION_{DM} = \downarrow MOTIVATION_{DM\ SYS\ 1} + \downarrow MOTIVATION_{DM\ SYS\ 2}$$

$$= \frac{\uparrow VALUE_{OBSERVED} * \downarrow SELF\text{-}EFFICACY\ STRENGTH_{RATE} * CBS\downarrow}{\downarrow IMPULSIVENESS_{SYS\ 1} * DELAY\uparrow * OBC\updownarrow + 1}$$

$$+ \frac{\uparrow VALUE_{OBSERVED} * \downarrow EXPECTANCY_{RATE} * \downarrow SELF\text{-}EFFICACY\ LEVEL_{RATE} * CBS\downarrow}{\downarrow SELF\ CONTROL\ EFFORT_{SYS\ 2} * LEAD\ TIME\uparrow * OBC\updownarrow + 1}$$

Where:

MOTIVATION (DM) = Decision Motivation Total (All Systems) → very low to zero
MOTIVATION (DM SYS 1) = Decision Motivation for System 1 → very low to zero
MOTIVATION (DM SYS 2) = Decision Motivation for System 2 → very low to zero
VALUE (OBSERVED) = tends to be high for difficult goals
SELF-EFFICACY STRENGTH (RATE) = (because of high ambiguity, little to no feedback, little effort) → very low to zero
IMPULSIVENESS (SYS 1) = tends to be low for high value goal
DELAY = (mostly independent of goal difficulty, while difficult goals tend to require more delay) → constant to increasing (Choice deferral possible)
CBS = CONCEPT BELIEF SWITCH (which is either „0" or „1") for known goals „1", but for difficult, complex with anticipated negative feelings „0"
OBC = OPPORTUNITY BELIEF COUNTER (for known and priority goals → low, but for complex or low priority goals where the decider believes „I do not think it is going to happen" → high)
EXPECTANCY (RATE) = (with low SELF-EFFICACY LEVEL (RATE) and difficult goal) → very low to zero
SELF-EFFICACY LEVEL (RATE) = (here status quo and ommission bias as well inaction inertia can be active) → very low to zero
(or alternative for SELF-EFFICACY LEVEL (RATE) <=> SELF KNOWLEDGE or VALUE FIT → „This is not me or mine" → very low to zero
SELF CONTROL EFFORT (SYS 2) = tends to be low for high value goal
LEAD TIME =(mostly independent of goal difficulty, while difficult goals tend to require more lead time) → constant to increasing (Choice deferral possible)

Equation 8: ME-DM equation for inappropriate (too ambitious) or "No" conscious (System 2) goal with low self-efficacy level

Analyzing the ME-DM equation for an individual at point A (in Figure 6 above) with low self-efficacy level, shows the big ambiguity present for the decider. On the one hand, (s)he decides for a high value goal, telling herself and her environment "just wait and see" sensing and knowing though that this is not really her goal. On the other hand, "It is just not going to happen" (low priority goal -> high OBC value) and the "CONCEPT BELIEF SWITCH" (CBS) will soon switch to "0", as the decider does not really buy into the decision, and prefers to avert or reduce negative emotions of failure by not engaging. "Self-Efficacy Level" is small, so sooner or later the decider will realize that this goal or decision [VALUE (observed)] "is not me or mine". In consequence this means that from a motivational perspective it does not make a difference if the decider fixes on the "too ambitious goal" or whether the decider drops the goal in the process. The result is the same, low motivation, low effort, no decision and no feedback.

1.1) Challenge of decision making under conditions of low self-efficacy

The challenge, as indicated above, can be summarized for the decider under the heading: "Ability and goal management process". In other words work with the current limitations and develop a growth strategy.

1.2) Strategy to improve decision making under conditions of low self-efficacy

The growth strategy requires the correct identification of the current and realistic starting position. Unrealistic goals and decisions that are too complex, with important and irrevocable consequences, cannot be dealt with, with a low self-efficacy level. We are literally missing the appropriate resources to take and execute difficult decisions under these conditions. Our current resource is a low self-efficacy level, so we should match this ability level with an appropriate and easier task level, i.e. moving from point A in Figure 6, to point B. A practical way to do this is to subdivide the complex decision into smaller and discrete aspects that you can decide on. With those "smaller or easier" decisions you put yourself in a position where you have a realistic chance to overcome the motivational gate keeper of your decision process, namely the "Belief-Controller", consisting of the CBS and the OBC. Only with concepts and experiences that match your current self-efficacy level, as well as your primary and secondary memory, will you be able to proceed.

