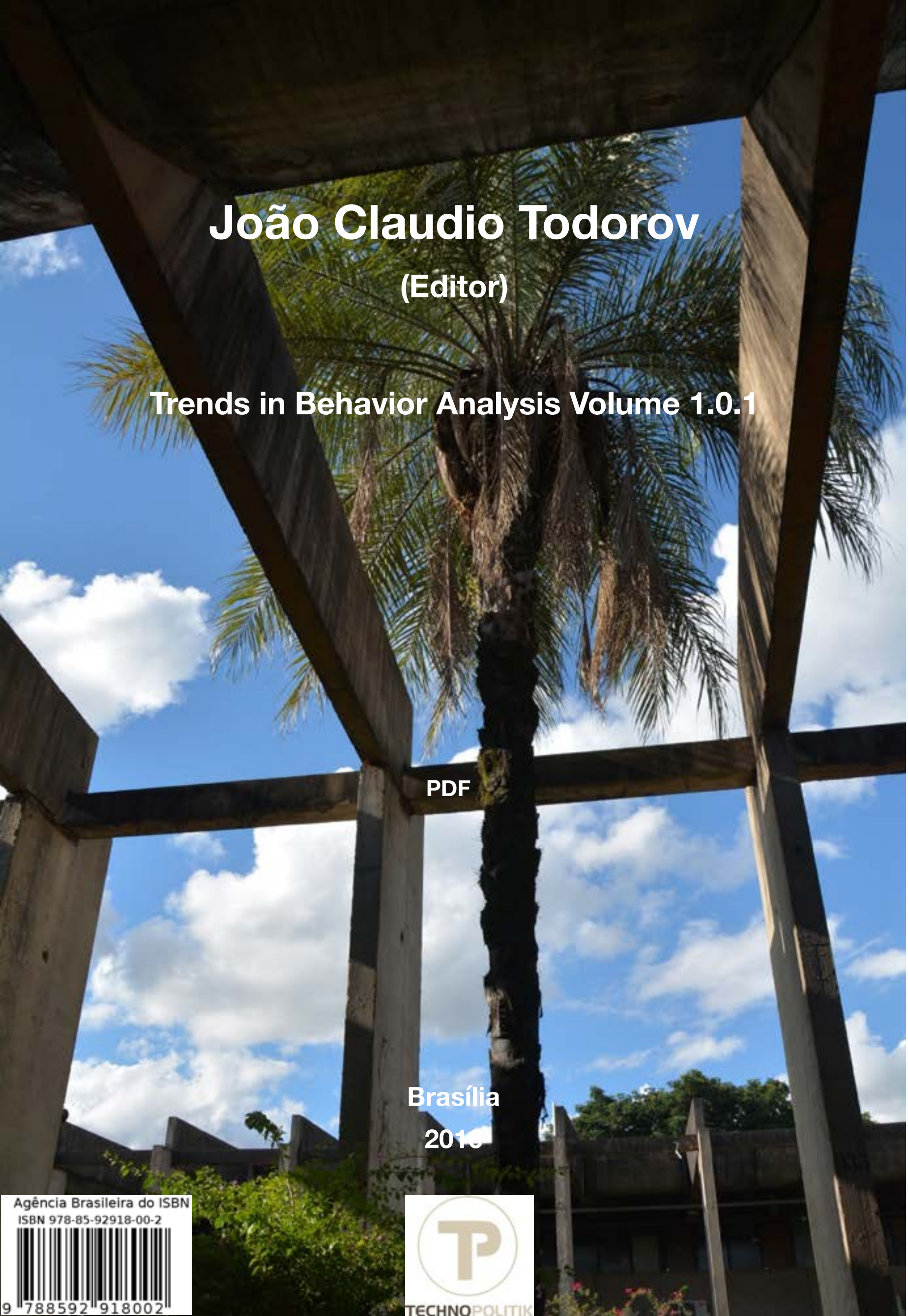

João Claudio Todorov

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Introduction

Some old and new trends in Brazilian Behavior Analysis

João Claudio Todorov, Universidade de Brasilia, Brazil

Brazil has the largest number of undergraduate professional courses in Psychology in the world, so far more than 220. Of those, most offer Behavior Analysis courses, some only introductory disciplines, others a full training including practical work in the field. About 30 universities offer graduate courses, both basic and applied, with 15 of them leading to the PhD. This volume of activity, production and spreading of knowledge, has been going on for 55 years, since Professor Fred S. Keller went to the University of São Paulo as a Fulbright Scholar in 1961. Everything considered, Brazil is second only to the United States of America in both number of researchers and of publications on Behavior Analysis.

All that notwithstanding, Brazilians are underrepresented in citations. That is understandable when we publish in Portuguese. Only people in Portugal (Europe), Angola, Mozambique, Cabo Verde (Africa), Timor East, Goa and Macau (Asia) can read what we publish in our common language (for the Asians, usually their second language). But Brazilians are also underrepresented even when publishing in English in major Behavior Analysis periodicals and books published in the US. Even Brazilian authors publishing there undercite Brazilian researchers.

Citing is behavior, under the influence of all variables that influence choice. Having no way of directly control the environment of authors, we can at least enrich that environment. Trends in Behavior Analysis, Volume 1.01 is here offered online, for download, as an opportunity to make the Brazilian production available internationally.

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1 What is ethical behavior?

Alexandre Dittrich

In an often quoted passage from *Verbal Behavior,* B. F. Skinner (1957) stated that “men act upon the world, and change it, and are changed in turn by the consequences of their action” - and soon after this, introducing the subject matter of the book, he went on to say that “much of the time, however, a man acts only indirectly upon the environment from which the ultimate consequences of his behavior emerge. His first effect is upon other men” (p. 1).

Men acted upon the world long before anybody could have said that their actions, the changes produced by them or the effects of these changes upon men's behavior were "ethical" or "unethical", "good" or "bad", "right" or "wrong". Before ethical talk there was just (nonverbal) behavior. Our present actions, the changes they produce and its effects upon us are, in part, a product of this long human history that precedes the emergence of verbal behavior. However, the same can be said about our present verbal behavior, including ethical talk. Part of the explanation for the fact that we go for some things (and usually call them "good") and avoid other things (and usually call them "bad") is in our phylogenetic history. But that is not the only relevant history, of course - as Skinner (1981) pointed out. Ontogenetic and cultural selection act in concert with phylogenesis, producing verbally competent human beings that not only go for some things and call them "good" or "bad",

but also emit words such as "good" or "bad" to have an "effect upon other men". They do this by classifying actions, the changes they produce and their effects upon behavior with these and many other words.

We are here, of course, in the field of ethics. The first systematic conceptual treatment of these problems from a behavior-analytic point of view was performed by Skinner in *Beyond Freedom and Dignity* (1971b - especially chapters 6 and 7). Although Marr (2013, p. 194) rightly says that in comparison with other typical philosophical themes ethics is "less often discussed" in radical behaviorism, some behavior analysts have tackled the same ethical issues first addressed by Skinner over the years, either praising or criticizing Skinner's approach, and also expanding its scope. In what follows, I will try to summarize Skinner's main contributions and those of the authors that built upon these, and also to point out some possible limitations of the behavior analytic approach to ethics.

What do "good" and "bad" mean?

There would be no point in discussing ethics if there were no ethical talk - no classification of things or processes as "good" or "bad". For this reason, the pioneer treatment of ethical problems by Skinner (1971b) was especially concerned with the functional analysis of classes of verbal behavior usually classified as ethical.

When asked to provide the "meaning" of any given verbal operant, behavior analysts usually treat this as an empirical matter: find out the variables that control the probability of a given verbal operant, and you have found its meaning. Verbal behavior is just behavior, and to ask about the meaning of a verbal operant is to ask about the variables that explain its occurrence. As Skinner pointed out, the "meaning" of any behavior (verbal or nonverbal) is a property "of the conditions under which behavior occurs" (1957, pp. 13-14).

Skinner (1971b) spends considerable time pointing to the variables that control the emission of ethical words, and comes to the conclusion that we usually call positive reinforcers "good" and negative reinforcers "bad" - or, put differently, that “good” and “bad” are usually tacts emitted in the presence of, respectively, positive and negative reinforcers. The things we call "good" or "bad" occasionally give rise to feelings that we can also call "good" or "bad" - but, as Skinner insists, "the important thing is not the feeling but the thing felt...It is the reinforcer that feels good, not the good feeling…What is ultimately good or bad, are things, not feelings" (1971b, p. 107).

In a functional analysis of ethical talk as verbal behavior, it must be clear that, as put by Hocutt (1977), we should not confuse "(1) saying that whatever reinforces anybody is good and (2) saying that whatever reinforces anybody is what he or she will (correctly) *call* 'good'. Skinner's thesis is 2, not 1" (p. 334). In other words, we must note that "Skinner's definitions are lexical definitions, not stipulations. Skinner is telling us what is called good or right; not what he thinks is good or right. In short, he is explaining evaluation, not evaluating" (Hocutt, 2009, p. 169). The point of the analysis is not to define what *is* good, but to identify the variables that control the emission of "good" from different persons or groups.

The relativity of “good” and “bad”

When we point to the “things” that people usually call “good” or “bad”, it is important to remember that reinforcement and punishment, be they positive or negative, are relational concepts – as many authors do when discussing this matter (e.g., Graham, 1977, 1983; Hocutt, 1977, 2000, 2007, 2009, 2013; Waller, 1982; Zuriff, 1987). Contrary to a long-standing tradition in ethical philosophy, behavior analysts do not think that the things we call “good” or “bad” have in them any intrinsic qualities of “goodness” or “badness” – or, for that matter, any

common qualities at all, besides being positively or negatively reinforcing[1]. But this quality – or better said, this power - is historical, relational and ever changing. It is always the behavior of a specific person, at a specific time, in a specific context which is reinforced or punished. This leads us to some obvious conclusions: (1) something that is reinforcing (or punishing) to a person may not be to others; (2) something which is reinforcing (or punishing) now may not be one hour, one day or one year later; (3) something which is reinforcing (or punishing) in the presence of some contextual variables may not be if these variables change. This is part of our common experience: we like to read books and our neighbor does not; we liked to play certain games when we were children, but not anymore; we like to dance alone, but not in public. It follows that nothing is good or bad “in itself”; nothing is essentially, or universally, or definitely good or bad. We can only make sense of the practice of calling some things "good" or "bad" by analyzing continuously changing behavioral relations.

The same applies to groups or cultures. As Skinner (1971b) noticed, what actually reinforces the behavior of the members of a culture at any given time is an empirical matter: “The effective reinforcers are a matter of observation and cannot be disputed” (p. 128). Of course, the reinforcers (the “values”) of cultures differ among them, and also change over time within the same culture. If this is all that is meant by cultural relativism, then Skinner and probably all behavior analysts are cultural relativists. To be a cultural relativist in this sense is simply to agree with Skinner (1971b) that "each culture has its own set of goods, and what is good in one culture may not be good in another" (p. 128).

All of this, of course, is a matter of interpretation (in the sense of interpretation given by Skinner, 1971b, pp. 22-23). To know whether people

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1. We will not deal here with the traditional "naturalistic fallacy" objection, originally developed by G. E. Moore (1903/2004) and occasionally levelled against Skinner. Hocutt (2000, 2009, 2013) offered particularly detailed and effective rebuttals to this argument, to which the reader is referred.

actually call positive and negative reinforcers "good" and "bad" is an empirical matter, and the evidence which supports Skinner's analyses is anecdotal, not experimental. It should therefore be no surprise to encounter some exceptions, as we shall see.

If someone says something like "it was good to leave that annoying meeting", there are probably no positive reinforcers controlling the use of "good". The word "good" is, in this case, being emitted under the control of the escape from a negative reinforcer. We find it good to produce good things, but also to get rid of bad things. So, the emission of "good" may be controlled not only by the presence of positive reinforcers, but also by the elimination of negative reinforcers. Conversely, the emission of "bad" may be controlled not only by the presence of negative reinforcers, but also by the elimination of positive reinforcers. We can express this in a more succinct way by saying that we usually call the consequences of reinforcement contingencies (be they positive or negative) "good" and the consequences of punishment contingencies (be they positive or negative) "bad".

The intensity and duration of stimuli are important variables in the control of the probability of saying "good" or "bad". Sugary cakes are "good", but too much sugar in a cake would be "bad" – as would eating too much cake be. A dim light is "good", but an overly bright one is "bad". Listening to music is "good" for a certain period of time, but not all day long. We can even say that something is simultaneously "good" and "bad", but when we do this we are probably under the control of the different effects that things have on our behavior, depending on their intensity or duration, among other variables.

It is not hard to imagine situations in which someone can call something positively reinforcing "bad" or something negatively reinforcing "good". We may call something "good" or "bad" because our verbal communities have taught us to do so, regardless of its effect on our behavior. We can call sugar "bad", for example, even if it is highly reinforcing to us. A criminal may insist that crime is

“bad”, even while routinely practicing it. The fact that a culture teaches its members to classify certain operants or its products as “bad” obviously does not guarantee that they will not be emitted. Exceptions like these constitute no serious harm to Skinner’s descriptions, as long as we can explain why sugar consumption and crime were considered “bad” in the first place (most probably because other effects of the consumption of sugar and the practice of crime have proven aversive in many ways) and how cultures teach their members to repeat this verbal classification. Again, it would be no surprise to find people saying that sugar or crime are simultaneously “good” and “bad” when they know - verbally, if not from first-hand experience - that, as with many other things, sugar and crime may have different effects over time. The practices of verbal communities certainly control our uses of "good" and "bad" in many other ways.

A somewhat trivial situation in which we should find someone calling something "good" which would otherwise be negatively reinforcing for him is when a person is lying (e.g., a guest can call a dish "good" just for the sake of politeness). But it is, of course, not difficult to spot important social variables controlling the occurrence of exceptions like this. Nonetheless, lying is an important social phenomenon, as it is probably more frequent than we usually can notice - for example, in business, marketing and politics. A politician may boast about his good deeds, even if he does not actually engage in them. As behavior analysts know well (e.g., Peláez, 2001), there is no necessary connection between verbal and nonverbal behavior, and several characteristics of the audience certainly may have important effects on the probability of emission of "good" and "bad".

Another important function of “good” and “bad” also noted by Skinner (1971b) is the social control of behavior. "Good" and "bad" function as generalized reinforcers, and we usually call any behavior that reinforces us "good" - or, to put it differently, any behavior that produces consequences that

we would usually call "good". This is the way we all learn what is deemed "good" in our social groups[2]. As Skinner (1971b) pointed out, “behavior is called good or bad - and the ethical overtones are not accidents - according to the way in which it is usually reinforced by others” (p. 109). The ethical customs of a group are sometimes called its "morality". As Hocutt (2010) reminds us, there is a long tradition in philosophy of trying to explain morality appealing to absolute laws (divine commands or universal principles), but "morality in the real world consists not of a priori principles but of customs and conventions, tacit understandings about what conduct will be accepted and what will not" (p. 34) - and thus defined, morality varies "with the group, the time and the place" (p. 47). "Good" and "bad", as generalized verbal reinforcers, are pivotal in the shaping and maintenance of these varying "moralities".

It may be argued that we are not necessarily the best judges about what reinforces our behavior (Skinner, 1974, p. 30), (even if we are "in a favorable position to observe the variables of which our behavior is a function" - Skinner & Blanshard, 1967/1976, p. 215) - and maybe much less about what reinforces the behavior of other people. The assertion that people usually call positive reinforcers “good” and negative reinforcers “bad” does not, of course, entail that this is preceded by a rigorous behavior-analytic judgment about the reinforcing power of things over their behavior. Again, the problem is empirical, and there is no infallibility to defend. If the emission of "good" and "bad" is generally controlled by reinforcing and punishing consequences respectively, then Skinner's point is valid, even with the possibility of exceptions. As noted by Hocutt (1977), Skinner could only write about the "fundamental uses" (p. 322) of "good" and "bad" - if for no other reason, because it would be impossible to explain them all, or even know them all. Thus, Skinner's proposal to identify the "meaning" of "good" and "bad" is, as put by Graham (1977), an "empirical hypothesis" (p. 104). There would be no point in a behavior analyst

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2. Words like "right", "just" and "correct" are also used in this case, as Hocutt (2000, 2013) notes.

offering an essentialist explanation of the "real" meaning of any word. Vargas (1982) is precise about this point: while traditional metaethical theories focus on the logical and formal properties of ethical sentences, behavior analysis is interested in its functional properties - that is, in the variables that control them. Even when they assume a functional stance, traditional metaethical theories tend to single out just one of the many possible controlling variables of ethical talk as responsible for all of its instances. Thus, a functional behavior analysis provides for some welcome flexibility in the analysis of ethical talk.

