Chapter 16

Variation and Selection in Psychopathology and Psychotherapy:

The Example of Psychological Inflexibility

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Why do human being suffer amidst plenty? We can understand the suffering of those who face deprivation or war, but that hardly explains the increase of mental and behavioral health challenges in the developed world. Thirty years ago, depression was the fourth leading cause of disability and disease worldwide after respiratory infections, diarrheal illnesses, and prenatal conditions. Twenty years ago, it was the third leading cause. Ten years ago it became the second (Ferrari et al., 2013).

There are many statistics like that and they can easily tempt us into the details. For example, we might dive into what depression is, and generate ideas about why it might be increasing. But depression is only a small part of the picture. The next strand would then have to be picked up (perhaps chronic pain, addiction, or anxiety) and treated in the same way. As behavioral causes for the many faces of poor mental and behavioral health were examined one at a time, we would almost certainly lose the big picture. We would lose the original question. Why do human being suffer amidst plenty?

One way to proceed with a big question of that kind is to focus on well-researched processes that are known to lead to poor mental outcomes in many different areas. We can then consider why this process is toxic and what is known about how to change it. The advantage of such a strategy is that it turns the big question into one with an empirical focus, but without losing track of the big picture.

In this short essay we will briefly examine psychological inflexibility (Hayes, Luoma, Bond, Masuda, & Lillis, 2006) and its subcomponents and will consider why it is problematic and how it can be changed. Having established an example of knowledge in contextual behavioral science we will then examine how the components of psychological inflexibility deal with variation and selection, and how contextual behavior science fits with modern evolution science, before turning back to our original big question.

Psychological Inflexibility

Psychological inflexibility constitutes one of the more studied psychological processes. If you enter "psychological inflexibility" and its various specific sub-processes into search engines such as the Web of Science, several hundred studies will appear. In its positive form, psychological flexibility refers generally to being open, aware and actively engaged. On the opposite, psychological inflexibility corresponds to interacting with the world in a way that is psychologically closed, mindless, disconnected, and often functionally repetitive.

Psychological inflexibility is arguably one of the more toxic psychological process known, as defined by its breadth and magnitude of impact, and its tendency to mediate or moderate other psychological processes known to be problematic (Chawla & Ostafin, 2007). High quality longitudinal and experience sampling studies show that psychological inflexibility predicts the development and elaboration of psychological distress, over and above baseline levels (e.g., Kashdan, Barrios, Forsyth, & Steger, 2006; Spinhoven, Drost, de Rooij, van Hemert, & Penninx, 2014). Cross-sectional (e.g., Bond et al., 2011), and

meditational studies (e.g., Fledderus, Bohlmeijer, & Pieterse, 2010) point in the same direction.

It is an odd empirical fact: when emotions and thoughts are avoided (Abramowitz, Tolin, & Street, 2001), or are treated as literally true (Gillanders et al., 2014), their frequency or intensity tends to increase, leading to still more escape, avoidance, and belief. Each of the six subcomponents of psychological inflexibility (experiential avoidance, cognitive fusion, inflexible attention to the past and future, dominance of the conceptualized self, deficits in valuing, and the inability to make and keep behavioral commitments) have this same basic pattern: they tend to foster a self-amplifying loop in which the output of a process is the input to that same process (see Hayes, Sanford, & Feeney, 2015).

Psychological inflexibility can, however, be changed and when it is these negative trajectories turn positive. Although a number of methods alter psychological inflexibility, Acceptance and Commitment Therapy (ACT: Hayes, Strosahl, & Wilson, 2012) is an intervention method that is consciously based on psychological inflexibility as its core target for change. As an example consider the inflexibility process of "cognitive fusion", the tendency for verbal rules to dominate over other sources of behavioral regulation. ACT targets this process using "cognitive defusion" methods that are designed to reduce the behavioral impact of difficult self-statements. One such method is word repetition (Masuda, Hayes, Sackett, & Twohig, 2004) in which challenging thoughts are distilled down to a single word, that is then repeated over and over for about 30 seconds until it loses all meaning. Another such method is silly voices (Eilers & Hayes, 2015) in which difficult thoughts are repeated aloud in the voice of cartoon characters or least-favored politicians. As another example, ACT targets weaknesses in values clarity by helping people explore chosen qualities of being an doing, an intervention process that alone changes a wide varieties of action (Chase, Houmanfar, Hayes, Ward, Vilardaga, & Follette, 2013). Over 170 randomized trials

and over 50 mediational studies (https://contextualscience.org/state_of_the_act_evidence) show that ACT is helpful across a wide range of mental and behavioral health problems, and is helpful because it alters psychological inflexibility.