Set up a time table that allows you to deal with those sub-decisions one after the other.

Case 2) Appropriate (optimal) conscious (System 2) goal with **average** self-efficacy level (located in the sweet-spot range)

Let us reconsider the definition of Evans (2008) for dual process theory: "Almost all authors agree on a distinction between processes that are unconscious, rapid, automatic, and high capacity [System 1], and those that are conscious, slow, and deliberative [System 2]". In Figure 5, I suggested that in the "Self-Efficacy or Expectancy Sweet Spot" we have the highest ratio of System 2 decision contribution (applied knowledge, processes, considerations) and System 1 (effort, arousal and time). We are ready to apply our maximum resources, for a challenging goal that offers the chance to gain in experience and ability, with a fair chance of a successful outcome. It is the area, in which decision making is most conscious and most deliberative, but also most engaged with effort and arousal. Here with the highest degree of freedom to apply System 2, we also face the biggest challenge of striking the right balance (see Figure 7, point A) between the System 1 and the System 2 contributions, between chances and risks, and between gaining knowledge, and experience versus “using tried and tested”.

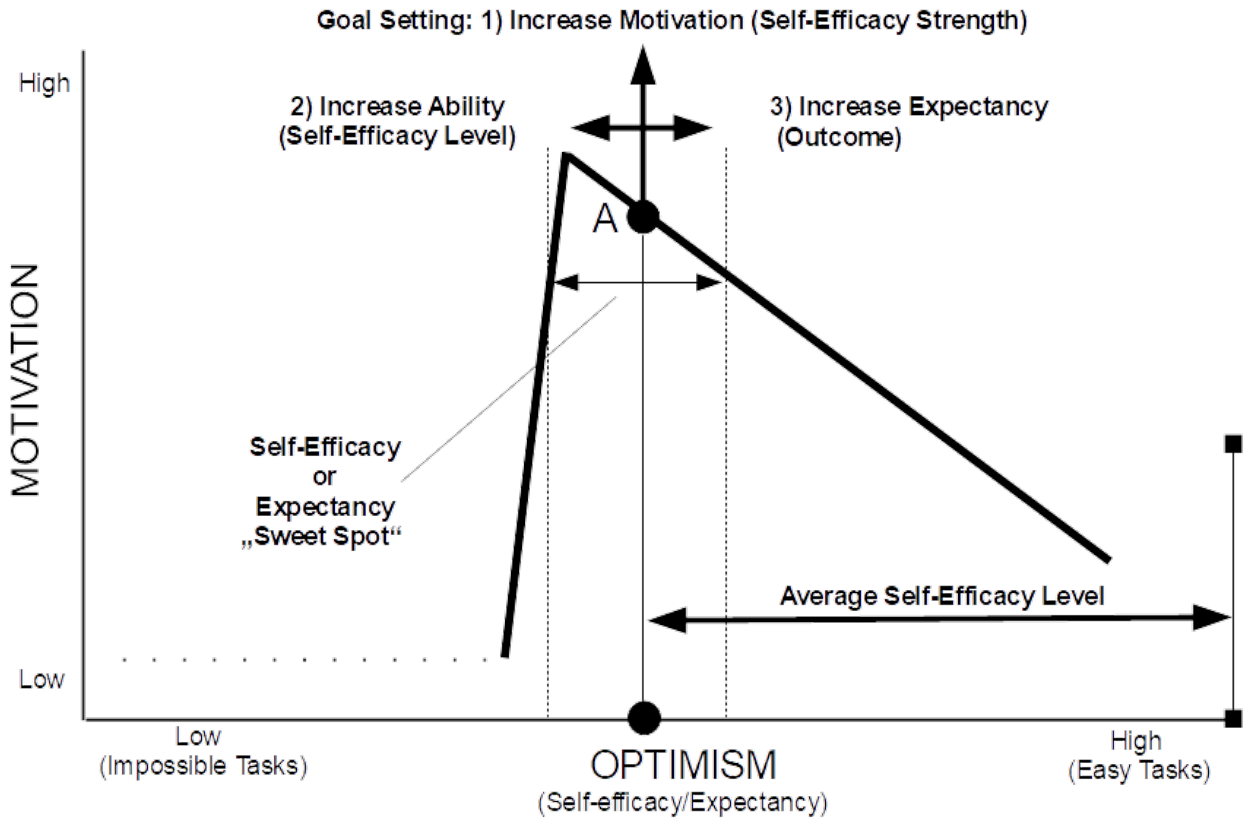


Figure 7: Appropriate (optimal) conscious (System 2) goal with average self-efficacy level

Under Case 1) "Inappropriate (too ambitious) conscious (System 2) goal with **low** self-efficacy level", an "*ability and goal management process*" was necessary to improve outcomes.