To sum up, instead of saying simply that “good things are positive reinforcers” and "bad things are negative reinforcers", behavior analysts would be better advised to say that reinforcing consequences usually increase the probability of the emission of the word “good”, while punishing consequences usually increase the probability of the emission of the word “bad”. Exceptions exist, but they can be explained by social selective contingencies acting over our verbal behavior. If the “meaning” of ethical words and sentences depends on the variables that control their emission, these words and sentences are polysemic. Whenever they are emitted the task of the behavior analyst is to functionally analyze the emission. Even if we can identify certain functional patterns, there is no point in stipulating beforehand what variables *should* control ethical talk. Behavior analysts must not be surprised in identifying many other variables controlling ethical talk, considering the variability of ontogenetic and cultural contingencies selecting verbal operants in human cultures and the multiple control of verbal behavior.

Cultural survival as a "good"

In *Beyond Freedom and Dignity* Skinner (1971b) identified three kinds of "goods", roughly corresponding to the three levels of behavioral selection: (1) personal goods, which reinforce the behavior of the person that produces it; (2)

the goods of others, which are produced by the behavior of a certain person but are reinforcing to the behavior of others; (3) the good of the culture - that is, any consequences of our actions that increase the chances that our cultures will survive. Cultural design for the survival of cultures is a common theme in Skinner's works (e.g., 1953/1965, 1971b, 1974, 1978a, 1987a). Occasionally, as Baum (1994) and Chiesa (2003) have noted, Skinner also refers to the survival of humankind, or of the human species as a whole.

The historical record (e.g., Diamond, 2005), clearly shows that cultural evolution is a fact: cultures emerge, undergo constant changes in their practices and survive or perish depending on the success of their practices in dealing with multiple environmental demands. As put by Skinner (1971b):

> The survival of a culture then emerges as a new value to be taken into account in addition to personal and social goods. ... A culture, like a species, is selected by its adaptation to an environment: to the extent that it helps its members to get what they need and avoid what is dangerous, it helps them to survive and transmit the culture. (p. 123)

But one can ask if, or in what sense, this allows us to justify the adoption of cultural survival as a guide to cultural planning - or, moreover, to present cultural survival as a "true" or "scientific" value. Is cultural survival, as a fundamental value, open to discussion? Skinner himself was dubious about this problem. There are a few passages of his work in which he not only advances cultural survival as an ultimate value, but seems clearly impatient with ethical discussions:

> To confuse and delay the improvement of cultural practices by quibbling about the word *improve* is itself not a useful practice. Let us agree, to start with, that health is better than illness, wisdom better

> than ignorance, love better than hate, and productive energy better than neurotic sloth. (1955-1956/1972c, p. 6)
>
> If a science of behavior can discover those conditions of life which make for the ultimate strength of men, it may provide a set of "moral values" which, because they are independent of the history and culture of any one group, may be generally accepted. (1953/1965, p. 445)

At a certain point in *Walden Two* (1948/1976), Frazier states, in an even more incisive way:

> The philosopher in search of a rational basis for deciding what is good has always reminded me of the centipede trying to decide how to walk. Simply go ahead and walk! We all know what is good, until we stop to think about it. For example, is there any doubt that health is better than sickness? (pp. 146-147)

Skinner seems to exhort us to abandon ethical discussions and get into action. We know what is good - why don't we just do what we got to do? At other moments, Skinner seems to dismiss the importance of ethical discussions by pointing out that to discuss anything is simply to behave:

> The disputing of values is not only possible, it is interminable. To escape from it we must get outside the system. We can do this by developing an empirical account of the behavior of both protagonists. All objections to cultural design, like design itself, are forms of human behavior and may be studied as such. (1961/1972b, pp. 39-40).
>
> ... those that are accustomed to the traditional values hesitate to accept survival as an alternative. We have no reason to urge them to do so. We need not say that anyone *chooses* survival as a criterion

> according to which a cultural practice is to be evaluated. Human behavior does not depend upon the prior choice of any value. (1953/1965, p. 432)

As many authors have noted (e.g., Castro & De Rose, 2008; Chiesa, 2003; Day, 1977; Garrett, 1987; Hinman, 1979; Hocutt, 1977, 2000, 2007; Leigland, 2005; Rottschaefer, 1980; Staddon, 2004, 2009, 2013; Waller, 1982; Zilio & Carrara, 2009; Zuriff, 1987), the mere fact that cultures evolve and survive or perish does not justify the adoption of cultural survival as a "true" or "scientific" value. To describe the third level of selection by consequences is different than to prescribe cultural survival as a value in cultural design. It can even be questioned if we, as behavior analysts, must adopt this value as a guide for cultural planning (e.g., Hayes, 1993; Ruiz & Roche, 2007; Staddon, 2004, 2009, 2013). Nor does the fact that ethical discussion is just behavior get us "outside the system": if we want to advance any cultural practices, we will inevitably have to engage in such discussions and "urge" other people to take our suggestions into account, whatever they are.

When Skinner (1955/1972a) says that "survival is not a criterion which we are free to accept or reject, but it is, nevertheless, the one according to which our current decisions will eventually be tested" (p. 22), it is not difficult to grasp what he means: either our cultures will survive or perish, in spite of any values that we single out as cultural goals. But this, of course, does not oblige any person, group or culture to deliberately adopt cultural survival as a fundamental value. The point of the third level of selection by consequences is just that cultures that do adopt this value may make their own survival more probable - but it is still possible, as Hume (1739/2012) famously noted, "to prefer the destruction of the whole world to the scratching of my finger" (p. 637).

Skinner himself, however, has made other observations about cultural survival as a value, more in agreement with the radical behaviorist rejection of "absolute truths":

> We cannot answer these questions [about values] by pointing to absolutes. There is no absolute truth in value judgments. No one has that kind of truth or can answer questions by appealing to it. (1971a, p. 547)
>
> It would be a mistake, however, to try to justify them [cultural practices with survival value] in any absolute sense. There is nothing fundamentally right about the survival of a culture, any more than there is something fundamentally right about the set of traits which define a species. (1971a, p. 550)

And there is also nothing fundamentally right about the selective histories that lead some of us to work for cultural survival. There is no ultimate justification for cultural survival as a value: “Do not ask me why I want mankind to survive. I can tell you why only in the sense in which the physiologist can tell you why I want to breathe” (1956/1972d, p. 36). As anyone else, Skinner can only point to his own selective history to explain why he wants to breathe and why he wants mankind to survive. The fact that part of the members of given cultures are reinforced by events that indicate a possible increase in the probability of cultural survival is a result of the very selective contingencies that act at the cultural level.

Of course, as Chiesa (2003) notes, the recognition that values have no absolute justification must not prevent Skinner - or any other person, for that matter - from advancing their own values, be they cultural survival or any other. Skinner’s appeals regarding the need for cultural design are quite

understandable considering the fact that if we passively contemplate the ways of cultural evolution without planned intervention the survival of our cultures (and ultimately of humanity) will probably be at serious risk. Cultural survival, however, is not a “better” or “worse” value than any other. One can ask then: why should we work for it? Skinner foresaw this question and gave the following answer: "There is no good reason why you should be concerned, but if your culture has not convinced you that there is, so much the worse for your culture” (1971b, p. 137). It is quite an odd situation: Skinner is among those who try to offer “good reasons” for people to work for cultural survival, but readily admits that there is none. Cultural design for cultural survival entails “giving good reasons” – that is, to reinforce behavior classes that will probably increase the chances that cultures will survive. Reinforcers are the only “good reason” – the only effective ones: “We shall work for the survival of our culture, if at all, because of the personal goods which are effective because of our genetic endowment, as these arise naturally or as part of our cultural environment” (Skinner, 1971a, p. 551).

According to Skinner, considering the fact that we cannot predict with absolute precision the outcomes of our present practices, cultural design requires that we *guess* what these outcomes will be (Skinner, 1953/1965, p. 436; 1961/1972b, p. 49). However, science, with its insistence upon “careful observation, the collection of adequate information, and the formulation of conclusions which contain a minimum of wishful thinking” (1953/1965, p. 435), may offer the most dependable way of guessing. We can never be sure that our practices will bring the outcomes that we expect (Skinner, 1955-1956/1972c, p. 6, p. 13; 1971a, p. 549), but cultures that explicitly plan the way to achieve their goals will more probably be successful. The alternative would be to let go of any attempt towards design and just hope for happy accidents - but, as Skinner notes, “there is no virtue in the accidental character of an accident” (1955-1956/1972c, p. 12). These suggestions are, of course, debatable in many

ways. Staddon (2004, 2009, 2013), for example, is especially emphatic in stressing that cultural evolution is inherently unpredictable, thus putting into question any attempts at cultural design.

Much more than the advancement of specific values, the heart of Skinner's proposal regarding cultural design seems to lie in experimentation:

> Perhaps the greatest contribution which a science of behavior may make to the evaluation of cultural practices is an insistence upon experimentation. We have no reason to suppose that any cultural practice is always right or wrong according to some principle or value regardless of the circumstances or that anyone can at any given time make an absolute evaluation of its survival value. So long as this is recognized, we are less likely to seize upon the hard and fast answer as an escape from indecision, and we are more likely to continue to modify cultural design in order to test the consequences. (1953/1965, p. 436)

In *Walden Two* the so-called “Walden Code” contains rules that must be followed by members of the community – but these rules are not fixed, but “changed from time to time as experience suggests” (Skinner, 1948/1976, p. 150), in what Skinner calls an “experimental ethics” (p. 161).

Instead of proposing a set of fixed *a priori* ethical principles, radical behaviorism recommends an inquisitive attitude towards cultural planning: “We must continue to experiment in cultural design, as nature has already experimented, testing the consequences as we go.” (Skinner, 1955/1972a, p. 22). Science has an important role in predicting the possible consequences of our present choices based on available data - but, as appropriately noted by Ruiz and Roche (2007), "as pragmatists we are not searching for solutions that are ultimately 'true' or 'right'. We are instead making decisions about the best

possible courses of effective action" (p. 14). Our capacity of prediction is obviously limited, but the experimental character of science allows us to correct our practices according to its outcomes.

Radical behaviorism and the "is-ought" problem

The so-called "is-ought" problem is one of the most traditional in ethical philosophy. Vargas (1982) notes, however, that there are significant faults in the way some authors have stated the problem. Hume's words in his *Treatise of Human Nature* (1739) are improperly cited as proving that "the two sorts of statements are of a different kind, reflecting different domains of knowledge - that of facts and that of values", or used as a "canonized principle" or "advertising slogan": "No ought from an is". In fact, Hume only demanded from writers on morality that derived prescriptive statements (containing "ought") from descriptive ones (containing "is") that they explain how they did it.

This problem can be analyzed in at least two perspectives by radical behaviorism. The first one, with which we have already dealt, regards the relation between description and prescription in behavior analysis as a science, especially considering the cultural level of selection by consequences. The basic question is: does the descriptive fact that cultures survive or perish justify the prescription of cultural survival as a scientific value? As we have just seen, Skinner was dubious about the problem, but most behavior analysts seem to think that the answer is negative.

The second perspective regards the functional analysis of everyday verbal behavior when words like "is" and "ought" are emitted. The problem was analyzed by Skinner (1971b), and basically what he suggests is that we can "translate" operants containing "is" into operants containing "ought" (or vice-versa) if they are controlled by the same variables, and therefore have the same behavioral function:

> "To get to Boston you should (you ought to) follow route 1" is simply a way of saying "If you will be reinforced by reaching Boston, you will be reinforced if you follow Route 1." To say that following Route 1 is the "right" way to get to Boston is not an ethical or moral judgement but a statement about a highway system. Something closer to a value judgement may seem to be present in such an expression as "You should (you ought to) read *David Copperfield*", which may be translated, "You will be reinforced if you read *David Copperfield*." It is a value judgement to the extent that it implies that the book will be reinforcing. (p. 112)
>
> Long before anyone formulated the "norm" ["Thou shalt not steal"], people attacked those who stole from them. At some point stealing came to be called wrong and as such was punished even by those who had not been robbed. Someone familiar with these contingencies, possibly from having been exposed to them, could then advise another person: "Don't steal." If he had sufficient prestige or authority, he would not need to describe the contingencies further. The stronger form, "Thou shalt not steal", as one of the Ten Commandments, suggests supernatural sanctions. Relevant social contingencies are implied by "You ought not to steal", which could be translated, "If you tend to avoid punishment, avoid stealing", or "Stealing is wrong, and wrong behaviour is punished." Such a statement is no more normative than "If coffee keeps you awake when you want to go to sleep, don't drink it." (p. 114)

Skinner's point is that verbal operants can be controlled by multiple variables, and the formal properties of verbal operants do not necessarily correspond to its functional properties. Thus, the verbal operants mentioned by Skinner, whether containing "is" or "ought", can be controlled by classes of

variables typical of tacts (specific discriminative stimuli), by classes of variables typical of mands (deprivation or aversive simulation) or by both at the same time.

Ethical philosophers, on the other hand, usually restrict themselves to the formal and logical analysis of given instances of verbal behavior: "Statements are examined not as behavior but as 'statement' ... 'Ought' and 'is' statements are what they are simply on the face of it" (Vargas, 1982, p. 20). Thus, radical behaviorists' perspective about the "is-ought" problem is markedly different when compared to the most traditional one in ethical philosophy. The question about the possibility of a "translation" between "is" and "ought" is regarded as primarily behavioral rather than logical. However, Vargas also notes that under a functional analysis this "translation" is possible "only within the same domain of control" (p. 21). This is the key to understand Skinner's proposal of a "translation": formally descriptive statements (containing "is") can have manding functions, and formally prescriptive statements (containing "ought") can have tacting functions. A verbal operant containing "is" can only be "translated" into another one containing "ought" (or vice-versa) if they have the same functional properties. It is worth noting that all examples of "translation" offered by Skinner imply already extant natural or social contingencies: Route 1 actually leads to Boston, *David Copperfield* reinforces the reader in question, stealing is usually punished in a given society. Moreover, the speaker is not telling the listener what should reinforce or punish his behavior; he is saying only that, given that certain things actually reinforce or punish his behavior, if the listener emits certain responses he will probably produce those things. It is only in this way that a "norm" can be "simply a statement of the contingencies" (Skinner, 1971b, p. 115).

It should be noted, however, that many "norms" (mands) seem not to be simply statements of contingencies. If a speaker urges a listener to "vote for the democrats", for example, it would be pointless to translate this into "if you are

reinforced by the election of democrats, then vote for them". The speaker will probably emit additional verbal operants to affect the listener's behavior (to "convince" him to change his verbal and nonverbal behavior), but these operants will not necessarily be "statements of contingencies". The translation proposed by Skinner seems not to be applicable in such cases. This, however, is only one example of the fact that we cannot state that functional translations of "is" into "ought" (or vice-versa) can always be made. Despite the possibility of functional translation, one can still say, following Hocutt (2009), that it is "almost always wrong to argue 'It is the case that p; therefore, it ought to be the case that p'" (p. 167).

Radical behaviorism, behavior analysis and ethical conflicts

As we have seen, Skinner (1971b) proposed a scientific understanding of some traditional ethical problems, most of them involving verbal behavior (the behavioral functions of "good" and "bad", "is" and "ought", etc.). At the same time, Skinner suggested that we should work to promote cultural survival (or the survival of humankind). In the years following the publication of *Beyond Freedom and Dignity*, many authors came to ask if Skinner's approach to ethics allowed us to resolve ethical conflicts in some way. Graham (1977) openly introduced the problem, which he recognized as a difficult one, in the following way: "how value conflicts can be resolved in Skinner's analysis, and in particular whether the notion of resolving value conflicts by appealing to what values persons ought to have is an intelligible notion in Skinner's view" (p. 108). Albeit not trying to answer the problem, Graham noted that the notion of the "good of the culture" (cultural survival) was especially relevant to it. Skinner, says Graham, "seems to write" (p. 111) as if we could make appeal to the concept of the good of the culture to rationally resolve value conflicts, permitting us to "determine what people ought to value". At the time, Graham's article ignited a heated debate about the problem (Garrett, 1979;

Rottschaeffer, 1980; Waller, 1982; Graham, 1983)[3], and the topic frequently reappears in works about ethics in radical behaviorism (e.g., Chiesa, 2003; Vogeltanz & Plaud, 1992; Zuriff, 1987). As we have seen, however, most authors seem to conclude that there is no way in which cultural survival can be considered a "true" or "scientific" value - and even if it was presented this way in ethical debates obviously people could still shrug their shoulders. Moreover, even if we could agree about cultural survival as an ultimate value, it seems that "it provides little or no practical guidance in difficult cases" (Staddon, 2004, p. 238), and cannot serve as a "guide to action" (Zuriff, 1987, p. 312).