Psychopathology as a loss in functional behavioral variability

From a Contextual Behavioral Science point of view, we can think of a psychological organism as a group populated by many different individual behaviors and "species" of behaviors, all interacting altogether and with their environment. These behaviors vary and are selected within the lifetime of the organism by means of learning processes, such as operant and classical conditioning, that allow for ontogenetic adaptation. They are passed across generations by such processes as social learning, cultural evolution, niche construction, and genetic assimilation.

Evolution writ large depends on variation and selective retention (Campbell, 1960). Intentional evolution requires the application of these evolutionary processes in the right context, on the right dimension, and at the right level of selection (Wilson, Hayes, Biglan, & Embry, 2014). Given the extensive body of evidence on psychological inflexibility as a behavioral pathogen, and on positive outcomes when inflexibility is changed, it seems worth examining these six evolutionary processes (variation, selection, retention, in context, and with the right dimension and level) when considering the development and change of behavior. Given the shortness of the present essay, we will focus most heavily on variation and selection, while just mentioning the other four processes (see Hayes, Monestès, & Wilson, in press)

Variation needs to be thought of both in a functional and a formal sense. Actions are defined functionally when we focus on how they transition the organism from a given antecedent state of affairs to a given consequential condition. For example, actions that lead to

successful prey capture, successful mating, and the construction of favorable environments for child rearing, are functionally distinct.

Formal variability in behavior is a matter of having many or few behavioral topographies given functional type. For example, if I know many routes to the store I can get there easily by changing directions if a particular road is blocked. If I know only one route, I will not be certain to get there is the same thing happens.

Psychopathology can result from either formal or functional behavioral rigidity (or both). When change is necessary, those with both greater formal and functional diversity of behaviors are more likely to change and adapt.

Contingency learning can both increase and decrease behavior variability, depending on the type of variability being considered. Operant learning increases entire classes of formal behavioral variations, all serving a common function. For example, if a young bird sees other birds removing the tops off milk bottles, the bottle top may acquire the function of a food source, but trial and error learning may establish the particular forms of action that remove the top (Sherry & Galef, 1984). Learning allows the exploration of the environment resulting in the selection of environmental niches, which in turn changes the contacted contingencies that establish new behaviors (i.e. functionally different) through reinforcement. When a behavior alters the physical, behavioral, social, or cultural niche in which it takes place, a positive behavioral loop (Monestès, 2016) can be established that further increases functional variation. Thus, learning can increase both formal and functional variation.

But learning can also under some conditions *narrow* behavioral variability. If one set of antecedents or consequences dominates over others, reduction in functional variability may crowd out other behavior types.. For example, a person addicted to a drug may become disinterested in his family, or sex, or educational pursuits as the proportion of his day functionally linked to the drug increases. In this case, functional variation is narrowed. If

access to the drug is cut off, enormous *formal* variability may be seen -- doctor shopping, criminal activity, conning family members – but they are all in the service of a given functional behavioral species: the addiction itself. In this case, formal variation increased, but functional variation remained low.

Thus, each individual's behavioral repertoire can present with high or low levels of formal and functional variation. Table 1 presents the different cases of high and low formal and functional levels of variation and their common adaptive or problematic (i.e., psychopathological) outcomes.

FUNCTIONAL VARIATION

	LOW LEVEL	**HIGH LEVEL**
FORMAL VARIATION **LOW LEVEL**	STEREOTYPY	CREATIVE SYMBOLISM
HIGH LEVEL	UNPRODUCTIVE EXPLORATION (INFLEXIBILITY)	ADAPTIVE EXPLORATION

Table 1: Outcomes of interactions between high and low levels of functional and formal variations

At one extreme, formal and functional variation are at a high level, which is common in the normal exploration of the environment that results in discovering adaptive ways of behaving or of maintaining adaptation to the environment. Functional and formal variations can also evolve in opposite directions. While functional variation is uncommon at a low level of formal variation, it is nonetheless possible at least for humans, via creative symbolism, that is, via the attribution of different meanings to different occurrences of the same behavior. For example, eating an egg can be to increase access to nutrition or to curry favor with the goddess Ēostre.