Here now under Case 2) with an **average** self-efficacy level, "*Balancing and managing the System 1 and System 2 contributions best*" is key for an optimal result.

Let us look at this aspect in more detail in the ME-DM equation:

$$MOTIVATION_{DM} = \uparrow MOTIVATION_{DM\ SYS\ 1} + \uparrow MOTIVATION_{DM\ SYS\ 2}$$

$$= \frac{\bullet VALUE_{OBSERVED} * \uparrow SELF\text{-}EFFICACY\ STRENGTH_{RATE} * CBS\uparrow}{\uparrow \bullet IMPULSIVENESS_{SYS\ 1} * DELAY\downarrow * OBC\downarrow + 1}$$

$$+ \frac{\bullet VALUE_{OBSERVED} * \uparrow EXPECTANCY_{RATE} * \uparrow \bullet SELF\text{-}EFFICACY\ LEVEL_{RATE} * CBS\uparrow}{\uparrow \bullet SELF\ CONTROL\ EFFORT_{SYS\ 2} * LEAD\ TIME\downarrow * OBC\downarrow + 1}$$

Where:

MOTIVATION (DM) = Decision Motivation Total (All Systems) → high to maximum (depending on chosen value of decision difficulty)
MOTIVATION (DM SYS 1) = Decision Motivation for System 1 → high to maximum (depending on chosen value of decision difficulty)
MOTIVATION (DM SYS 2) = Decision Motivation for System 2 → high to maximum (depending on chosen value of decision difficulty)
VALUE (OBSERVED) = average denoted with „•", for average decision difficulty
SELF-EFFICACY STRENGTH (RATE) = (big effort, maximum feedback) → high
IMPULSIVENESS (SYS 1) = tends to be average to increasing (depending on decision difficulty)
DELAY = tends to zero as process is applied with big effort at that moment
CBS = CONCEPT BELIEF SWITCH likely to be „1", because of big effort
OBC = OPPORTUNITY BELIEF COUNTER likely to be low, i.e. High priority because of big effort
EXPECTANCY (RATE) = fairly high
SELF-EFFICACY LEVEL (RATE) = changing between average and maximum (depending on feedback and decision difficulty)
(or alternative for SELF-EFFICACY LEVEL (RATE) <=> SELF KNOWLEDGE or VALUE FIT → „This is me or mine" → changing between average and maximum (depending on feedback and decision difficulty)
SELF CONTROL EFFORT (SYS 2) = tends to be average to increasing (depending on decision difficulty)
LEAD TIME = tends to zero as process is applied with big effort at that moment

Equation 9: ME-DM equation for appropriate (optimal) conscious (System 2) goal with average self-efficacy level

Comparing the ME-DM equation 9 with 8 you will note a number of changes that allowed the decider to move into the *self-efficacy* or *expectancy sweet-spot* at point A in Figure 7 . First of all, by applying the growth strategy in 1.2, the decider managed to overcome the "Belief-Controller" which switched the Decision Motivation of System 1 and System 2 on. With an average, yet optimal goal or decision difficulty, the self-efficacy strength rises to high resulting in big decision effort and maximum process feedback. Not only System 1 is working with full power in this state. "Self-Efficacy Level" (with a System 2 focus) is perfectly matched with a goal difficulty that it can **just reach**. Operating near or close to the point of maximum decision motivation, there is still some room for improvement and positive goal setting.

2.1) Challenge of decision making under conditions of average self-efficacy

Again we face a challenge in this particular decision situation, this time with average self-efficacy that I like to set into the context of: "Balance management". In other words having to focus on what we need more and what we need less.