However, cultural survival was not the only value recommended by Skinner. On several occasions Skinner mentions some values that would probably favor cultural survival: happiness (1955-1956/1972c, p. 3; 1956/1972d, p. 36; 1971b, p. 152), health (1955-1956/1972c, p. 6; 1956/1972d, p. 36; 1971b, p. 152), safety (1956/1972d, p. 36; 1971b, p. 152), productivity (1955-1956/1972c, p. 3; p. 6; 1956/1972d, p. 36; 1971b, p. 152), education (1955-1956/1972c, p. 3; p. 6; 1971b, p. 152), creativity (1956/1972d, p. 36), experimentation (1971b, p. 153), love (1955-1956/1972c, p. 6), cooperation and support (1972/1978b, p. 197) and environmental preservation (1971b, p. 152; 1987b, p. 1). However, here again Skinner puts himself far from the territory of absolute, unquestionable values: "The values I have occasionally recommended ... are transitional" (1956/1972d, p. 36); "Survival ... is not an unchanging criterion, for what may in this sense be a 'good' culture in one period is not necessarily 'good' in another" (1953/1965, p. 431).

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3. Incidentally, it is interesting to note that these articles together form a very convincing case to the effect that different readers may strongly disagree about "what Skinner actually meant" about any topic, showing once again the complexity of the variables controlling verbal behavior.

The generic adoption of health or education as secondary values does not, of course, provide us with all the answers we may need about many problems regarding health (e.g., genetic therapies, abortion, euthanasia) or education (e.g., curricula issues), nor does science automatically provide those answers. It is always possible to have an attitude like "we're scientists, and you don't understand" (as put by Wood, 1979, p. 10) towards ethical decisions, but behavior analysts seem to be aware of its many shortcomings (e.g., Fawcett, 1991; Fawcett et al., 1988; Staddon, 2004, 2009, 2013; Wolf, 1978). The negotiation of values is inevitable, and we must be willing to take part in it. Behavior analysts continually make ethical decisions about their goals and methods, and these decisions should be open to public scrutiny and debate. Skinner (1953/1965) seems to recognize this when he states that "no one course of action may be exclusively dictated by scientific experience ... The formalized experience of science, added to the practical experience of the individual in a complex set of circumstances, offers the best basis for effective action" (p. 436). The recognition of the limits of science in ethical decision-making does not mean that we should not also recognize its importance in this process (Hocutt, 1977, 2000; Waller, 1982). As Hocutt (1977) noted, however, ethical decisions are very complex, as they raise "enormously complicated empirical questions, the answer to which are not at all self-evident" (p. 328). It would be naive, to say the least, to boast that we, as behavioral scientists, are in possession of some set of “scientifically true” values that should serve as infallible guides for the ultimate benefit of humankind. Scientists have an important place in cultural design, but it is not a place of moral authority based on moral truths. Ethical decisions demand dialogue and negotiation. We must participate in these dialogues, with healthy skepticism about our own

suggestions, and be always open to the possibility of reconsidering them[4].

In this context, the account given by Rutherford (2006) about the public concern over behavior modification techniques in the 1970s deserves special mention, as it clearly illustrates "the close interdependence of science, its practice, and its publics" regarding ethical issues (p. 205). Behavior modification techniques were then gaining increased visibility, and as a response to growing outcries about human rights violations by behavior modifiers the profession came under close public scrutiny. This lead applied behavior analysts not only to stop calling themselves "behavior modifiers", but to "assess their work and their role in society in a systematic, self-conscious, and relatively nondefensive manner" (p. 213). Eventually this process favored the full professionalization and certification of behavior analysts, and even the creation of the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research by the US Congress in 1974. Through a complex interchange of control and countercontrol, behavior analysts became fully aware that their profession must be open to public scrutiny and control, as they received "the clear message that they were not separate, aloof, and self-governing but part of, and accountable to, a much larger community representing diverse interests and varying agendas" (p. 218).

The need to decide over ethical issues is an all-too evident feature of everyday behavior-analytic practice, long recognized by behavior analysts (e.g., Goldiamond, 1975; Kanfer, 1965; Krapfl & Vargas, 1977; Krasner, 1962; London, 1970; Stein, 1975; Stolz & Associates, 1978; Ulrich, 1967; Wexler, 1973). This concern has always been present among behavior analysts, as shown by

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4. Ethical and political debates are a matter of manipulating the complex variables that control our verbal and nonverbal behavior, and it should be noted that behavior analysis can make substantial contributions to the understanding of these variables. For example, Leigland (2005) identifies establishing operations as an important class of variables to understand "values" as behavioral phenomena, and consequnce analysis (Sanford & Fawcett, 1980; Moore & Mattaini, 2001) seems to be a valuable tool for increasing informed opinion about public policy decisions.

several examples in the general application of behavior analysis (e.g., Bailey & Burch, 2011; Behavior Analyst Certification Board, 2016; Leslie, 1997; Matos, 1981; Van Houten et al., 1988), and in traditional areas, such as education (e.g., Lamal, 2001; Moore, 2001; Rakos, 2001; Winett & Winkler, 1972), clinical behavior analysis (e.g., Bonow & Follette, 2009; Plumb, Stewart, Dahl, & Lundgren, 2009; Vandenberghe, 2005; Zilio, 2011) and organizational behavior management (e.g., Berthold, 2001). Moreover, behavior analysts have been concerned with ethical problems covering a broad and ever-growing range of areas and issues: science and technology (Killeen, 2003; Lacey, 2003; Melo, Castro, & De Rose, 2015), public health (Botomé, 1981), community interventions (Fawcett, 1991), feminism (Ruiz, 1995, 1998, 2009, 2013; Wolpert, 2005), sexual orientation and gender identity (Malott, 1996; Nordyke, Baer, Etzel, & Leblanc, 1977; Winkler, 1977), terrorism and collective violence (Nevin & Mattaini, 2003), public policy (Fawcett et al., 1988), human rights (Mattaini, 2006), global warming (Heward & Chance, 2010; Todorov, 2010), international policy (Soreth, 2011), and politics and economics (Holland, 1974, 1975, 1978a, 1978b; Morrow, 1988; Laurenti & Lopes, 2015; Rakos, 1988a, 1988b, 1989; Ulman, 1988, 1989, 1991, 1995). Occasionally, radical behaviorists also establish productive dialogues with other philosophical traditions, offering provocative reflections about the purposes of our science and technology (Abib, 2001, 2008; Adkins, 1997; Hayes, 1993; Ruiz & Roche, 2007).

Considering its subject matter, the ethical responsibilities of behavior analysis must be obvious. Not so obvious are the answers to the pressing ethical questions continuously presented to our science and technology. The effort to build such answers must be transparent and inclusive, requiring increasing collaboration between behavior analysts and all the persons and institutions potentially concerned with the results of our practices.

Behavior analysis and "moral development"

As is well-known among behavior analysts, Skinner (1971b, 1974) criticized the metaphor of "development" as inadequate for the description of behavior changes over time (see also Baer & Rosales-Ruiz, 2003). Behavior "develops" not through the mere passage of time, but through the exposure of an organism to complex selective contingencies. As put by Skinner (1971b), "the contingencies 'develop' as much as the behaviour they generate. If developmental stages follow one another in a fixed order, it is because one stage builds the conditions responsible for the next" (p. 140). Whether using the word "development" or not, behavior analysts are interested in the ever-changing interactions between organisms and their physical and social environments, and are thus able to propose behavior-analytic ways to investigate and interpret the processes typically approached in so-called developmental psychology (Bijou, 1976; Bijou & Baer, 1961, 1978; Novak, 1996; Schlinger, 1995). The same, of course, applies to moral development.

Schlinger (1995) notes that, as occurs in the general field of psychological development, the literature of moral development is rife with concepts referring to internal entities and processes supposed to explain moral behavior (moral sense, altruistic motivation, empathy, expectancy, assimilation, tension, arousal). From a radical behaviorist perspective, the study of moral development must analyze behavioral interactions, spanning "the moral continua, from selfish to altruistic behaviors, from social to antisocial or asocial behaviors, from hurting or nonhelping to helping behaviors, and from aggressive to nonaggressive conflict resolving behaviors" (Schlinger, 1995, p. 216). Behavior analysis can offer plausible behavioral interpretations of traditional studies in moral development psychology (usually couched in cognitive terms). Moreover, it also has a long tradition of its own studies analyzing behavioral phenomena that are indispensable to a comprehensive understanding of moral behavior: cooperation and competition (e.g., Buskist & Morgan, 1987;

De-Farias, 2005; Dougherty & Cherek, 1994; Hake, Olvera, & Bell, 1975; Matthews, 1977; Mithaug & Burgess, 1968; Schmitt, 1976; Shimoff & Matthews, 1975; Weingold & Webster, 1964); altruism and selfishness (Borba & Tourinho, 2014; Jones & Rachlin, 2009; Rachlin, 2002; Weiner, 1977; Zin, Escobal, Esteves, & Goyos, 2015), choice and decision-making (e.g., Herrnstein, 1961; Baum, 1972, 1979; Fantino, 1969, 1998; Fantino & Romanovich, 2007; Moore, 1979; Todorov & Hanna, 2005), rule-governance (Catania, Matthews, & Shimoff, 1982; Hayes, 1989; Vaughan, 1985), to name a few.

Behavior-analytic principles are readily applicable to the problems typically studied in the field of moral development, rendering a broad comprehension of the selective contingencies involved in the evolution of moral behavior - with special emphasis on the role of verbal communities (Gewirtz & Peláez-Nogueras, 1991; Goldiamond, 1968; Hayes, Gifford, & Hayes, 1998; Hayes & Hayes, 1994; Hayes & Tarbox, 2007; Leigland, 2005; Peláez, 2001; Peláez-Nogueras & Gewirtz, 1995; Schlinger, 1995). Such analysis, of course, discards appeals to a “moral sense” or any such entity to explain moral behavior. As with any behavior, the evolution of moral behavior, as explained through selection by consequences, implies an “unintentionalizing and de-teleologizing” of such behavior (Day, 1977, p. 207).

Conclusion

Ethical behavior is important to behavior analysis in a variety of ways. First of all, ethical behavior, as with any behavior, can be treated as a proper scientific subject matter. Behavior analysts aim to identify the complex variables that control classes of verbal and nonverbal behavior usually studied in the field of ethics. We want to know why people do what they do, and why they call certain things "good" or "bad", "right" or "wrong", etc.

The scientific treatment of ethical behavior allows radical behaviorists to offer distinct solutions to traditional philosophical problems in the field of ethics. From a radical behaviorist perspective, there is no point in the search for an absolute, universal and unquestionable standard of goodness. The very act of calling something "good", as part of our behavior, must be explained from a selective viewpoint. The old "is-ought" problem can be tackled in a new way. "Is" and "ought" are instances of verbal behavior, and we can only know what they "mean" - and to what extent they are "translatable" into each other - by identifying the variables that control their emission.

As researchers and practitioners, behavior analysts are continuously confronted with ethical questions. Most behavior analysts agree that we cannot justify any fundamental value by appealing to science - behavioral or otherwise. Moreover, the adoption of any value by behavior analysts does not, by itself, resolve the complex ethical problems that we have to face. This suggests the need to maintain a "serious and open dialogue on how we, as a community, can make valued ethical decisions and use them as guides to scientific action" (Ruiz & Roche, 2007). Behavior analysis has no way out of the ethical debate. To better serve the cultures in which we do our jobs we must participate in ethical debates as equals - with the right to our own voice, but always open to the voices of any person or group potentially interested in the results of what we do. Moreover, we must continually examine “the contingencies governing our own behavior” as behavior analysts (Day, 1977, p. 206; see also Holland, 1974, 1975, 1978a).

We live in increasingly complex times regarding ethics, with many serious problems to resolve and difficult decisions to make. This should make clear that ethical discussions are not meant to have a proper end. We have good reason to expect that a transparent and inclusive interchange between behavior analysis and the cultures that support it will yield the best ethical results that our science can produce.

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2 Behavior Analysis, creativity and insight[1]

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The premise supported by Behavior Analysis (BA) envisions the understanding of any behavioral phenomenon, regardless of its level of complexity (Skinner, 1953/1965; Baum, 1994; Catania, 1998). Although historically the strategy used on experimental investigations was strongly marked by inductivism, focusing at fist on more simple aspects, the transition from behavior "analysis" to "synthesis" was predicted since its foundation, losing its meaning without such complementation. (Carvalho Neto, 2002). In fact, several phenomena described as complex had already been and/or have been target of behavioral investigation (language, thought, subjectivity, cognition, etc.). The denial in providing a response without previous and careful accumulation of data doesn't necessarily mean lack of interest on the subject, on the contrary, it means to acknowledge the task seriousness (Skinner, 1953/1965).

To that matter, behavior analyst have and still are frequently accused of having ignored or not having explanatory tools for complex behavioral events, such as, creativity and originality (Skinner, 1974). A collection of works attempts to answer to this kind of criticism indicating possible theoretical interpretations

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1. This study is partially based on Carvalho Neto and Barbosa (2010). Contact: marcusbentesufpa@gmail.com
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(behavioral) for creativity (Epstein, 1980; Skinner, 1974; Sloane, Endo, & Della-Piana, 1980; Wells, 1983) and/or presenting empirical researches that would forward the explications of aspects related to it (Epstein, 1996; Hunziker, 2006; Marr, 2003; Neuringer, 2004; Shahan & Chase, 2002).

In general, such studies deal with specific phenomena that are already acknowledged as "creative" (such as insight and language, for example) and adopt the concept of operant as a basic explanatory resource. Despite the importance of such studies, the creativity concept still needs better systematization and range, because it cannot be limited to isolated lines of research.

Therefore, the objectives of the current study are: (a) present how BA deals with creative behavioral processes, chiefly those not acknowledged as such; (b) discuss the concept of creativity, in the attempt to produce a wide and functional definition of creative behavior; (c) explore a particular case of creativity, insight, based on the generative theory of Epstein (1996).

I – Creativity as an operant

On the initial part of his work, Skinner (1953/1965, 1957, 1969, 1974) approached creative behavioral processes inside the frame of operant behavior. Later, with the formalization of the selection by consequence model, Skinner (1981/1988, 1990) made use of selectionism as a broad explanatory tool. The literature on creativity classify these types of approaches as "associationist" for adopting "associative processes" as essential causes of the phenomena (Busse & Mansfield, 1980; Brown, 1989). In this context there are authors that derivate their interpretative propositions on the ones elaborated first by Skinner (Epstein, 1980; Sloane, Endo & Della-Piana, 1980 and Wells, 1986, for example) and authors that proposed their own associationist theories (as Campbell, 1960 and Mednick, 1962, for example).

Skinner and some authors inspired on his work basically proposed that creative behavior would be an operant, subjected therefore to the same laws (such idea was previously and widely explored in Skinner's works here mentioned and in works of Barbosa, 2003, Bandini & De Rose, 2006 and Nelson, 2006, for example). The origin of creativity would be a matter of variation and ontogenetic selection. Later, this explanation was extended with the notion of selection by consequence (Skinner, 1981/1988, 1990). In this context, creative behavior, as well as the others, would be the result of variation and selection processes that occur in three levels: phylogenesis, ontogenesis, and culture. Its followers seem to have emphasized only one or another aspect approached by him. For example Sloane, Endo and Della-Piana (1980) explained creative behavior as a result of a rare variation under informal or weaker stimulus control, what would enable new arrangements. Non-usual antecedent stimulus controlling different responses would explain different effects produced for an audience that would name such event as creative. Wells (1983), on his turn, suggests the existence of three basic factors in a creative behavior: a problem as antecedent stimulus, variation of responses producing new forms and functions of acting, and at last, group recognition through social reinforcement. Epstein (1980), remarks that the term creativity is used in contexts in which a clear environmental determination is not possible. Thus, to him, the term creative is restricted to name the patters of responding to those still unknown control variables. Therefore, that would be a "negative" concept (indicating the unknown), instead of "positive" (indicating what is known).