It is our argument that psychopathological issues correspond most closely to low levels of functional variation. One case corresponds to the minimal formal variation and low functional variation, what we are calling here stereotypical behaviors, such as what can be observed in autism. Indeed, repetitive behaviors of people with autistic spectrum disorders tend to correlate with the severity of the disorder (Mirenda et al., 2010), notably because they represent obstacles to adaptive behaviors. The other case of psychological issues corresponds to high levels of formal variation with minimal functional variation, what we are calling here "inflexibility". This corresponds to an unproductive exploration of the environment in search of the same consequences. We already used the example of drug addiction but another example would be attempting to avoid difficult emotions. When one feels anxious for example, anxiety disordered clients commonly try a wide variety of formally different behaviors to reach a single desired function – getting rid of the anxiety. From the outside the behavior looks extremely variable – such as avoiding giving a talk, drinking alcohol before social events , or running 10 miles per day to down-regulate arousal – but it is in fact highly invariant in a functional sense. Many forms of psychopathology appear to be characterized by engagement of myriad ways that a specific but unhelpful function can be achieved.

Language as the main source of functional variation loss in humans

Why would human psychology be readily dominated by relatively rigid forms of behavior even in relatively successful economic and social situations? One possibility is that characteristic forms of human language and cognition are central to both of these results. Said in another way, our greatest success evolutionarily speaking is our greatest weakness.

Human language and cognition can enormously impact the formal variation of behavior: it can increase it or decrease it. For example, the simple instruction "never tell the same joke twice" might lead to a virtually endless string of different behavioral forms, each

with a broadly similar function (i.e. making people laugh). Conversely, with a compliant child, the instruction "don't ever go out into the street without an adult" could virtually eliminate that topography from their repertoire, even for situations where it could be adapted (house on fire for example). Underlying relational learning processes account for this effect. There is considerable evidence that human language and cognition are relational, not associative (Hayes, Barnes-Holmes, & Roche, 2001). The ability to derive relationships regardless of the form of related events begins with the mutual entailment of an object → name relation, such that when object gives rise to characteristic signs, those signs will often lead to provision of the object by derivation (and vice versa). This likely first emerged as a cooperative social process (for that analysis see Hayes & Sanford, 2014), but it rapidly extended to relational (that is, symbolic) networks based on a wide variety of different types of relationships (difference, opposition, comparison, hierarchy, causality, and so on). This view is explored in Chapter 4 of the current volume.

The impact of relational learning on formal behavioral phenotypes has been shown in myriad studies (Dymond & Roche, 2013) that largely conform to predictions made decades ago when the relational nature of human language was just beginning to be understood (Hayes, Gifford, & Ruckstuhl, 1996). Language does not just alter formal behavioral variation, however. It can change other evolutionarily relevant processes (see Hayes et al., in press, for a more comprehensive description). Language can make remote or probabilistic consequences effective, or create verbal motivational processes. At the same time, language and cognition can decrease functional variability by diminishing control over behavior by non-verbal processes. Like a non-native plant can do to other plants, human symbolic behavior rapidly crowds out other behaviors. This reduces behavioral functions in the sense that symbolically establishing predictive and comparative functions begin to dominate over all others. For example, when faced with difficulties, humans tend to plan, reason, and problem-

solve – all symbolically established functions. This begins naturally to turn human thought, emotion, memory, or sensation from events to be experienced into problems to be solved. If someone tells you that losing love is horrifically painful, you may begin to look at your partner's loving reactions with suspicion and fear of painful disappointments to come. If something important (such as the opportunity to get a new and much desired job) produces anxiety, you may try to tamp down the fear by withdrawing from the opportunity. In other words, psychological inflexibility is in part a natural extension of human symbolic problem solving.

Human verbal behavior dominates over other forms of action for several reasons. One is that it is so broadly useful, and thus tends to be overused. When verbal behaviors are selected, they diminish the ability of other behaviors to survive, or for new ones to appear, simply because time and attention are limited resources. Selection of behaviors can diminish variation in a functional sense even if it increases variation in a formal sense (Neuringer, 1986, 2002, 2004). If many moments are characterized by the participation of human thought, reasoning, or verbal communication, over time fewer and fewer behaviors of other kinds stand unaffected.