2.2) Strategy to improve decision making under conditions of average self-efficacy

Finding the right balance is a matter of feedback and trial & error. Based on our current self-efficacy level, we constantly try increase our decision knowledge and decision ability. We have to find out what we know and what we do not know about our decision. Ideally through an incremental testing process, like *decision timing* (Schürholz, 2017). Key for the success of such a process is that decision motivation is high, which is accomplished by the decider through the appropriate choice of a relevant, important and reachable goal. In this case strategy 1.2 and 2.2 link up.

Case 3) "Automatic" or "low fit/untested" conscious (System 2) decision with **high** self-efficacy level (located to the right of the sweet-spot)

With increasing self-efficacy level, we have a tendency to go for quantity and speed, rather than quality and patience, if there is no attractive goal that we can focus on. As far as decision making and a high self-efficacy level goes, we tend to pride ourself of being able to deal with many decisions at the same time, with as little effort as possible. We try to squeeze more and more decisions, in less and less time. While this "automation process" works for simple and easy decisions, it does not, for complex, very important and irrevocable decisions.

For those, we need System 2 to intervene, and to start to reduce choice, to be able to focus again, on a small number of decisions that really matter.

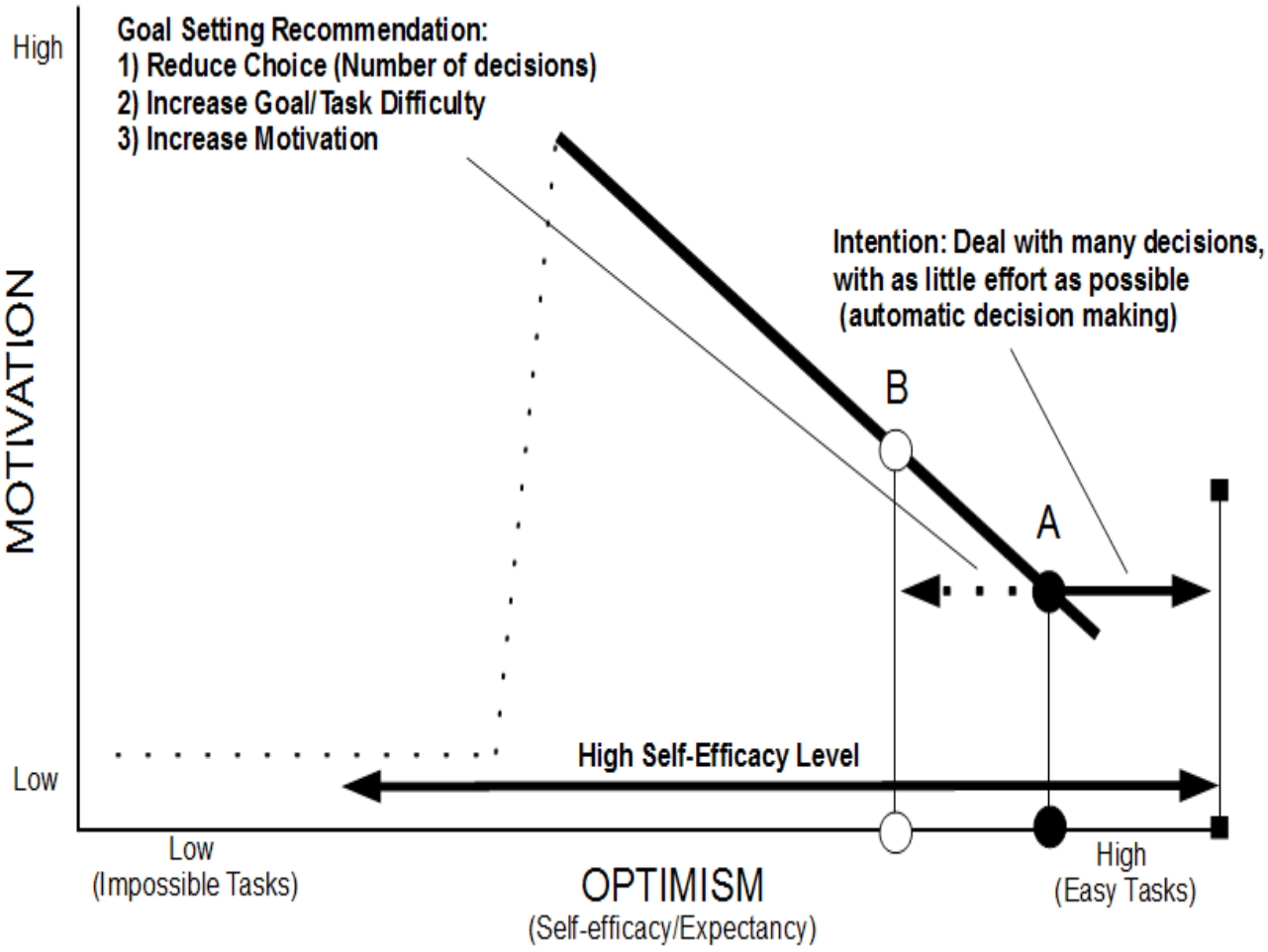


Figure 8: "Automatic" or "low fit/untested" conscious (System 2) goal with high self-efficacy level

Let me have a look at the ME-DM equation for high self-efficacy level, if we do **not** reduce the number of decisions (reference point A in Figure 8):

$$MOTIVATION_{DM} = MOTIVATION_{DM\ SYS\ 1} + MOTIVATION_{DM\ SYS\ 2}$$

$$= \frac{VALUE_{OBSERVED} * SELF\text{-}EFFICACY\ STRENGTH_{RATE} * CBS}{IMPULSIVENESS_{SYS\ 1} * DELAY * OBC + 1}$$

$$+ \frac{VALUE_{OBSERVED} * EXPECTANCY_{RATE} * SELF\text{-}EFFICACY\ LEVEL_{RATE} * CBS}{SELF\ CONTROL\ EFFORT_{SYS\ 2} * LEAD\ TIME * OBC + 1}$$

Where:

MOTIVATION (DM) = Decision Motivation Total (All Systems) → average to low
MOTIVATION (DM SYS 1) = Decision Motivation for System 1 → average to low
MOTIVATION (DM SYS 2) = Decision Motivation for System 2 → low
VALUE (OBSERVED) = low decision difficulty
SELF-EFFICACY STRENGTH (RATE) = (average to low effort, average feedback) → average to low