Another assembly of work investigates creativity through interrelated specific behavioral processes. Behavior variability, induced (Skinner, 1938; Antonitis, 1951; Eckerman & Lanson, 1969) and learned (Pryor, Haag & O'Really, 1969; Neuringer, 2004; Hunziker, 2006; Abreu-Rodrigues, 2005), occupy a special place in this area. By observing that variability is itself a delicate dimension to reinforcement, thus could be selected through contingencies

arrangements, one of the ways to teach creativity was to explicitly reinforce different response patters (Goetz & Baer, 1973; Glover & Gary, 1976; Holfman, Goetz, & Baer, 1977; Goetz, 1982 and 1989). Those studies in the applied area based their methodology on Pryor, Haag and O'Really (1969) a study performed with dolphins.

Maltzman (1960) assembled the main experimental results until the 1950s that contributed to the development of techniques to produce original behavior and for an analysis of the processes involved on its production. A previous discussion of this author separates the processes of originality and creativity. To Maltzman, the original response is related to the unusual character of its occurrence at a given contingency, on the other hand, creative behavior would yet deal with social recognition of such behavior as relevant, based on the effects produced by it.

According to Maltzman (1960), four training procedures were, until then, the most common to increase originality: 1) present an unusual stimulus situation, in which the usual responses wouldn't be available; 2) evoke different responses for a single stimulus situation; 3) evoke unusual textual responses; also 4) provide instructions to behave originally. Maltzman and his collaborators (cf. Maltzman, Gogartz & Berger, 1958; Maltzman, Simon, Raskin & Licht, 1960) performed a series of studies testing he effects of such variables on the production of original responses, and the results showed that evocative trainings or instructions produced an important augmentation in those responses, even larger when both strategies were combined.

A conclusion derived from the results obtained by Maltzman's group is that producing successive original behavior can be maintained through reinforcement and continue to happen in new situations, although that depends on the type of stimuli used, for generalization of originality would not always happen. On the experiment done by Maltzman et al. (1960) it was observed that the use of the same words as stimuli for evoking other original verbal responses

was not always successful, perhaps due to the limitation of a single verbal stimulus produce a large number of original verbal responses associated to it.

Despite some individual advances on basic and applied research, and some general interpretative effort, the concept of creativity remains yet mainly obscure. On the next topic an interpretation attempt is presented.

II – A conceptual analysis of creativity

There are dozens definitions for creativity, inside and outside psychology (Boden, 2000). In general, propositions purely theoretical prevail, strongly marked by the common use of the term. The use of metaconcepts, concepts that are derived from other concepts (already poorly described) is also frequent. Mooney (1963), for example, dismember creativity in “creative process”, “creative product”, “creative person”, and “creative situation”, however, such taxonomy is done without the definition of the main concept: “creative”.

The standard concept has elements that suggest a phenomenon inflexible to rational exam. Creativity derives from the greek *creatus, creare*, that means bring to life something new by inspiration (divine or earthly). On the Christian period, the term creation prevailed, which means and act of God “creating everything out of nothing”, according to His own designations, His reasons were not accessible to man. This use had a contrast with facere, that was constrained to the mundane creation, restricted to the human universe, and liable to rational comprehension. In the Renaissance, on the other hand, the most meaningful and elaborated creation (in arts and science) was guided by divine inspiration, and was understood as a typically human characteristic; however its mechanisms remained mysterious (Tatarkiewicz, 1980).

Boden (1994), on an attempt to characterize the current context, comments:

> (...) many people assume that there will never be a scientific theory of creativity - for how could science possibly explain fundamental novelties? As if all this were not daunting enough, the apparent unpredictability of creativity seems to outlaw any systematic explanation, whether scientific or historical. (p. 75)

And continues:

> If we take seriously the dictionary definition of creation, ‘to bring into being or form out of nothing,’ creativity seems to be not only beyond any scientific understanding, but even impossible. It is hardly surprising, then, that some people have ‘explained’ it in terms of divine inspiration, and many others in terms of some romantic intuition, or insight. From the psychologist's point of view, however, ‘intuition’ is the name not of an answer, but of a question. How does intuition work? (p. 75).

In search for a rational comprehension of the creative phenomenon, many propositions were made. Brown (1989) presents a general panorama, identifying the main attempts to explain it from the psychology’s point of view. In his classification, the author identifies creativity as (a) an intervenient variable, (b) as a trace, (c) as an unconscious process, (d) as an element in problem solution, and (e) as an associative process. It is noted that all of them mention more precisely the origin of creativity instead of its definition. From an analytical-behavioral standpoint, the last, creativity as a product of associative process, seems the most plausible and this alternative will be further explored. However, before that, it is necessary to better characterize what it is a “creative” event.

Oliveira-Castro and Oliveira-Castro (2003) look for a definition for an equally important, problematic, and related term: “intelligence”. Analyzing the

context the term is more frequently used, they conclude that: “An analysis of the use of intelligence in ordinary language indicated that the concept has an adverbial function, which characterizes an action as successful or well executed under certain conditions.” (p. 1).

Therefore, for the authors, there wouldn’t be a specific behavior named intelligent, as “play” or “speak”. It would be, on the contrary, a property or characteristic attributed to any behavior: play or speak “intelligently”, for example. However, which characteristic or qualities would be attributed to intelligence? The authors identify some basic elements:

> The use of the concept of intelligence in ordinary language seems to follow the same logic, for it has the adverbial function of characterizing the manner according to which an action is executed. An intelligent action could be almost any action that: (a) is well performed and successful, in the sense of following specific criteria of good performance in the task; (b) represents the exercise of certain ability of the individual, that is, good performance or results were not due to luck, for the individual can repeat actions of that sort; and (c) occurs in a situation involving some degree of novelty and challenge, that is, the action is not simply a repetition of a well-established performance, what differentiates an intelligent action from a habit (Oliveira-Castro & Oliveira-Castro, 2003, p. 6).

Based on these three properties it would be possible to disclose the uses of these terms in our culture. Nonetheless, the term intelligence does not necessarily describe specific behaviors. A common use is to name the agent of the action as “intelligent”. In other words, someone is intelligent or has intelligence and because of that does intelligent things. A person is then considered intelligent if presents a set of behaviors with the properties

described before: “The expression [John is intelligent] functions as an imprecise adverbial characterization of several things that John does, that is, it works as an ‘adverbial summary.’ (Oliveira-Castro & Oliveira-Castro, 2003, p. 8, brackets added).

The interpretation proposed by Oliveira-Castro and Oliveira-Castro (2001) to the concept of intelligence seems to fit in many points of the concept of creativity: the term, for example, doesn’t indicate a specific action, however certain characteristics of an action (whichever that is). Therefore, we can play, speak, sing, smile, etc., in a creative fashion.

The use of creativity as an adverbial summary is not uncommon either: someone is considered creative for presenting a set of actions classified as such. Nonetheless, can all three defined properties identified in the use of the term intelligence fit?

A more evident property would be the novelty, or the unprecedented character of the action. A behavior would be named creative if it would maintain some original component (not previously existent) however, what is the extension of this novelty? Hunziker (2006) discusses such aspect:

> What degree of difference is required? Does it suffice to be different than some behaviors emitted recently or does it have to be different from any previously emitted behavior? Is it mandatory to be entirely different from any behavior already emitted by the individual (do something never done before) or does it suffice to be different from the behavior previously emitted by the subject in that environment (to do something that has never been done in that condition)? In a more radical manner, can it be considered that, to be creative, it is essential that a behavior is different from any other behavior presented by a member of its species? For example, when Armstrong, the astronaut, stepped on the moon for the first time, this behavior was different from all the others already presented by

> the human species. Is that enough to be considered creative? A song, new to some, but known by others, is it creative by some but not by the others? Such questions seem to point out to an aspect to be considered in the analysis of creativity: the characteristic of being new/original/creative is not a property of the behavior, but a property provided by the references to which it is being compared, in a certain universe. In other words, the characterization of a behavior as creative is mutant and relational, which makes its analysis fairly complex" (Hunziker, 2006, p. 157, original underlining).

Therefore, as a relational concept, an action is new or not in an external reference frame (relatively arbitrary). Young (1985) comments in regards to that:

> Originality implies being the first of its kind. It suggests Original something that has never been done before. Thus you must know what has gone on before - you must know history. (...) Originality depends upon context. If you don't know the context, you can't evaluate its uniqueness (p. 83).

Nevertheless, being original or different would be only one of the common properties to intelligence and creativity. How about the other properties identified by Oliveira-Castro and Oliveira-Castro (2001)?

Another criterion would be the success of the action in some context or more generally its effect in solving some problem (MacKinnon, 1962). This success or this effectivity is in several contexts defined by the social group (Stein, 1953 and 1968). Boden (1994) comments:

> The novel combinations must be valuable in some way, because to call an idea creative is to say that it is not only new, but interesting (...).

> However, combination theorists typically omit value from their definition of creativity. Perhaps they (mistakenly) take it for granted that unusual combinations are always interesting. (...) ('Certainly, little Ms. Jane Gray could not have had that particular idea before – but it's not worth having, anyway. You can't call it creative!') Such value judgments are to some extent culture-relative, since what is valued by one person or social group may or may not be valued – praised, preserved, promoted – by another (...) (p. 75, 76, and 77).

The result from a creative action can be the elimination of a diseases or the production of a tool that increases the amount of food available for a population (more natural consequences) or a way of painting, or playing an instrument, producing different perceptual or aesthetic effects recognized by a group as advances in a reference frame (arbitrary consequences). Speaking about success or efficacy in this scope is to transition through these two universes of reinforcing consequences (natural and arbitrary). This use also seems to be applicable to the concepts of intelligence and creativity.

The last classification criterion presented by Oliveira-Castro and Oliveira-Castro (2003) is the requirement that the action cannot be accidental or incidental, on the contrary, it must be part of the skills of an individual. In this moment, there seem to be a detachment between the concepts, whereas a creative action doesn't need to attend this demand. Rosenman (1972), for example, describes a vast assembly of "creative" scientific findings that were product of a happy accident or "serendipity": penicillin, X-rays, the anesthetic effect of nitrous oxide, electric current, and microwave radiation, among many others. Alencar and Fleith (2003), making reference to MacKinnon (1964), presented three basic conditions to classify a creative event:

> [a] It involves a response or an idea that is novel or at the very least statistically infrequent. [b] It must to some extent be adaptive to, or of,

> reality. It must serve to solve a problem, fit a situation, or accomplish some recognizable goal. [c] True creativeness involves a sustaining of the original insight, an evaluation and elaboration of it, a developing of it to the full (p. 485, brackets added).

The last condition predicts not only the occurrence of a new pattern that solves problems, but an action that, additionally, was refined since its first occurrence. As such additional requirement, mostly arbitrary, not justified, it disregards a large number of events acknowledged as creative, as the ones involving serendipity, for example, perhaps the concept must broaden its scope removing such criterion. A single and accidental action, not consolidated in a person's repertoire, may be considered creative, even though it is not considered "intelligent" according to the analysis of Oliveira-Castro and Oliveira-Castro (2003).

Thus, a behavior to be acknowledged as creative or original in our culture should attend two basic criteria: (a) be new or original in some dimension (in antecedent control and/or in some property of the response); and (b) produce relevant consequences (natural or arbitrary).

It is obviously a temporary definition, but that should not paralyze the researches in this field. As stated by Epstein (1980): "Defining a natural category is a thankless if not impossible task and in fact unnecessary for a functional analysis of behavior. On the other hand, when we can agree that someone has behaved 'creatively,' it may be useful to determine the controlling variables." (p. 65).

Preliminarily defined what makes an event creative, we can now ask whether behavior analysis would accommodate events of this nature. A traditional reply is to directly attack phenomena that are historically acknowledged as involving creativity (language, insight, variability, etc.).

Nonetheless it is also possible to identify in more basic processes some creative elements. The next topic intends to extend this discussion.

III- Would there be room for "non-creative" events in behavior analysis?

Contrary to what it is suggested by the critics; in BA there is no behavioral event that does not present any property or dimension of creativity, chiefly variability. A basic concept in this area is response class (Skinner, 1938; Sério, 1983). A response is never equal to another. There are variations happening in some dimension of responding at every new occurrence. Therefore, strictly speaking, it wouldn't be possible to talk about environmental variables that elicit, strengthen or weaken an immutable, stationary response. What we have are responses with common properties, clustered in functional or topographic classes, under the control of environmental variables (Catania, 1998). Baum (1994) making an analogy with natural selection, uses the concept of "population of responses" to refer to these groups of responses forming a single class, in a continuum process involving variation, selection, and retention. Variability would be an inherent characteristic to behavior itself, and the concept of class of response incorporates this notion to the basic explanatory tool of behavior analysts.

The effects of consequences on a class of responses, occurred in a given context, would be the type of basic relation summarized in a three terms contingency (Skinner, 1953/1965). The effects of consequences would also be productive and not stereotyped. When a class of response is reinforced, other adjacent responses (topographically or functionally) are also indirectly affected. The phenomenon of induction predicts exactly the extensive character of reinforcement (Catania, 1998). Therefore, reinforcement acts direct or indirectly on classes of responses, in and outside of its strict space-temporal width. Reinforcement, therefore, has creative properties, either for acting on classes of

responses, and not on the same individual response, or for extrapolating its effects to not directly trained classes (emergent character).

This productive effect is also observed on the first element of the triple contingency: when a class of response is strengthen in the presence of a stimulus, other antecedent stimuli also gain indirect control on this pattern of response. This phenomenon is named stimulus generalization (Skinner, 1953/1965). Thus, it is also inexistent, as the result of a history of reinforcement, a responding under the strict control of an antecedent stimulus. In fact, it would not even be possible to speak of "a single reinforcement". There are variations in any of its multiple dimensions, also in this element at every occasion. The notion of class would also be applicable to this case. There would be, then, a class of antecedent stimuli controlling a class of response, both affected by a class of consequent stimuli.

These three fundamental concepts – class of response, induction, and generalization, demonstrate how BA already deals with behavioral processes with creative properties. Stereotypy, and not variability or creativity, would be strange to the analytic-behavioral framework.

IV- Insight and interconnection of repertoires: an experimental investigation model of creativity

By considering novelty and variability as inherent properties of behavior, it is also expected that the conceptual framework of BA is able to predict and control what organisms can do in new situations. A paradigmatic experimental study in this theme was Epstein, Kirshnit, Lanza and Rubin (1984).

The authors (Epstein et al., 1984), inspired by a classic problem situation developed by Köhler (1917/1948), tested pigeons (*Columba livia*) in a situation that pecking a disk would give access to a portion of food. The problem was in the target not being in the pigeon's reach, the only way of reaching it would be

pushing a box towards the target, stand on it, and peck the target. This test was later called “box displacement test” (Cook & Fowler, 2014). Two pre-requisite repertoires were trained independently: 1) directed pushing (a box should be pushed towards a green target), and 2) stand on the box and peck a target (a plastic banana fixed on the ceiling of the experimental chamber). The animals that received the training of the two pre-requisite repertoires solved the task swiftly, without pauses between the emissions of the responses that constituted the solution. At first, these subjects demonstrated what the authors call a state of “confusion” that consisted in staying between the box and the target, emitting responses towards both. After this initial moment, the pigeons started to push the box towards the target, stopped pushing when the box was close to the target, stood on the box, and pecked the target. Other pigeons received an incomplete training, as the training of only one of the two repertoires, or the training of standing and pecking and non-directed pushing. In all of these cases, none of the pigeons presented the same well succeeded performance of animals that received the complete training.

The results of Epstein et al. (1984) identified the role of history of training as a decisive variable to the subtle solution of a task; for the animals with none of the behavioral pre-requisite repertoire could not solve the problem, while the ones with the proper repertoire could promptly solve it. Shettleworth (2012, p. 217), specialist in animal cognition, places the work of Epstein et al. (1984) as a landmark in the study of animal “insight” in the 20th century, sided by Köhler (1917/1948). Köhler was a pioneer in showing that chimpanzees (*Pan troglodytes*) demonstrated original and creative behaviors in problem-situations created in a controlled environment. Epstein et al. (1984) demonstrated the origin and a course to build these original behaviors from a history of controlled training. The authors (Epstein et al. 1984) named this process interconnection of repertoires. Interconnection of repertoires is a behavioral process in which repertoires learned independently (that is, not sequenced and not chained) can

be interconnected into a new sequence, given an adequate discriminative control (a problem situation).