In addition, human verbal relations tend to become dominant because they are symbolic, in the sense of being relational responses that are somewhat detached from the physical forms and contingencies. This property makes them an "all terrain" behavior. Language and cognition can potentially apply to anything, anywhere, and anytime. For example, when someone is told that he mustn't be weak, anything that can be analyzed as a sign of weakness can become painful, from a B+ at school, to bad luck in games, to experiencing a painful but normal emotion. This in turn decreases sensitivity to actual consequences of action (Monestès, Villatte, Stewart, & Loas, 2014).

The social reinforcement that comes from being right in creating verbal understanding, and the immediate sense of coherence that comes from assembling consistent verbal networks (see Quinones & Hayes, 2014), can sustain verbal networks even in the absence of other forms of behavioral effectiveness. Understanding gives humans the illusion of mastering the world merely by being able to describe it. A patient with a rash of unknown origin may be distressed because they do not know what they have, while a patient who is told they have idiopathic dermatitis will likely be reassured, even though it means exactly the same thing.

As functional variability decreases and functions that can readily be combined with literal verbal events can increase in an assimilated form, other functions that do not combine well with literal, evaluative, predictive verbal events may weaken. Awe, a sense of transcendence, love, or peace of mind may all wane as a single functional class of behaviors becomes more and more dominant. It is a kind of behavioral selfishness in which other types of action that could be useful as part of a cooperative group of actions get little time or attention. Elements of the verbal problem-solving repertoire selfishly get more time and attention than is their functional due. This is an example of a kind of adaptive peak, in which processes produce self-amplifying loops or self-sustaining processes that restrict further development via normal evolutionary processes.

Let's expand on an earlier example that does not require human language and cognition so that the process can be understood: drug addiction. The consumption of addictive substances can produce powerful reinforcers and gradually crowd out other forms of behavior. Each step in the "hill climbing" of an addiction can be highly appetitive but its self-amplifying and self-sustaining qualities may eventually so reduce access to other behavioral events that there is little time for anything else. Further development via normal evolutionary processes is restricted by the highly aversive effects of withdrawal from addictive substances.

In summary, we are arguing that psychopathology is a form of symbolic problem-solving, that disrupts the normal interplay of the expansion and contraction of variability, lessening functional variability. Verbal relations can foster this change for the reasons specified above: their general utility, their "all terrain" nature, the ubiquity of social support, and the reinforcing effects of literal coherence. Said in a colloquial way, we begin to live in our heads as psychopathology takes over because the very source of our highest achievements, human symbolic problem solving, is fostering a self-sustaining contraction of functional variability.

Successful Psychotherapy as an Increase in Flexibility

Psychotherapy and intentional behavior change can be thought of as a form of applied evolution science, with the recovering of variability selected by chosen qualities of action as the main goal. Successful psychological intervention promotes context-appropriate selection and retention of successful variations of the right dimensions at the right level of selection (Hayes & Sanford, 2015; Wilson et al., 2014).

It is the task of psychotherapy to increase context-appropriate functional flexibility in all relevant behavioral domains, including overt behavior, emotion, and cognition. This is suggested by the fact that changes in these forms of psychological flexibility are known to mediate outcomes in many forms of therapy (e.g., Arch, Wolitzky-Taylor, Eifert, & Craske, 2012).

Consider how this might be done. For one thing, psychotherapy is deliberately built on an intimate, caring relationship, but it turns out that relationships of that kind tend themselves to model psychological flexibility. Instead of experiential avoidance, caring therapists model experiential openness. Almost any feeling, memory, urge, or action can be talked about openly, and the therapist is unlikely to recoil in horror or wag a finger of shame. Judgmental is put to the side and instead the experiences of the clients are examined with a sense of

dispassionate curiosity. Rigid attention to the past in the form of rumination, or the future in the form of worry, is rarely supported and instead the focus is on what can be done now. By being willing to explore all aspects of a client's life more openly, awareness is modeled over maintaining a narrow process of self-presentation. What the client deeply cares about is given center stage, and actions are evaluated based on their benefits to a vital life. Phrased broadly as we have just done, you can see that a therapeutic relationship in psychotherapy tends to model psychological flexibility. If the client internalizes that environment, their own flexibility increases.