IMPULSIVENESS (SYS 1) = tends to be high for easy decisions
DELAY = tends to zero as process is applied at that moment
CBS = CONCEPT BELIEF SWITCH likely to be „1", because of average effort (moderated by System 1), but „1" or „0" (moderated by System 2)
OBC = OPPORTUNITY BELIEF COUNTER likely to be average to high, i.e. average to low priority because of average to low effort
EXPECTANCY (RATE) = high
SELF-EFFICACY LEVEL (RATE) = is assumed high but worth little with low decision difficulty and low degree of application
(or alternative for SELF-EFFICACY LEVEL (RATE) <=> SELF KNOWLEDGE or VALUE FIT → „No idea if this is me or mine" → is assumed high but worth little with low decision difficulty and low degree of application
SELF CONTROL EFFORT (SYS 2) = needs to be high for easy tasks and decisions
LEAD TIME = tends to be higher as System 2 is not processed or processed later

Equation 10 : ME-DM equation for "Automatic" or "low fit/untested" conscious (System 2) goal with high self-efficacy level

From a System 2 perspective, the high self-efficacy level is basically wasted. IMPULSIVENESS and SELF CONTROL EFFORT is high without achieving anything of real value for System 2. With a low decision difficulty (or value), few resources are allocated for decision making leading to automatic, repetitive and sub-optimal decisions. What served well in the past is assumed to apply in the present. The decider tends to become subject to all kinds of biases (Tversky & Kahneman, 1974 - Baumeister, 2003 - Ariely, 2008).

3.1) Challenge of decision making under conditions of high self-efficacy level

I introduced this article with the statement by Klein (2009), when he refers to "the human-as-hazard model... [and] ...the human-as-hero model". The two models appear to refer very much to

the range of perceived high self-efficacy level denoted by point A in Figure 8, where we potentially expect the most skillful and intuitive decisions (by making very good use of skills), as well as the most disastrous (by making no use of skills).

Kahneman & Klein (2009) define it, as the range of "boundary conditions that separate true intuitive skill from overconfident and biased impressions". The range also relates and is very much connected with our ability to recognize patterns or to make judgments based on an adaptive unconscious (Wilson, 2002).

This is all well and good, and the power and capacity of our System 1 is truly phenomenal, but it is also mystified to the point of being misleading for decision makers.