After the studies of Epstein et al. (1984), other studies tested the interconnection of three repertoires, by dismemberment of standing and pecking in two separate trainings (Epstein, 1985; Luciano, 1991), the interconnection of four repertoires with the inclusion of a door that gave access to the box (Epstein, 1987), and recently (Cook & Fowler, 2014) it was tested whether the pigeons presented any indication of "causality understanding" in a replication of the original study of Epstein et al. (1984) with two repertoires. Cook and Fowler (2014) performed this study exposing pigeons that were trained to push two distinct boxes (one functional and other non-functional) in the box displacement test. In the test situation, both boxes were available, but only the functional box led to solving the problem. In this test, both animals pushed the boxes at random. The authors (Cook & Fowler, 2014) discussed that only the training of the pre-required repertoires, as done by Epstein et al., (1984), is not sufficient for pigeons to present in this task, what the authors called "understanding of causality" or "means-end processing" (that is, the emergence of the response of choosing the correct box).

Up to that period, all the observations of interconnection of repertoires were obtained with pigeons in variations of the same problem, the box displacement test. The lack of generalization of the phenomena nurtured critics which pointed out that, possibly what was observed in the data was nothing more than a methodologic artifact of pigeons in situations in which there was nothing else to do but to emit the responses that led to the solution of the problem (Ettlinger, 1984). Nonetheless, in the latest years the interconnection of repertoire was observed in different tasks, with different species as capuchin monkeys (Delage & Galvão, 2010; Delage, 2011; Neves Filho, Barros, Costa & Carvalho Neto, in press; Neves Filho, Carvalho Neto, Tayteulbaum, Malheiros & Knaus, Submitted), albino rats (Delage, 2006; Tobias, 2006; Ferreira, 2008;

Delage & Carvalho Neto, 2010; Leonardi, 2012; Neves Filho, Stella, Dicezare & Garcia-Mijares, 2015), New Caledonian crows (Taylor, Elliffe, Hunt & Gray, 2010; Neves Filho, 2015) and humans (Sturz, Bodily & Katz, 2010). The studies with capuchin monkeys and albino rats, performed in Brazil, will be used as examples of recent advances acquired by empirical research on the interconnection of repertoires.

With capuchin monkey (*Sapajus spp*.), Neves Filho et al. (Submitted) observed the interconnection of two repertoires: 1) joining tools, and 2) rake food using a tool; in a task also inspired by the classical experiment of Köhler (1917/1948) with chimpanzees. At the final task, a translucent box with food inside was visible but out of reach, and a pair of joinable tools, never seen by the subject, was available. To solve the problem it was mandatory to join the parts of the tool and use it to reach the food. Six monkeys were used in the experiment, separated into two groups. One group received a balanced training of both repertoires (same amount of sessions and same learning criteria), the other group received an unbalanced training (larger amount of training and more strict criterion for *raking*, in comparison to joining tools). In both groups, the repertoires were trained independently. Before the beginning of the training all the subjects had to a pre-test session in order to check whether they were able to solve the problem without any training of the pre-requisite repertoire. None of the animals solved the task in the pre-test. At the final test, after the training, all the subjects solved the task in the first attempt, in less than 5 minutes, however, with distinct topography of solution. The subjects that received a balanced training began the session joining the pair of tools (the first response for the solution of the problem), nonetheless, they did not immediately used the joined tool to rake food. These animals, before raking with the joined tool, threw the tool around in their environment, after some seconds were past, they started raking with the joined tool. The animals from the unbalanced group started the session with attempts to rake the food with only one of the parts of the tool (a

response that does not lead to the solution), what was followed by the response of joining the tools. These animals readily used the joined tool to fish the food. From these data, in the words of authors as Cook and Fowler (2014), it is possible to infer the presence of an understanding of causality, as well as an absence of it. The animals that began the session with the correct response (fitting) didn't use the fitted tool immediately to reach the food, what would indicate a lack of "understanding" of the task. On the other hand, the animals that readily used the joined tool indicated that the joining happened "in order to solve the task", what can be considered an indicative of their understanding of causality. In fact, both topographies can be explained by the different training history given to the subjects, or in other words, it is a specific training history that leads the animal to present what researchers interested in cognition call understanding of causality. The animal that begins the session with attempts to rake with only one part of the tool is already responding under the control of the box out of reach, which is the matter in question, while the other animals that begin by joining the tool demonstrated that the problem was only in joining, what was previously sufficient to acquire food. The different histories altered the probability of emission of the first response in the test situation. A balanced history made the joining of the tools more probable, because at the beginning of the session there was the discriminative for this response: two available tools (in the raking training there was only one tool available). An unbalanced history, with a longer raking training increased the probability of raking to happen in the beginning of the session. By the occurrence of raking, it is assured that the animal is responding to the problem planed (raking the box), not only emitting a response that produced reinforcement in similar previous situations (as it was the case of the group with balanced history). Beginning with the attempt to rake with only one piece of the tool can be considered what was already called by Köhler (1917/1948) a "good mistake", a behavior that indicates that a subject is responding under the control of the task planed by the experimenter, which was

a direct result from how the pre-requisite repertoires were trained in this experiment.

In another study, also with capuchin monkey (*Sapajus spp*.), Neves Filho et al. (In Press) manipulated the training and test contexts. In all the studies with pigeons, rats, and monkeys, the training and test contexts were similar. Using the same problem and pre-requisite repertoires from Neves Filho *et al.* (In Press), a repertoire (joining tools) was trained in an experimental chamber and another (raking) in the home-cage the animal lived in. The test was performed in the same home-cage used for the raking training. The training of both subjects was unbalanced, similar to the one that produced the interconnection of repertoires in Neves Filho et al. (In Press). Both participants solved the problem, however, with the same delayed topography, with pauses between the emissions of the responses that constituted the solution, as did the participants of the balanced group in Neves Filho et al. (In Press). The data indicate that distinct training and test contexts hinder the interconnection of repertoires, something already demonstrated in similar studies with rats (Maier, 1931). In this task with capuchin monkey, unbalanced training produced a swift solution, with no pauses, but only when the repertoires were trained in the same environment. These data indicate that more training variables may possibly facilitate or disturb the interconnection of repertoires in a given task, also that training only the pre-requisite repertoires is not sufficient for the occurrence of interconnection.

Moreover, in the scope of the discussion about “understanding of causality”, authors as Lavalle (1999) and Visalberghi et al. (2009) proposed that the investigation of such perspective defended by these authors is that studies in which the subjects make stereotyped use of tools – including the use of familiar tools in new contexts, new tools in familiar contexts, and also familiar tools in unprecedented contexts – would be evidence that animals would have

an understanding of the function of the tool, not only responding stereotypically in the presence of a familiar stimulus.

In order to forward this discussion, Delage and Galvão (2010) performed an experiment with infant capuchin monkey (*Sapajus spp*.) in which the training and tests situations were very different from each other. The subject was exposed to an initial test in which a piece of equipment called "*cuieiro*" was placed outside the animal's home-cage, out of its reach. This piece of equipment was composed by a metal frame that sustained three wires placed horizontally, each one trespassing three "*cuias*" (bowls) creating a 3x3 matrix of bowls, where pellets of chocolate cereal were available. In case the subject hit the border of the bowl, it spun on its own axis dropping the cereal on a tube that led the food into the animal's cage. Parallel to that, two joinable bamboo sticks were given to the subjects. If used separately the sticks wouldn't reach the bowls, but would work properly if joined. Even though they already used sticks to reach for food out of their direct reach, the subjects weren't capable of solving the problem for not having joined the sticks, spending most of the time emitting responses towards the *cuieiro*. Then, the training sessions of pre-requisite repertoires began.

Two groups of training sessions were performed: (1) training in reaching the *cuieiro* with a simple stick, straight and made out of bamboo; (2) fitting the two bamboo sticks, one of them had a T-shaped extremity, and use it to rake a food pellet on a wood platform. Both were done with the animal inside the cage and it had to reach food pellets outside the cage; whereas the training sessions of repertoire 1 were performed at the same place the baseline session happened and where the final test session would be performed, the training of repertoire 2 was performed at a position exactly opposite to that. Both training sessions were performed on alternate days, the same amount of sessions were performed for both repertoires.

When the training sessions were finished for each repertoire, the problem was again presented to the subject. Even though the final test was similar to a training situation (*cuieiro* out of direct reach), the task demanded skills trained in another context (joining sticks on a platform). As an additional variation regarding the training situations, the sticks available were new to the subjects: were made of aluminum (different material), longer, and thinner than the bamboo ones (different dimensions). To complete, until that moment, the subject was trained to "join and rake", and now it should "join and hit". In this situation the subject succeeded in solving the problem, concluding the task in less than 3 minutes. Moreover, in the follow up 20 days after the original test, the subject solved more complex variations of the test, that included the use of meta-tool (using one half of the stick to reach the other, out of its direct reach) and search for parts of the stick hidden from it at a first moment.

Considering that: (1) the tools used in this test were new for the subject; (2) the test situation didn't evoke joining responses, once the training context of these skills were not the same; and (3) the required sequence of responses to solve the problem was not the same one directly trained in previous phases. The results of this study seem to corroborate to the proposition of Anderson and Henneman (1994), according to them the diversity and richness of training would make it possible to identify a response pattern as the "comprehensive" type, as the use of tools would be derived from its functional properties, not based at a stereotyped repetition of learned patters in controlled training situations.

Similar discussion can be done based on the criteria of "intelligence" of Oliveira-Castro & Oliveira-Castro (2003), as the criterion success is reached, because the subject had success in the task; the reoccurrence of problem solution in the follow up sessions indicates that the solution wasn't incidental; the novelty effect is regarded not only in the first test, but also along the success of the subject in variations of the problem, as in situations involving the

use of meta-tools and occultation of some parts of the elements essential to the solution.

Thus, studies with capuchin monkey point out that a complete knowledge of training conditions can help elucidating issues regarding response topographies at the moment of solving a problem. Moreover, it is here observed that for the problem solution to reach the criteria for an “intelligent” solution, apparently it is necessary that rich and generalized trainings are provided.

Regarding albino rats (*Rattus norvegicus*), several studies attempted to observe the interconnection of two repertoires in the box displacement test (Delage, 2006; Tobias, 2006; Ferreira, 2008; Leonardi, 2012). In all of these studies, the performance of rats in the first exposure to the box displacement test was very different from the performance observed in pigeons in the same test (Leonardi, Andery & Rossger, 2011). In all of these studies only two subjects solved the final task with a similar performance to the pigeons in Epstein et al. (1984), one in Tobias (2006), and another in Ferreira (2008). In both cases that the swift solution was observed, one of the subjects needed longer training (Ferreira, 2008) and the other solved the task only after the elements “climbing the box” and “standing” were explicitly taught as in Epstein (1985), after the first test was negative (Tobias, 2006). Possibly, in this case, the box displacement test is not a very appropriate test for this species, whereas rodents as albino rats are animals with low visual acuity (Slotnick & Schellinck, 2002). Pushing a box towards a target, standing on it, and pulling another target that is above the head are tasks with mainly visual stimuli. With that in mind, Neves Filho et al. (2015) conducted an experiment with albino rats (*Rattus norvegicus*) in a different task that involved the interconnection of two repertoires: 1) digging, and 2) climbing. Both repertoires were trained independently. Digging was trained in a box where pieces of food were buried in sawdust; climbing was trained in two flights of stairs that lead to a platform where there was a piece of food. In the test session, the access to both flights of stairs was blocked by a

translucent acrylic hurdle. The floor of the chamber during the test session was covered with sawdust, underneath it there was a gap in the hurdle that served as tunnel, submerged in sawdust, that led to the other side of the chamber, and to the stairs. The task solution required digging the sawdust, finding the tunnel, going through the tunnel, and climbing the stairs. Six rats were used in the study, divided into 3 pairs. One pair received training for both repertoires, another one received only the training for digging, and the other one only for the climbing. All the subjects did a pre-test to check whether the final problem could be solved without training the pre-required repertoires. None of the six rats solved the problem in the pre-test, after the training, only the pair that received the training for both repertoires could solve the problem. The solution of the pair that received the full training was swift and with no pauses between the responses. Both subjects, upon the beginning of the session, emitted responses towards the platform that had the food and readily started to dig close to the hurdle, what lead to the access to the tunnel and to the stairs. The other four subjects that received only part of the training emitted responses of digging in the test session, including the vicinity of the hurdle, but didn't cross the submerged tunnel. These four subjects received after the test the training of the second repertoire and were re-exposed to the test situation. From all four, only one solved the task with long pauses between the emissions of the responses that constituted the solution. Again, it is not sufficient to train the pre-required responses, at any order, to observe interconnection.

With all that data in hand, it is possible to affirm that there has been advances in the study of interconnection of repertoires as a basic process. The demonstration of this phenomenon in species other than pigeons, and in different tasks, brought more robustness to the knowledge acquired on the phenomena. It was also clear that different problems need to be developed according to the characteristics of the studied species. In addition, maybe the most important issue raised by these researches is that different training

variables produced different topographies for solving a problem. In other words, there are trainings that facilitate or difficult repertoire interconnection. In the classic study with pigeons in the box displacement test, the manipulated training variable was training the pre-requisite repertoires. If all the repertoires were trained, solution would happen; when part of the repertoire was suppressed during the training the solution wasn't observed. In the following studies it was assessed the effects of training properties of pre-requisite repertoires. The task to enlist ontogenetic variables that produce swifter interconnection seems tempting; however, it is possible that the effect of specific set of variables have distinct effect on different tasks and in different species. This is an empirical question yet to be solved. Despite that, interconnection of repertoires, as an empiric model of creativity, shows how an operant analysis can enrich the understanding of the phenomenon. Making use of an operant analysis it is possible to dismember a problem situation into pre-requisite repertoires and then train them. Moreover, based only in basic processes, it is possible to predict and control what an organism will do at a problem situation when confronted with it for the first time.

As repertoires, interconnection deals with the fist emission of behaviors (as the interconnected behavior is itself new), one can asks if it is in fact an operant behavior (Leonardy, Andery & Rossger, 2011). As discussed in the first sections herein, operant behavior is a term that deals with classes of responses selected by their consequences. It implicates that, single events by definition cannot be considered operant, for it cannot be observed the effect of selection, for there wouldn't be future occurrences (Glenn, 2004; Leonardy, Andery & Rossger, 2011). In fact, the first occurrence of interconnection is a single effect, as the interconnected response comes into contact with the consequence of solving the problem, this new responding becomes an operant, the effect of selection by consequences may easily be observed in all the experiments with repeated exposure to the problem situation (Neves Filho, 2015). However, as

already mentioned in part III of the current text, it is possible to look at interconnection of repertoires as the result of the "creator" function of reinforcement, such as induction and generalization. Interconnection occurs from operant training of pre-requisite repertoire and the responsible for this interconnection are discriminative control of the problem situation, and training history.

V – Final considerations

The study of behavior is intrinsically a study based on new events, given that every behavior occasion is unique (either by its topography or by its spatiotemporal location). All conceptual repertoire of BA was built taking into account the idiosyncrasies of the phenomena, and from that some concepts as class of response and basal variability of behavior are derived. The behavior analyst, when planning an experiment, inevitably works with responses somehow innovative in the ontogenetic level, either in installing the manipulation of an *operandum*, or the emergence of a response indirectly trained. The results of the experiment emphasize the effects of selection on these innovations. In this sense, creativity was always present in laboratories and in theories with behavior analytic basis.

Notwithstanding, creativity is yet commonly seen as an excessively complex process for the supposedly limited theoretical and methodological framework of BA. As BA is a science concerned with prediction and control, the data obtained in basic research not only extend the knowledge about mechanism involved in the origin and maintenance of a new behavior, but also make it possible the planned production through a behavioral technology. Such technology of producing creative behavior, as dreamed by Skinner (1968) is somehow demonstrated by the studies of Maltzman, Goetz and Glover (Maltzman, 1960; Maltzman, Simon, Raskin & Licht, 1960; Maltzman, Gogartz, &

Breger, 1958; Goetz & Baer, 1973; Glover & Gary, 1976; Goetz, 1989) that remove creativity out of the personal, intern, mysterious and incidental scope and places it in the scientific, verifiable, cognizable field, democratically reachable to everyone.

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3 Behavioral Analysis of law: a brief overview of the juxtaposition of law and radical behaviorism[1]

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It would be fair to say that, academically, legal study and other disciplines have often been wrapped up in its own world (Todorov, 2006, p. 93), treating other disciplines with an almost nihilist sense of abandon as to their usefulness, especially in Brazil. Meanwhile, social sciences tend to treat law as a mere fraction of their actual focus, a reflection of government and power, an approach which, while perfectly valid, surely leaves some of the nuances of law outside of their scrutiny.

It is certainly auspicious, then, that many studies have been breaching this separation and analyzing law directly in light of different methods and theories, with the economic analysis of law being the flag-bearer of such movement. This interdisciplinary approach opened space for several other types of analysis of law, using a multitude of sciences and methods, with varying degrees of success.