Some studies have looked at this idea by measuring both the quality of the working alliance in therapy, and the psychological flexibility of clients (e.g., Gifford et al., 2011). Both of these processes mediate therapy outcomes, but when they are placed in a multiple mediator model, the client's flexibility reduces or eliminates the impact of the working alliance (Gifford et al., 2011). There is an easy way to put this result into words: modeling and supporting psychological flexibility in the relationship matters in outcomes but the impact of this relationship on the client is determined by the degree to which the client internalizes it, and then adopts this posture with themselves. What remains of the therapeutic relationship after that effect is statistically abstracted is not helpful in terms of outcome.

The goal of psychotherapy is in part to reduce the domination of literal, temporal, judgmental language that make open contact with the inner and outer world impossible, and to establish more flexible responses that are free to maintain their contact with the current context and that can be selected based on their promotion of qualities of being and doing, that is, their promotion of human values (Ritzert, Forsyth, Berghoff, Barnes-Holmes, & Nicholson, 2015). In this way literal, temporal, judgmental cognition can be used when it is useful (e.g., when doing repairing a car by following a manual), but other forms of action

(e.g., observation, description, perspective-taking, feeling, appreciation, non-verbal behavior) can come to the fore when it is more useful (e.g., when seeking peace of mind).

The process underlying changes of this kind fits the model we have been proposing: new functions are being established. If particular emotions have strong avoidance functions, acceptance work adds other functions to those same emotions such as curiosity, observation, or description. If frightening or judgmental thoughts pull for argument, compliance, or resistance, defusion work adds others functions such as play, acknowledgement, humor, or self-kindness. By adding new functions greater behavioral flexibility is added, and the consequences of action can begin to select what works.

As symbolic behavior moves away from avoidant forms of problem solving it can instead be used to increase functional flexibility -- low formal variation can be related to high functional variation (what we called "creative symbolism" in Table 1). For verbal organisms, any behavior's function can be verbally transformed, without any formal change of that behavior, simply by introducing different contextual cues that bring attention to different relational networks focused on the consequences of action. The same behavior can be emitted in the same way while having different meanings for the person, providing they look are linked to different relational networks. For example, suppose a person working on an assembly line is suffering from the boring repetition of movements raising her anger against her parents who refused to pay for her higher education. At that very same moment she might also see her commitment as a proof of dedication to her children, or a challenge to find the best way to optimize the producing manufacturing. In this case, the function of these occurrences of the same behavior would be highly varied, from punishing to reinforcing, providing that the contextual cues point to the symbolic meaning of the action currently being done – to what this action "stands for."

Far from a passive activity, when combined with openness and awareness such transformations might encourage a worker to seek changes in the work environment, such as to agitate for a "take your child to work" day, or to insist on safer work conditions so work can actually foster family success. This is not hypothetical: it is an empirical fact that acceptance and values interventions naturally impact work environments in this way (Bond & Bunce, 2000).

The entire psychological flexibility model can be understood in terms of the six key concepts (variation, selection, retention, context, dimension, and level) necessary to intentional use of evolution science. In this paper we have emphasized variation and selection, but therapists also increase flexible attention to the inner and outer context of action, foster retention by practice, keep dimensions of action in focus (e.g., not allowing the symbolic dimension to crowd out other inheritance streams), and consider levels of selection (e.g., fostering positive outcomes for the whole person, not a dominant behavioral component; or fostering the success of couple and families, not just individuals). These ideas are more fully explored elsewhere (e.g., Hayes et al., 2015, in press; Hayes & Sanford, 2014).

Conclusion

Contextual behavioral science is a form of behavioral science that is consciously located under the umbrella of evolution science. We focused in this brief essay on variation and selection as they impact psychopathology and behavior change. Psychopathology involves formal or functional inflexibility, and psychotherapy helps by adding in new forms of flexibility and linking these to context and to values-based selection. By thinking of applied psychological work as applied evolution science, the range of issues is simplified without being simplistic – exactly the combination that seems likely to be practically helpful to those who work in the business of deliberate behavior change.

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