Malcom Gladwell (2005) in his #1 National Bestseller "Blink: The Power of Thinking Without Thinking" exaggerated the point a little, I believe. Many readers believe, after having read the book, that intuition (Thinking Without Thinking) is so important, that they can easily decide important things without conscious deliberation. You cannot fault the readers for thinking that, as there is a whole school, as mentioned above, "Naturalistic Decision Making Approach" (NDM) (deGroot, 1946/1978 - Chase & Simon, 1973) that can be interpreted that way too.

I am not trying to imply that Gladwell in Blink and NDM are actually making that claim for every decision maker. Many of their examples, related to the adaptive unconscious and NDM, are actually attributed to experts only (chess champions, scientists, firemen, doctors, pilots etc.).

This point is frequently overlooked by the general reader. Also overlooked, is often the fact, that many of the examples deal in fact with high value, i.e. important or difficult decisions like landing a plane with many passengers or deciding how to tackle a big fire.

Here, we are in fact looking at experts, with high self-efficacy level, who are applying their "true intuitive skill", not at point A in Figure 9 (see below), but at point B. This distinction is very important because it leads to another very common misunderstanding.

As "Blink" suggests, the decision or judgment might be taken without a System 2 contribution (Thinking Without Thinking). This of course is not true. As long as the decider has any concept (CBS=1) of what is going on, or what needs to be decided, there is always a System 2 contribution.

Of course in terms of actual data rate, the contribution of System 2 relative to System 1 might not be very large "...with an estimated 40 pieces a second by the conscious mind... [compared to] ... the 11,000,000 pieces of information per second processed by the unconscious mind" (Wilson, 2002), it still matters a great deal.

So it is not the size of the System 2 contribution that matters most, but the type of contribution. In fact, System 2 contribution can have a kind of override function (Evans 2006, Klaczynski & Lavallee 2005, Stanovich 1999). To use the words of Kahneman “System 2 takes over when things get difficult, and it normally has the last word” (Kahneman, 2011) with respect to System 1.

In consequence the impact of System 2 can be (as in this example) that the whole system (or the real decider) has in fact moved from point A to point B in Figure 9, with a respective increase in arousal, decision motivation and allocated resources, to make that decision.

If you look closer at Figure 9, you will in fact notice that at point B, you are actually taking a decision that is more "intuitive" (higher System 1 contribution) than at point A.

Most people would, probably mistakenly, class a decision at point A, as more intuitive, than at point B, because it is easier and has less S2 (System 2), i.e. conscious contribution.

If you think about it, this is not true in dual process theory. It is not a question of either System 1 or System 2 being active, i.e. excluding the activity of one, while the other is active. Both are active and are communicating all the time, and both are most active, as I like to suggest at point B, which is situated nicely at the "self-efficacy or expectancy sweet-spot".

Here you get the "Real-Blink", as I like to contend, with the "most intuitive decision", based on the highest System 1 contribution. Of course it would also be fair to say, that at point B, you are also taking the "most rational decision".

I believe, both descriptions are correct, and just as valid.