The analysis of law through radical behaviorism, focus of this paper, has certainly had a curious development, in that it never was considered one of the main or standard fields of study, particularly from the law schools standpoint, but it always refused to fade. Ever since Skinner proposed such possibility –

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analyzing law by means of radical behaviorism –, the interest in the subject, while originally not particularly strong, has been kept alive and, in the latest years, in Brazil, a major activity in the field has been identified.

Todorov (1987, 2004, 2005, 2010) and Aguiar (2013, 2014, 2015), both Brazilian authors, have been the main contributors and inspired several experimental and non-experimental papers pertaining to the analysis of law through radical behaviorism, from different start points, such as metacontingencies and the analysis of the legal norm.

It is our opinion that the reason why the conjunction between law and radical behaviorism has shown such resilience derives from the consistency of radical behaviorism as a theory capable of explaining relevant social phenomena vis-à-vis the importance of law as an instrument of affecting behavior. Consequently, a concise literature review on the subject should be significant.

Chronology of Law and Radical Behaviorism

Originally published in 1953, Skinner`s seminal work Science and Human Behavior singlehandedly kick-started the possibility of analyzing law by means of a consistent behavioral theory, namely, radical behaviorism. Together with Sigrid Glenn's concept of metacontingencies, these works substantiated a myriad of theoretical and practical studies years to come and form the bulk of the inspiration behind Todorov's and Aguiar's most prominent studies on the behavioral analysis of law.

Skinner, radical behaviorism and the analysis of law

Skinner introduces the subject by discussing controlling agencies. These controlling agencies are analyzed from the specific perspective of the types of power over variables that result in expected changes in human behavior, as well

as the controlling practices, which can be employed because of these types of power (Skinner, 1953, p. 334).

According to Skinner, a controlling agency, considered in conjunction with the individuals controlled by it, form a social system. His proposition is to consider the behavior of all participants – the controllees (those who are controlled by the controlling agencies) and the controllers (the individuals which compose the agency). His analysis tries to find out why the controllers have their power to manipulate the variables utilized by the agency, its general effects on the controllees, and how this "leads to a return reinforcement which explains the continuing existence of the agency" (Skinner, 1953, p. 335).

The link between controlling agencies and law very soon become apparent, as Skinner pronounces that (i) the government is the primary controlling agency; and (ii) the government is the use of the power to punish (Skinner, 1953, p. 335).

The power to punish can be used to affect behavior in two ways – either by punishing illegal forms of behavior or strengthening legal behavior by making the removal of a threat of punishment contingent upon the wanted legal behavior (Skinner, 1953, p. 337).

Skinner considers law the codifications of the controlling practices of the government, and an important point as to the development of governmental agencies and its ability to affect behavior of the controllees. It has two important features – specification of behavior and implication of a consequence (Skinner, 1953, p. 339).

Law tends to specify behavior from the perspective of its effect upon others. To illustrate, if an individual committed the crime of 'embezzlement', there is no designation of a specific form of response. The depiction is solely of the "properties of behavior which are aversive to others" (Skinner, 1953, p. 339),

in this case, the negative effect on positive reinforcers due to the subtraction of property of others through socially non-acceptable means.

The consequences implied by the laws, on the other hand, are commonly some form of punishment, although they can also be some type of prize. By maintaining the contingency of reinforcement, governmental agencies can use law to affect future behavior of controllees, while simultaneously describing past practices (Skinner, 1953, p. 339).

Skinner understands that conditioning of controllees is not executed by the governmental agencies, but other parties, which would be a consequence of the ubiquitous *ignorantia legis neminem excusat* legal principle (ignorance of law excuses no one). Therefore, contingencies are established by the controllees own social circle of parents and friends, with the backing of ethical, religious and educational institutions (Skinner, 1953, p. 340).

The workings of social conditioning could be demonstrated in a situation where an individual both watches illegal behavior and the contingent punishment, as the theory expects this individual to not only avoid that behavior, but also to act as to inhibit others from showing the aforementioned behavior. Notwithstanding, Skinner notes that only rarely do a single individual spectates the behavior and the punishment, which leads to the need for mediation via complex verbal processes. These verbal behaviors, which bonds punishment and the behavior of others, are supported by the codes of law (Skinner, 1953, p. 340).

Skinner also considers how law affects governmental agencies, stating that contingencies of governmental control are maintained when these agencies identify the illegal behavior, resolve which punishment is adequate as per a legal code and perform the punishment via specialized governmental agency (Skinner, 1953, p. 340).

Skinner, however, fails to delve more deeply in the workings of law as a controlling practice of the government and of social behavior control, an omission that left plenty of space for present day scholars.

Likewise, Skinner recognizes that law itself is contingent on the idiosyncrasies of any given culture or era (Skinner, 1953, p. 341), but this affirmation and the mention of culture does not explain the strengthening of behavior widely separated from its consequences.

The link between behavior and culture was further discussed by Skinner in several opportunities (1976, 1981) and tackled in greater detail by Sigrid Glenn and her 'metacontingency' concept proposed in 1986.

Glenn and the metacontingencies

Glenn commences her definition of metacontingencies by recapping the concepts of operants and contingencies. For the benefit of potential readers hailing from law school, operant is "a group of responses that have been bundled into a functional class as a result of their having produced a common consequence" (Glenn, 1986, p. 2). A common example would be the group of behaviors related to reaching a closed door: turning the key or pushing down the handle are both possible behaviors related to the desired consequence.

On the other hand, the contingency of reinforcement is the 'if action, then expected consequence' relationship between two events. Glenn defines contingency as the unit of analysis that "describes the functional relations between operant behavior and the environment with which the organism interacts" (Glenn, 1986, p. 2).

Radical behaviorism theory had, in solid grounding, explained and proved by means of practical experiments the reinforcement of operant behavior related to either negative reinforcement (the removal or prevention of aversive stimulus) or positive reinforcement (introduction of positive stimulus). It had not,

however, a clear explanation for the strengthening of behavior widely separated in time from these positive or negative reinforcements.

Glenn defined metacontingency, then, as “the unit of analysis describing the functional relations between a class of operants, each operant having its own immediate, unique consequence, and a long term consequence common to all the operants in the metacontingency” (Glenn, 1986, p. 2).

Long-term consequences of behavior relate to culture in that wide, socially relevant transformations of human behavior affect the collective customs and social institutions of a society, therefore dictating or, at the minimum, influencing culture.

Glenn asserted that metacontingencies required intervention of several contingencies of reinforcement grouped together and organized (Glenn, 1986, p. 2). As an example, producing the consequence of reducing corruption in a country requires numerous different behaviors – legislators must write more efficient legislation, the various police departments need to increase the vigilance over illegal actions related to corruption, individual judges must punish crimes related to corruption and such punishment must, preferably, be extensively reported to the society, possibly by the media.

It is unlikely that all these behaviors occur, simultaneously, without socially mediated contingencies (Glenn, 1986, p. 3). Hence, verbal behavior, especially in the form of rules – law and its codes – form a crucial connection between contingencies and metacontingencies.

In her influential 1986 article, Glenn also reviews the behavioral contingencies engendered by the technological and ceremonial cultural processes, as posited by Veblen (Veblen, 1934), originally discussed by Glenn in 1985. In sum, technological contingencies relate to behavior changes derived from reinforcers related to usefulness and value, while ceremonial contingencies

comprises behavior the reinforcers of which derives its existence from status and position.

It should be important to note that the concept of metacontingency evolved with time and Glenn herself reassessed the discussion. In 1988, Glenn emphasized interlocked behavioral contingencies ("IBC") – a cohesive collection of operant contingencies wherein the behavior or behavioral product of one person simultaneously functions as the antecedent or consequence for the behavior of another person (Glenn, 1988). The concept was further refined by the proposition of a difference between the processes of metacontingencies, which occur in in the cultural level, and macrocontingencies, arising from an individual level (Glenn, 2004; Glenn & Malott, 2006).

Todorov: Incomplete Contingencies and Metacontingencies

As J. C. Todorov tells the story (Todorov, 2010), it was Christmas Eve, 1986, and he was acting as Dean of the Brasilia University when he first read the recently published Glenn (1986) article which crafted the metacontingency concept. Given that Brazil, at the time, was in the midst of writing a new Constitution, the entire University was aflame in discussion about the subject. It was then that the idea of the Constitution as a metacontingency sparked in his mind.

Todorov's works related to the application of radical behaviorism to law are several (1987, 2005, 2012; Todorov & De Farias, 2009; Todorov, Moreira, Prudência, & Pereira, 2005), and their focus varied. For the purposes of this literature review, we will organize his propositions in two main fronts. First, incomplete contingencies in law – legal commands that do not result in consequences. Secondly, the application of the concept of metacontingencies to law and the idea that the concept of metacontingency has evolved to allow laws to constitute metacontingencies themselves.

Incomplete contingencies

A law is a statement of a contingency of reinforcement held by a governmental agency. It is a rule of conduct, in the sense that it specifies the consequences of certain actions that, in turn, govern behavior (Skinner, 1953).

Contingencies may have been, in the past, a cultural practice made into law. Alternatively, it may represent a new practice, which comes into force with the approval of the law. Thus, laws can be, at the same time, descriptions of cultural practices adopted in the past and assurance that such behavior will be maintained in the future (Skinner, 1953).

Law serves as a means to socially control people's behavior for the sake of society. Specialized state organizations select rules (legislative), which accordingly serve as the basis for imposing punishment (by the judiciary). Based on this explanation, in order for a law to be useful, it necessarily must prescribe a consequence (usually punitive) for a type of behavior, so that the law can effectively influence the rate of occurrence of the punished behavior.

A key feature of punitive legal contingencies is that they always assume the simultaneous existence of a reinforcement contingency. It is quite simple: behavior must exist in a society in order to be punished. If people behave in certain ways, therefore that must be the result of a reinforcement contingency that conditioned and maintained such behavior. If that behavior is unwanted by the governmental agency, then the law overrides the reinforcement contingency with a punitive contingency to try to reduce the behavior frequency and probability.

Laws are comprised of triple contingencies (antecedent, behavior and consequences) interlocked into metacontingencies (Todorov, 1987; Glenn, 1986). In fact, the legal system itself derives from the same individual behavior analysis premise, based on a triple contingency: to observe the law

(antecedents), to demand that law is followed (behavior) and to apply the punishments in case law is breached (consequences).

The antecedents consist of the punishment itself – by observing others suffering the punishment or by generalizing from a punishment observed or expected. Furthermore, the mere observation of law allows for the identification of expected consequences in the event of certain specific actions.

Based on these considerations, a well-written law shall describe, through clear consequences and behaviors, not only the undesired behavior of the controllees, but also the desired behavior of punisher agencies to deal with the unwanted behavior (Todorov, 2005).

Laws, as description of contingencies and metacontingencies, or principles (e.g. "education is a universal right and a duty of the state", as stated in the Brazilian 1988 Constitution), do not guarantee that the probability of different behaviors increase or decrease by themselves. Governmental agencies use its coercion and punishment powers, through its agents, such as the police and the courts of law. The more straightforward and clearer the legal texts, the easier their disclosure and enforcement (Todorov, 2012, p. 40).

These ideas led to several studies of rules and codes of law (Todorov, Moreira, Prudência, & Pereira, 2005; Todorov & Sénéchal-Machado, 2008; Todorov & De Farias, 2009; Martins, 2011), in which the contingencies and metacontingencies of the laws were identified and the effectiveness of the law could be estimated based on the completeness of the interlocked contingencies.

Metacontingencies

Todorov's review of the concept of metacontingencies stems from the idea of interlocked triple contingencies. Behavior is considered interlocked when the behavior of one individual serves as reinforcement for the behavior of a second

individual, and so forth. When the triple contingencies that describe the relations of the behavior of group members are interlocked, then the effect on the environment may be an aggregate product, i.e., an effect that would not exist without the collaborative work of the group members (Todorov, 2010). Metacontingencies, themselves, are the rules that specify which consequences an aggregate product will have for a group, organization or society (Todorov, 2012, p. 38).

A metacontingency is not an arrangement of individual contingencies of different people. It consists in interlocked individual contingencies, intertwined, such that they all, together, produce the same long-term result. The concept of metacontingency allows the effective consideration of the behavior of large groups of individuals in certain situations (Todorov, 2004, p. 26).

According to Todorov, metacontingencies essentially involve socially determined contingencies. The bond that unites individual behavior in a metacontingency is the long-term consequence that affects the entire society (Todorov, 2004, p. 26). These are the consequences that bind the everyday actions of different people and its control originates from the rules of society - for example, the Constitution (Todorov, 1987).

As earlier explained, ceremonial and technological contingencies, exist, as well as ceremonial and technological metacontingencies in the cultural development process.

Family, Church and State use ceremonial metacontingencies to ensure the maintenance of the *status quo* of society. This ceremonial control is not necessarily harmful to the society, but it is insensitive to the possibilities of innovations that flow from constructive social change (Todorov, 1987).

On the other hand, technological metacontingencies considers a more substantial work comprising of the determination of specific rules, the provision

of immediate consequences for compliance of these rules and the evaluation of these rules and its consequences (Todorov, 1987).

The Constitution of any country, be it well or badly formulated, includes ceremonial and technological metacontingencies (Todorov, 2004, p. 27). Todorov argues that a Constitution should not be highly ceremonial, as it could frustrate the expectations of the population and crumble democracy. Simultaneously, it should not be exceedingly technological and held solely on legal principles, thus leading to abstract terms that do not pave the way for the actual implementation of ideas (Todorov, 1987).

Aguiar: Systems Theory and Behavioral Analysis of the Legal Norm and Legal Rule

Aguiar set out to create a self-sustained theory encompassing law and behavior using Luhmann's systems theory as a stepping-stone, by considering law as a system of punitive social contingencies comprised of interlocked behavioral patterns. Additionally, Aguiar employed the field of radical behaviorism as the building blocks to concoct a full analytical theory of law as a human behavior applied science.

Over time, the reiteration of the reciprocal relations between organizations and the behavior patterns that make up their social environment led to the emergence of social systems specialized in the performance of core functions to the survival of the social group as a whole, such as the economic, scientific, educational and legal systems (Skinner, 1953). Those systems were named by Luhmann 'functionally differentiated social systems' or, simply put, 'functional social systems' (Luhmann, 1990). The contemporary social landscape is dominated by such systems, one of the most important of which is the legal system (Teubner, 1993).

The key elements for the emergence of a functionally specialized system are the existence of organizations and the expertise of these organizations in fulfilling a critical function for the survival of the social group *en masse* (Aguiar, 2015). In the case of law, these fundamental elements are the governmental agencies and the punishment applied to individuals that display behaviors considered socially undesirable (Skinner, 1953; Skinner, 1976; Baum, 2005).

Aguiar posits that the law is a functionally specialized system of creation, transmission and implementation of rules reinforced by the punishment of certain behaviors considered socially undesirable (Aguiar, 2015).

One of the more preeminent aspects of Aguiar's studies lies on the distinctions between the legal norm (the contingency itself) and the legal rule (the normative statement). Thus, this inquiry shall organize Aguiar's considerations under two subheadings – analysis of the legal norm and analysis of the legal rule.

Analysis of the legal norm

The consistency of interlocked behavioral patterns that make up the organizations and their social environments is intensively heightened by the use of rules. A rule is a verbal behavioral pattern that describes a behavioral contingency - basically, if a behavior is adopted in certain context, a punishment or reinforce will follow. Rules are noticeably useful for their intended subjects to hastily adopt the expected behavior and, simultaneously, are convenient to the governmental agencies to guarantee heightened control over the behavior of individuals. Laws can be considered a type of rule (Aguiar, 2015).

Aguiar notes that, for the behavioral analysis of law, a legal norm is a social subsystem consisting of several interlocked behavioral patterns which intermediate the connection between the punitive legal control of object behavior and its respective punishment (Aguiar, 2014; 2015). Behavior patterns

are interlocked because one functions as context and motivation for the other, meanwhile, the other serves as a reinforcement for the one (Aguiar, 2015).

Punishment arising from the law varies considerably in type, having in common, however, the characteristic of being punitive social contingencies superposed to the reinforcing contingencies that maintain and strengthen the socially undesirable behavior (Aguiar, 2015), as already mentioned in the analysis of incomplete contingencies.

The predominance of the original reinforcing contingency (responsible for the existence of the socially undesirable behavior in the first place) or the legal, punitive contingencies will vary from individual to individual, depending on the relative influence of specific causal variables: motivation, context and the individual behavioral history with respect to reinforcers and punishment pertinent to the behavior in question (Aguiar, 2015).

The legal norm subsystem can be represented by a network of behavioral patterns, and its nodes called problem-situations. Problem-situations are situations in which, for whatever reason, individuals are not able to adopt a highly probable behavioral pattern as a consequence of a specific motivational state, generally due to completely or partially unprecedented or extraordinarily complex situations (Aguiar, 2015).

With time, if the uncommon situations become recurrent, individuals grow acclimatized to them, and behavior reverts to the usual. An example is the behavior of driving a car. At the outset, individuals need to learn such behavior using rules of driving and traffic. Gradually, such rules will not be thought about and driving develops into an almost automatic behavior (Aguiar, 2015).

The main characteristic of the abovementioned problem-situations is to sensibly heighten the probability of occurrence of behavior known as problem-solving behavior. The reinforcing consequence of problem-solving

behavior is, of course, the adoption of behavior that solves the problem-situation.

A common type of problem-solving behavior in the legal context is the crafting of legal rules, i.e., verbal behavioral patterns whose basic form is the indication of a behavior and the respective consequence, which can be a reward or, more commonly, a punishment.

Aguiar remarks that not all the nodes that make up a particular legal norm consist of problem-situations the solution of which is facilitated by consulting legal rules. In many cases, the individual benefits from informal rules or even personal past experiences.

The goal of the behavioral analysis of a legal norm is to first off identify and map the behavioral network and its contingencies. Next, to analyze the probability of the consequence to occur, given the occurrence of the behavior enunciated by the norm, based on the study of the contingencies of the multiple nodes that comprise the network.

This analysis will allow for intervention proposals aimed at making the unwanted behaviors less likely (or vice-versa), thus contributing for a more effective legal rule. In other words, proposals based on the behavioral analysis of the legal norm can boost the connection between behavior and likely consequence, henceforth optimizing the deterrent power of law.

Analysis of the legal rule

Amongst the most important nodes of the behavioral networks that comprise legal norms are the so-called judicial procedures or legal cases. They are basically composed of interlocked behavioral patterns of the judiciary authorities and other law professionals, such as public and private lawyers and prosecutors, and between those and the parties of the judicial procedure,

plaintiffs and defendants, or third parties, such as the victims, their relatives and friends.

Behavior varies depending on the position of the individual in the judicial procedure. Initially, one can identify (i) the plaintiff’s behavior, motivated by damage which was suffered (physical, moral or economic) and reinforced by the punishment that the defendant might suffer, as well as the possibility of economic benefit, and (ii) the defendant's behavior, motivated by the threat of punishment and reinforced by the possibility of escaping punishment.

Furthermore, one must consider the behavior of the people within the governmental agencies responsible for selecting rules and imposing punishment. In all cases, there must be contingencies that seek to ensure impartiality in the decision, but the motivations and reinforcements of these agents tend to be completely dissociated from those related to the plaintiff and defendant.

As one can observe, there is an important issue related to the application of law: as impartiality is relevant, contingencies seeking to reinforce behaviors that result in impartiality are put into place, notably the lack of discretion in relation to the content of the laws. If the judge decides against the law, punitive consequences are expected, e.g. the reform of the decision by a higher court or penalty of control agencies.

The positivization of control practices over the behaviors related to punishment has the effect of stabilizing the system. The determination that the judge has no discretion in relation to the content of the laws, for example, is a restriction of the power to punish. (Skinner, 1953)

A Constitution can also specify the composition of a government and the means by which their internal agencies receive their power, as well as procedures for writing, interpreting and enforcing the law (Skinner, 1953).

Both in court proceedings and in other contexts where law professionals are involved, a type of complex behavioral pattern called by the traditional legal doctrine of interpretation of the law becomes particularly relevant. More recently, such behavioral pattern came to be considered an integral part of a more comprehensive pattern called law implementation.

As its own name implies, this is a typical problem-solving behavioral pattern whose essential core is the consultation of legal texts - laws, judicial precedents and doctrine. Even though the behavior of law professionals is determined by the immediate consequences of their behavior in the various procedures they take part, whose reinforcing or punitive value will vary from individual to individual and according to the role played in the procedure. In fact, it is possible, mainly through verbal conditioned reinforcers and punishers, to make certain consequences of medium and long term significantly more relevant for the determination of such behavior. This is, actually, the main role of legal doctrine in general, and of the behavioral analysis of the legal rule, in particular.

For the purposes of practically carrying out the behavioral analysis in question, the legal rule is subdivided into three basic components: legal contingency, social goal and relevant behavioral assumptions.

The legal contingency of a legal rule is the contingent relationship between the conduct to be controlled via imposition of the consequence (generally, but not necessarily, punishment) and the consequence itself (Aguiar, 2014).

Social goal is the state of affairs or desired social situation that the imposition of legal contingency aims to achieve (Aguiar, 2014). Modern positive law is a politically defined right in the sense that laws are decided by organizations belonging to the specialized political social system (Luhmann, 1985, 1990). As the political system has come to be the main creator of legal

rules, the justification for the legal rules has become increasingly dependent on results in terms of social goals, since it is the nature of modern political contingencies that all initiatives of those in power are geared towards social welfare (Luhmann, 1993; King & Thornhill, 2003).

The model of the structure of legal rules as rules that seek to exert control over behavior is as follows (Aguiar, 2014):

{GIVEN THAT [the following relevant *behavioral assumptions* are valid as per the current state of human behavioral science], IF [a immediate or long term expected consequence of the imposition of the legal contingencies is a *social goal*], THEN [the following legal contingency should be imposed by the legal system, using the format IF such conduct -> THEN such consequence)]} (p. 265).

It can be inferred from the model above that the legal rules are designed as a more comprehensive rule in which the behavior of imposing legal contingency – that is, inflicting punishment as a result of a particular behavior described in law – engenders the attainment of the social goal. The basis for the assumption of the causal link between the imposition of legal contingency and obtaining the social goal are the relevant behavioral assumptions (Aguiar, 2014, p. 266).

Every legal rule has specific behavioral assumptions that are relevant to the behavior it aims to control by imposing the respective punishment. These relevant behavioral assumptions relate to the two fundamental causal relationships surmised by the legal rule, namely (i) the causal link between the imposition of the consequence (usually punitive) and the decrease or increase of the behavior depicted by the rule – the efficiency of the punishment; and (ii) the causal relationship between the decrease or increase of the behavior in

question and the achievement of the social goal – the social importance or pertinence of the punishment (Aguiar, 2014, pp. 267-268).

In addition to turning the realization of the social goal into a conditioned verbal reinforcer, the behavioral analysis of the legal rule introduces a new problem for the law professionals, which is to answer whether and to what extent the relevant behavioral assumptions are true. The solution of this problem will require the legal professional, especially the judge, to consult other types of texts and sources of verbal knowledge, which can significantly affect the existing biases in their behavior repertoire.

Conclusions

As a paper that focused on literature review, the possible conclusions are primarily related to the state of the scholarly development of the specific subject and its implied importance to society and, in a lesser extent, to the creation of substance for further development by other scholars.

In our opinion, the most recent developments on the subject, namely those carried out by Todorov and Aguiar, are a major contribution to society in the context that they provide actual models that can be used to improve and advance the application of law by societies.

Namely, Todorov's analysis of contingencies and metacontingencies in different legal codes allow for the verification of efficiency and expected results of a law in accord to the number of complete and incomplete contingencies, as well as the ratio of pure generic technological metacontingencies.

At the same time, Aguiar's analysis of the legal norm and the legal rule provide not one, but two different possible frameworks to analyze laws and provide pertinent legal policy advise, or, at minimum, suggestions on how to

properly write and implement a legal rule in accord to the expected social goals and intended social behavior control.

Finally, it is of important note that the lengthy and wide development of radical behaviorism and its application in several fields of study is more than satisfactory as a demonstration of the altogether consistency, coherence and interdisciplinary compatibility of the theory, which, in turn, demonstrates its undeniable usefulness. We believe these academic developments should galvanize those interested in the subject and stimulate the genesis of exciting new studies in the near future.

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4 Parental alienation construct

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In Brazil, especially because of Law Nº 12,318/10 (Parental Alienation Act), which address the subject and amends Article 236, Law Nº 8,069/90 (Child and Adolescent Statute), urges the development of interdisciplinary studies to clarify the nature of this phenomenon to enable correct diagnoses, differentiating alienation from other types of child abuse perpetrated by parents or caregivers. This law was created to prevent, after divorce or separation, legal guardians from impeding or hindering children from having a relationship with the non-guardian parent and to combat the slow pace of justice; a faster process can avoid damage caused by indefinite separation between parents and children. The law is composed of items that are considered alienating behaviors, which can be briefly enumerated as: disqualifying a parent's behavior; impeding the other parent's efforts to spend time with the child and disavowing the other parent before the child; omitting the child's or adolescent's personal information regarding school, health or address; untruthfully reporting the other parent or his/her family members (including grandparents) in regard to mistreatment to prevent them from keeping a relationship with the child or adolescent; moving away to impede the child or adolescent from spending time with the other parent, relatives or grandparents with no apparent justification (Brasil, 2010). This legislation enables changing custody arrangements and

even makes provision to impede the contact of one of the parents if parental alienation is determined to exist.

This subject is at the intersection of two fields of knowledge: Forensic Psychology and Law. On the one hand, it is related to Law because it affects parents and children in the process of custody disputes and the establishment of a visitation regimen. On the other hand, it is a phenomenon with strictly psychological characteristics.

Parental alienation has led to heated academic discussions given the poor operational definition that exists (Pepiton, Alvis, Allen & Logid, 2012; Walker & Shapiro, 2010). Researchers have addressed the subject to better define it and, consequently, provide reliable information to support the decision-making of judges (Bem-Ami & Baker, 2012; Darnall, 2008; Drozd & Olesen, 2004) who do not have psychological training to assess the issue.

Gardner (1985) coined the phenomenon Parental Alienation Syndrome (PAS), defining it as “a disturbance in which children are obsessively preoccupied with depreciation and criticism of a parent – defamation that is unjustified and or exaggerated” (p. 1). The author posited his theory from 1985 to 2004 in 16 papers, detailing the phenomenon’s characteristics, and drawing attention to its occurrence in the legal framework. He presented PAS’ symptoms (1985, 1998, 1999a, 2003a), the characteristics of alienators and alienated parents (1985, 1991, 1999b, 2002), degrees of child alienation as mild, moderate, or severe (1991, 1998, 1999c, 2002), made a distinction between PAS, false allegations of abuse, neglect and sexual abuse (1998, 1999b), counseled judges (1987, 1998, 1999c), suggested punishment for alienators (1991, 1998), proposed treatment for alienators, alienated and children (1987, 1991, 1999a, 1999c), suggested PAS evaluations (1985, 1987, 1998, 1999b, 1999d, 2002), defended the inclusion of PAS in the Diagnostic and Statistical Manual of Mental Disorders – DSM (2002, 2003b, 2004a), and refuted

accusations that PAS was a sexist theory (1991, 1998, 1999a). Only two papers among the aforementioned were peer reviewed.

Gardner (1991) stated that most cases of parental alineation occurred among women. The author asserted that, beginning mid 20th century, male parentality changed parental relationships after divorce. What was once an undisputed practice – the mother have custody of the children after separation – started to be questioned in courts, which led some mothers to denigrate the practice of children spending time with fathers and impeding its occurrence. This explanation aroused many critiques of PAS, which was considered to be a sexist theory. In subsequent papers, Gardner (1998, 1999a) changed his position, stating that both men and women were equally likely to present parental alienation without, however, presenting studies that supported his change of opinion. Bala, Hunt and McCarney (2010) studied 175 cases from the Canadian court. Of the cases, 68% refered to alienator mothers against 31% of alienator fathers. Gomide, Camargo and Fernandes (2016) investigated 48 families, which according to the court, presented indications of parental alieanation and found that 38.3% of women as opposed to 9% of men were very likely to be alineators. Dunne and Hedrick (1994) and Rand (2011) also reported a predominance of parental alienation among women, who, in most cases, had custody of their children. These studies indicate the need to properly investigate parental alienation, rather than simply label it as sexist, including the causal determinants of parental alienation among men and women through controlled studies using significant samples.

The main critics of including parental alienation, parental alienation disorder or parental alienation syndrome, in either the DSM-V or the ICD-11 (International Classification of Diseases) have listed a series of explanations to justify their position. Some agree that parental alienation occurs in a custody situation but do not accept that it should be included as a mental disease. Escudero, Aguiar and Cruz (2008) criticized Gardner for having coined the term

Parental Alienation Syndrome (PAS) without properly operationalizing the concept and without conducting sufficient empirical research. Walker and Shapiro (2010) pointed out that there is a lack of data to support the inclusion of a new child disorder in the DSM, one that differentiates trauma caused by sexual abuse from that caused by PAS domestic violence and also that shows the need to use the concept of PAS or PAD (Parental Alienation Disorder) in courts to force children to be reunited with alienated parents. Kelly and Johnston (2001) criticized PAS on the grounds that the term caused confusion in the judicial, legal and psychological fields and also because there is no empirical data to support PAS as a psychiatric diagnosis, leading to their rejection of the concept even though they admitted parental alienation existed in contexts of custody dispute. Brunch (2002) and Walker and Shapiro (2010) criticized Gardner for citing his own papers published in periodicals lacking peer review as sources of reference, which casts doubt on the scientific nature of the data and arguments presented. Houchin, Ranseen, Hash and Bartnicki (2012) strongly criticizes the inclusion of PAS or PA in the DSM-V or the ICD-11, stating that those supporting its inclusion grounded their opinions on papers with few participants and argued that the inclusion would increase procedural costs for it would require evaluators and experts to identify the existence of PAS; and, finally, they criticized the fact that Hollywood celebrities were using the concept on talk shows, or TV sitcoms, without PAS being supported by the scientific community (Alec Baldwin accused his ex-wife Kim Basinger, on a talk show, of alienating his daughter against him).

Walker and Shapiro (2010) argued that it is inappropriate to label a child with PAS as being a mental patient when s/he is simply responding with anger to changes in her/his life caused by her/his parents' divorce. These authors are experienced professionals in the field of forensic psychology and understand that when a court recommends a child have a relationship with the alienated parent, this is largely against the recommendation of experts on child traumas.

The victim needs to experience improved psychological health before contact with the alienated parent is reestablished. On the other hand, some researchers believe that children, victims of parental alienation, may eventually develop a psychotic condition (Maida, Herskovic & Prado, 2011; Segura, Gil & Sepulveda, 2006). This is certainly a controversial point. Literature addressing child abuse agrees that a parent perpetrating physical or sexual abuse has to be put away from the victim (Habigzang & Koller, 2011).

Supporting Gardner's theory, Bernet, Boch-Galhau, Baker and Morrinson (2010) proposed to the American Psychiatric Association to include Parental Alienation Disorder (PAD) in the DSM-V (Diagnostic and Statistical Manual of Mental Diseases, 5th Edition) and in the ICD -11 (International Classification of Diseases, 11th Edition). This proposal was based on the eight symptoms described by Gardner (1985) that exclusively refer to children's behaviors, which should last for at least two months, cause significant harm to the children's social or academic lives or other functional areas, and that "Parental Alienation Disorder" is not diagnosed when the alienated parent in fact mistreats the child. The authors believe that a change from Parental Alienation Syndrome (PAS) to Parental Alienation Disorder (PAD) would reduce resistance; there were manifestations contrary to PAS in the last decade due to a lack of empirical research supporting the concept. This proposition, however, was not successful.

In the literature (Darnall, 2011), the parent who promotes the defamation campaign and prevents the child from having a relationship with the other parent is called the **Alienator Parent** or preferred parent and is usually the one who has custody of the child. The other parent, usually the non-guardian, is called the alienated, rejected or **Targeted Parent**.

This chapter addresses the variables present in the parental alienation construct and that enable the identification of this phenomenon. Nonetheless,

first it is necessary to differentiate parental alienation from other types of abuse perpetrated against children and adolescents.

There are numerous situations that justify a child's rejection of one parent, as when there are "rational reasons" or true abuse. The literature uses the term 'estrangement' to designate what is considered to be a harmful relationship (Darnall, 2008). Kelly and Jonhson (2001) define the term as a rational reason for a child to reject a parent. Such reasons may involve neglect, physical, psychological or sexual abuse, abandonment or domestic violence.