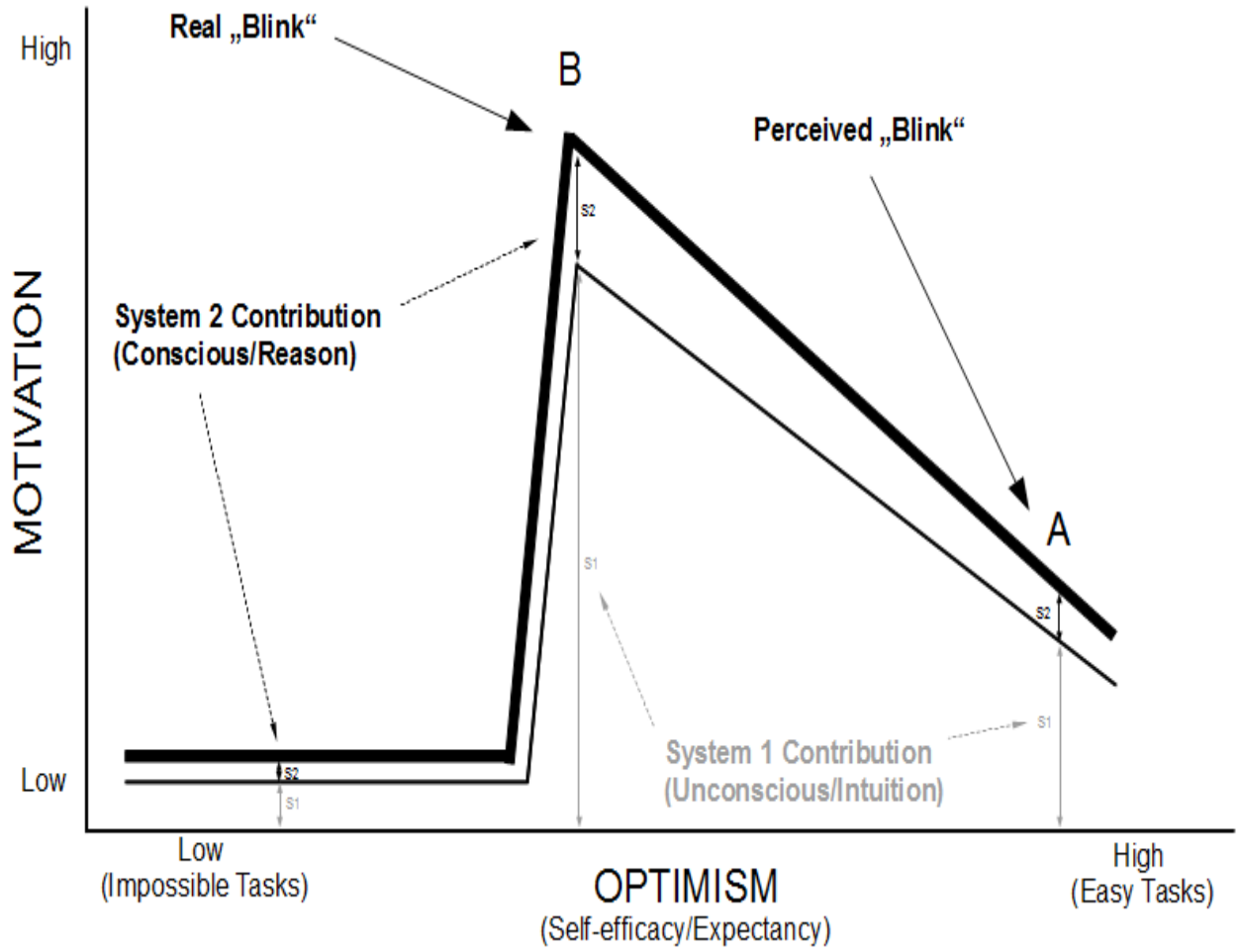


Figure 9: Perceived "Blink" versus Real "Blink" (Schürholz, 2017/2018)

3.2) Strategy to improve decision making under conditions of high self-efficacy

The point that is most important for me to get across, is that under conditions of high self-efficacy, the aspect of goal setting or choosing the appropriate task or decision difficulty, is still led by System 2. Put another way, intuition (System 1) is, to some extent, always guided by System 2. Without the effective "executive role" of System 2, the decider probably operates at point A in Figure 8 (similar to A in Figure 9), trying to deal with as many decisions at the same time, with as little effort, as possible. If that is the case, I suggest a change of strategy and the setting of higher and more difficult goals or decisions.

Only by decreasing the number of (important) decisions, taken at the same time, is the decider able to attempt and set more difficult decision tasks. This strategy increases the motivation and resources available, to tackle fewer, but more difficult decisions, more successfully. It also decreases and moderates the impact of the phenomenon of decision fatigue or ego-depletion (Baumeister et al., 1998 - Muraven & Baumeister, 2000) an effect that arises when taking many decisions in a short period of time.

Learning new decisions and learning new beliefs

As a last topic in this paper, I like to consider the aspects of learning and trying new decisions. Learning can in fact take place at all points of the spectrum from impossible to easy decisions or tasks. It is important to note though, that the effectiveness and efficiency of learning, will of course vary, depending on your chosen subjective goal or decision difficulty.

We can even learn when we are operating in the area that I have termed "Decision Avoidance" (see Figure 6 above). There we can save resources through the phenomena of status quo bias, omission bias, inaction inertia or choice deferral. We can just wait and take advantage of low arousal, low

impulsiveness and low self control effort. Let us assume that at that point, the CBS is switched off i.e. "0". The system is set to idle. Now learning can start. System 1 and System 2, can respectively begin to scan the incoming "VALUEs (observed)". The scanning takes the form of comparing incoming data with data stored in memory. The "Concept Belief Switch" (CBS), as introduced above, can be independently moderated and switched (see also Equation 10), by "Self-Efficacy Strength" (largely System 1, “I believe I can” or “I believe I want”) and "Self-Efficacy Level" (largely System 2, “I believe this is me or mine”). Both Systems 1 and 2 keep scanning and finally move into decision mode, when the CBS is switched to "1". When one CBS is “1”, either System 1 or System 2 has recognized a concept that it sees as valid or desirable.

It is at this point, where not only decision making starts, but also, where real learning can begin, as I like to contend.

Particularly "conscious learning" (System 2 learning) is here of prime or executive importance, as the "Self-Efficacy Level" sets the task or goal difficulty ideally to such a value that "Self-Efficacy Level" is maximum, i.e. the "Self-Efficacy Level" is just reaching the chosen task or decision difficulty (see point B in Figure 6 and point A in Figure 7).

Only under these conditions, is optimal learning and optimal decision making (for important decisions) taking place. Less learning is taking place when the chosen goal is "smaller" than the "Self-Efficacy Level" (see point A and B in Figure 8). Hardly any learning, is taking place when only one of the CBSs is switched "on" and "Impulsiveness" and "Self Control Effort" are low. Only when "Impulsiveness" and "Self Control Effort" start to rise, is learning possible and both CBS switches are likely to overcome their threshold value.

In what other ways are "Impulsiveness" or "Self Control Effort" important in learning?

The way new decisions are taken and new beliefs are learned, is based on the principle that more intense (more motivated, higher arousal) learning and decision making overwrites less intense (less motivated, lower arousal). In that way creating or experiencing new situations, due to say “Impulsiveness”, that are more intense (more motivated, higher arousal), will change the way we see the world and consequently how we react to it.

The nature and direction of our reaction will depend on our ability to set ourselves achievable goals to deal with this new situation.

"T*oo ambitious goals or decisions*" will make us freeze or withdraw. “*Too easy goals or decisions*” will lead to stagnation. “*Positive and achievable goals and decisions”* will make us act, advance and grow.

Conclusion and Summary of the "Integrated model for motivation, self-efficacy and decision making"

Decision making and learning, in my understanding, have a number of things in common. It is fair to assume that they use the same processes, and are connected in the way data is stored and retrieved in our brain. They turn situations of uncertainty and belief into certainty and knowing. They transform intention and motivation, into changes of: what we do, who we are and who we will become.

In our development from the simple multicellular organism into the modern homo sapiens sapiens, that we are today, every decision counted and made us who we are now. What we know about ourselves and how we can change, who we like to be, is intrinsically connected to the way we make decisions.

The (ME-DM) model, presented in this paper, contends that a nonmonotonic and discontinuous function best represents the relationship of “motivation and self-efficacy in decision making”.

It suggests that there is an optimal range of self-efficacy level (System 2 Focus) and self-efficacy strength (System 1 Focus), where optimal learning and optimal decision making, for important and irrevocable decisions, is most promising.

To reach, and stay, in this optimal range of self-efficacy appears to require a "strong ego" and an "intelligent and critical" System 2, that chooses its goals wisely.

In the last 70 years, the field of Judgment and Decision Making (JDM) has developed two schools "Heuristics and Biases Approach" (HB) (Meehl, 1954 - Tversky & Kahneman, 1971) and "Naturalistic Decision Making Approach" (NDM) (deGroot, 1946/1978 - Chase & Simon, 1973).

Both schools seem to have focused on different aspects of what we consider today, *dual process theory* (Evans, 2008). NDM focusing more on System 1, and HB more on System 2.

Following the argument of the paper presented here, with the integrated model for motivation and self-efficacy in decision making (ME-DM), I like to suggest, that possibly, the area of interest that is probably most promising for both schools, is now in fact the same.

It lies, as I like to contend, right in the center of the range of task and decision difficulty, at point B, in Figure 9 (above).

In most areas of our life, we believe an abundance of positive qualities and opportunity is generally good. More skill, more knowledge, more information, more favorable opportunity leads to better outcomes. The above model and research on goal theory and motivation show that this is not generally true. Easier or more is not always better.

The optimum, as so often, lies, as the ME-DM model suggests, in the middle.

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