Understanding the reasons behind a child's estrangement can help differentiate between problematic parental behavior and parental alienation. The first point is when contact with an infant is broken due to the parents' separation. Very young children preferably develop bonds with and attachment to the mother figure who spends hours feeding, caring for, and nurturing the baby among other care. When the mother is present, available, affectionate and responsive, the child sees in the mother her/his main safety figure. When this contact is broken, the infant may suffer and cry (Bowlby, 1984).

Poor parental practice is another preponderant factor. Bala, Hunt and McCarney (2010) found that 35% of cases in which children rejected visitation were related to a lack of ability or limitation on the part of the other parent, lack of interest or affection, lack of sensitivity toward the child's needs, violent temperament, or the use of alcohol or drugs on the part of the other parent or step father/stepmother. Careless parents who negletct the child's eating habits, hygiene, health or leisure lead to justified rejection on the part of the child after divorce; the child does not feel safe or cared for. Parents with an alcohol problem or drug addiction are avoided by their children due to their disruptive behavior. Depression may be related to a refusal on the part of the child to spend time with one of the parents, which in turn may cause neglect and inatention toward the child's needs. Children feel helpless and are often required to take responsabilities beyond their physical capacity, such as when

they have to take care of younger siblings when the mother is in bed under the effect of drugs, for instance. These children exibit the behavior of an adolecent or adult, which seems admirable at first, but in fact reflect a reversal of roles (Drozd & Olesen, 2004). Parents with physical, verbal or psychologically aggressive behavior cause rejection on the part of their children, who feel relieved in a situation of divorce. Adolescent children prefer the company of their friends over that of their parents, and this preference is sometimes confounded with a defamation campaign on the part of one of the parents. A mother may be legally accused of parental alienation if her adolescent children refuse to sleep in the father's home on the weekends: the children prefer the company of their friends and the father wants to monopolize their company. Lastly, but not least important, sexual and physical abusers are rejected by their children who seek safety in the non-abusive parent. If any of these situations are present, the diagnosis of parental alienation does not apply.

In short, unskillful or neglectful parents, those who use drugs or alcohol, have a psychological disease, depression, or present other factors that result in their not being sensitive to their children's needs may trigger justified estrangement. Parents who abuse their children physically, psychologically or sexually lead to justified fear and estrangement. Non-abusive parents usually present a protective behavior in situations in which there are rational reasons for estrangement, a behavior that is also presented by alienators. The protective parent tries to prevent the child from having contact with the other parent and denigrates the abusive parent. Such behaviors may be confounded with parental alienation and are skillfully used by lawyers defending abusive parents.

Promoting a defamation campaign and preventing contact with the parent is reported in all texts addressing parental alienation. Since its formulation, however, Gardner (1985), and later Baker (2005, 2006, Baker & Darnall, 2006; Baker & Chambers, 2011; Bem-Ami & Baker, 2012), who assessed adult victims of alienator parents, realized that the authors listed behaviors without the

operational definition of variables. Gardner (2003) defended the view that PAS should be included in DSM-V, listing a set of symptoms presented by the alienated child, namely: 1) denigrating campaign against the targeted parent; 2) poor, absurd, or frivolous rationalizations for defamation; 3) lack of ambivalence; 4) “independent thinker” phenomenon; 5) automatic support to the alienator parent in parental conflict; 6) absence of guilty feelings when being cruel and/or exploiting the targeted parent; 7) prearranged staging negative situations; 8) animosity is extended to the target’s friends and/or extended family. These symptoms lack an operational definition and can lead to divergent interpretations. Establishing a behavior given the lack of a behavior is extremely inefficacious, as is the case of items 3 and 6; stating that rationalizations are weak or frivolous can lead to not considering real facts, as in cases in which the parent rejected by the child present poor parental behavior, such as not feeding or properly cleaning the child (item 2).

The independent thinker phenomenon is when the child presents behaviors other than those “taught” by the alienator parent (Gardner, 1985), and which generate controversies in the assessment. The concepts of discrimination and generalization of stimuli help explain this process. If a parent teaches the child that the father abandoned her/him and the child refuses to see the father’s relatives, this behavior is in the same class of responses: refusal to see the father, cousins, grandparents, and so on, that is, are not a new “symptom”. The law cannot list the entire variability of responses within the same class of behaviors. Behaviors emerge based on each individual’s learning process. Terms such as “prearranged staging” (item 7) or “automatic support” (item 5) are ambiguous and hinder proper identification. Poor definitions and lack of operationalization of terms were widely explored by those opposing Gardner.

Defamation may assume varied forms and is not restricted to those examples listed in Law Nº 12,318 or mentioned by researchers. The alienator

parent can denigrate the targeted parent by providing false information in the legal process; disseminating distrust in various spheres, such as in school, sport club, neighborhood, or virtually via social networking; influencing the child by disseminating false fears toward the targeted parent; and denigrating the targeted parent's reputation among family and friends. Recently, under the advice of his mother and grandmother, a 12-year old child caused various problems at school, which in turn resulted in disciplinary measures, aiming to trigger aggressive reactions from the father. On that occasion, the father in fact lost control and pulled the adolescent by his ear. The boy immediately took a photo of his swollen ear and sent it through his mobile to the mother's family members saying: we did it! The mother attached the photo to the legal process saying the adolescent was victim of abuse by his father. Therefore, the forensic evaluator needs to take care identifying behaviors in this category.

Systematic interference in the parental relationship, preventing or hindering the child from having a relationship with the targeted parent is essential for parental alienation to exist. Even though researchers (Baker, 2006; Hands & Warshak, 2011) state that parental alienation also occurs among intact families, parents need to be separated for the relationship between parent and child to be impeded. Targeted parents in intact families have daily opportunities to relate to children and properly respond to a campaign of defamation. Again, in addition to those described in law, behaviors in this category are numerous and can include a range from impeding/hindering telephone contact, scheduling medical consultation during the targeted parent's visiting hours, traveling or moving away, or harming the relationship with the targeted parent.

The alienator parent presents peculiar behavior during the assessment. They may hinder procedural progress, disobey court orders, disqualify the technical team, ignore warnings, frequently present petitions, and are insensitive to the effects that a legal dispute may cause to a child's wellbeing, among others (Darnall, 2008; Suárez, 2011). As a rule, when the alienator fails to

comply with a legal order, a new order is issued and the alienator is forced to comply with all agreements previously signed. Nonetheless, one should be careful when making assessments, because the behavior of parents protecting their children from abusers is very similar to that of alienators in regard to very frequently presenting petitions, submitting unsolicited reports, disqualifying and impeding contact of the child with the ex-spouse. The alienator is, however, uninterested in the negative effects the process may cause on the child. This behavior on the part of the alienator may be linked to a narcissistic, antisocial, or paranoid personality reported in various studies (Baker, 2006; Darnall, 2011; Lass and Gomide, 2016). Satisfactory changes of behavior on the part of alienators are rarely achieved with only guidance or mediation; personality disorders require therapy and medication. Individuals with these disorders do not weigh the consequences of achieving their goals, even if in doing so, as is the case of parental alienation, it costs the psychological wellbeing of their child.

Huerta (2007) identified the refusal of alienators to become involved with therapy even when ordered by a court. Darnall (2008) notes the resistance of alienators to following court orders; their discourses may express some interest in collaborating with judges' decisions but, eventually, they sabotage agreements. Hence, obsessive alienators disrespect scheduled assessments and joint interviews, impede or hinder supervised contact of the child with the other parent in a forensic environment, while alleging danger or other reason. When they are asked to reflect on their parental roles and their responsibility to maintain the bond between the child and the other parent, alienators are arrogant and repeat the other parent should be away, defending this by saying it is the child's choice. Alienators also show a lack of interest in child development milestones or in the negative consequences accruing from impeding the child from having a relationship with the targeted parent.

Suárez (2011) compared the existence of PAS among families with and without the interruption of visitation using the eight symptoms proposed by Gardner (1985) and analyzed documents and psychological assessments that indicated disorders that harmed the parent's ability to give attention to a minor, such as alcohol or substance abuse, psychotic illness, abandoment, depression, and antisocial disorder. The author found that alienator parents are demanding; have an exagerated feeling of self-worth; exhibit rigid behavior that reafirms their initial position; rejects assessments without understanding the reasons such assessments are performed; demands the child stop visiting the targeted parent or that visits be reduced; depreciates care provided by the targeted parent to the child: acuses the targeted parent of abandoning the child with other family members during visitations; states that the child is forced to perform tasks that are incompatible with his/her age; is not interested in the negative effects a lack of visitation may cause; and accuses the targeted parent of not being economically able to suport the child.

Arce, Fariña and Seijo (2005) verified 782 decisions that established the custody of children to see if the decisions met the "children's best interest" as established by Spanish law. The authors concluded that 57.3% of the decisions presented no criteria; motivation criteria were not always valid; custody was given to the father because the mother was excluded; there was no follow-up of the decions made; in 18.2% of the cases, decisions were a result of an agreement between parents; in 9.7% of the cases, it met the child's desire; in 15.6%, the habitual caregiver retained custody; in 16.7% of the cases, the decision followed a psychosocial report; and in only two cases (0.3%) were decisions motivated by PAS. Mothers had custody in 91.56% and fathers in 8.44% of the cases. As a rule, paternal custody took place due to the mothers' lack of merit (e.g., addiction, parental alienation, abandoment or maltreatment, mental disease, lack of resources or impossibility to take care of children) rather

than due to the fathers' positive characteristics. The study shows how fragile the concept is in some international courts.

Baker and Darnall (2006) conducted a retrospective study to operationalize the concept of alienation and pointed out standard behaviors in 97 participants who believed they had experienced parental alienation when they were children. They grouped 66 behaviors into six categories: 1) defamation of the other parent; 2) impeded or limited visitation: moving away, leaving city or state without providing the new address or telephone number, prohibiting the school from receiving the other parent, excluding contact with the extensive family, letting the child choose whether s/he wants to visit the other parent or not, monitoring telephone calls and emails, scheduling other activities on visitation days; 3) limiting or interfering in information: not communicating important facts about the child, not allowing access to medical reports, school or social activities; 4) interfering in or limiting symbolic contact: not allowing the child to circulate toys between homes, not allowing pictures of the other parent or the child to mention the other parent's name, changing the child's surname, throwing presents away, not allowing the child to visit the targeted parent on festive dates or holidays; 5) threatening to withdraw love if the child chooses to stay with the other parent, threatening to abandon her/him, gratifying the child when s/he rejects the other parent, making the child feel guilty for wanting to visit the other parent; and 6) alleging abuse: falsely reporting sexual or physical abuse or neglect.

The child's behavior during the custody dispute is key in the parental alienation construct. Children, who are themselves victims of parental alienation, go through at least three phases: the initial phase, which is when the alienator parent denigrates and prevents contact with the targeted parent but the child still has a good relationship with the targeted parent, is called mild alienation; the intermediate or moderate phase is when the child starts presenting reasons for not seeing the targeted parent, though visitation is still

maintained; and the severe phase is when the child refuses to maintain a relationship with the targeted parent.

The child, as a victim of parental alienation, is in permanent affective conflict: attempts to be near the targeted parent are punished by the alienator, while rejection is reinforced. Emotional blackmail on the part of the alienator is common, such as saying the targeted parent abandoned him/her (the parent) and that the child is the only one to stay by his/her side; using trickery to obtain detailed reports concerning visits; acting out illnesses, and, by any means, emotionally blackmailing the child to distance him/her from the targeted parent. Emotional manipulations harm the child's psychological development as s/he is impeded from equally spending time with parents after separation and is forced to develop avoidance and manipulation repertoires. To survive the dispute and avoid severe consequences from not behaving as expected by the alienator, the child demeans her/himself and breaks with natural behavior.

Various authors (Bem-Ami & Baker, 2012; Segura et al, 2000; Warshak, 2010) found anxiety, sleep, eating, and conduct disorders, feelings of helplessness, vicarious learning of manipulation strategies to reach conflict resolution, a deficit in self-conception and self-worth, low self-sufficiency, high levels of major depression disorders, and insecure attachment style among adult victims of parental alienation. These symptoms were observed in the short and long terms; the level of conflict between parents during and after the divorce has been the best predictor for negative outcomes in children.

Alienating behaviors succeed in two situations: 1) efficacious control strategies on the part of the alienator, that is, punishing by withdrawing affection or privileges whenever the child displays positive affection toward the targeted parent and, at the same time, positively reinforcing rejection and defamation on the part of the child toward the targeted parent. Instilling guilt in the child when s/he displays happiness in the presence of the alienated parent, for instance, or when the child comes back from the father's home happy and the mother says

“I spent the weekend all by myself, alone and sad, you don’t love me anymore, now you want to live with your father, you’ll abandon me too” is an efficient strategy of parental alienation; and 2) the targeted parent also displays negative parental behavior, that is, the targeted parent neglects the child, is absent, does not provide a good role model, is aggressive, consumes drugs or alcohol, thus, presents a risk behavior or poor parental skills. If, however, the targeted parent shows positive parental practices, the alienator is likely to fail.

Definition of the parental alienation construct

The concept of parental alienation is complex. The first category of parental alienation assumes that every rejection a child displays toward the targeted parent is unfounded. The second is that there is an attempt to impede or hinder the relationship between child and parent, both on the part of the alienator parent and the child. The third condition is that parents are separated, disputing custody and visitation as something to be assessed by court. The fourth category refers to a campaign of defamation promoted by the alienator and child toward the targeted parent. Both defamation and impeding contact should have no justification; that is, whether there are rational reasons for rejection should be first assessed. The fifth category refers to resistance and non-compliance on the part of the alienator parent with legal orders, repeatedly litigating. If rational reasons exist, attempt to impede contact with the other parent or a campaign of defamation toward the other parent is intended to protect, rather than intending to alienate the child. Finally, the sixth category refers to the child’s rejecting the targeted parent without true abuse. Table 1 presents the operational definitions of each of these categories.

Table 1

Operational definition of the categories of the parental alienation construct

Categories	Operational definition
Lack of rational reasons	First, verify the existence of rational reasons for the child to refuse the company of the targeted parent or for feeling uncomfortable in the presence of the targeted parent. Motives may be related to the child's age. When too young (0 to 3yr.), children may have difficulties being away from mothers. The targeted parent may present poor parental practices, consume alcohol or drugs, have a mental disorder, or present abusive behavior (physical, psychological or sexual abuse) or be neglectful.
Impede/ hinder	The alienator parent impedes or hinders contact by telephone, email, or personally between the child and targeted parent, his friends or family members and prevents the child from keeping objects (e.g., clothing, gifts, or pictures) given by the targeted parent.
Dispute situation	For a court to be asked to assess the existence of parental alienation, there should be a dispute between the parents regarding custody and/or visitation.
Defamation	Defamation is toward the targeted parent on the part of the alienator and child, in which maltreatment or neglect is directly or indirectly alleged to relatives, school community, or legal authorities, using various means (e.g., messages, implication/ innuendo, and petitions) without the existence of rational reason.
Parent's behavior during assessment	The behavior displayed by a parent during the assessment toward legal decisions, hindering the progress of assessments, refusing to provide documents or information, showing greater concern over the process than the effects it might have on the child's development.
Child's behavior during assessment /visitation	The behavior displayed by the child during assessment, interviews, or visits scheduled by the technical team in which the child refuses or avoids being in the presence of the targeted parent, denigrating him/her, behaving differently when accompanied by one or the other parent, seeking confirmation on the part of the alienator before providing information.

Parental alienation refers to attempts, on the part of one parent, usually the one who has custody, to impede contact between the child and the other parent and to denigrate the other parent, systematically interfering in the parental relationship between child and targeted parent, constantly disobeying court orders, including the child's participation who, however, has no fair justification to refuse a relationship with the targeted parent.

This phenomenon takes place in the legal sphere and for this reason, requires forensic assessment (Gaffal, 2012), multiple informants and various assessment techniques, considering that the parties involved in court cases have contradictory arguments and hide information that may harm them. Petitions from both parts are loaded with arguments and reports of facts. The forensic evaluator collects data using interviews, observations, analysis of documents, and appropriate assessment instruments, aiming to clarify doubts. There are multiple sources of information: people who live with the child, teachers, relatives, neighbors, and other professionals. Analyzing the profiles and parental practices of parents is also necessary. Categories of alienation should be present and the evaluator should first discard the existence of rational reasons to consider, only then, the existence of parental alienation.

A forensic assessment requires an expert in parental alienation due to the complexity of this phenomenon. This device is specified in Law Nº 12,318/10, a procedure already adopted by the Canadian court (Bala, Hunt & Mccarney, 2010) After parental alienation and its level of intensity (mild, moderate, or severe) is identified, the court has to assign therapists to acompany the family members. Intervention may be recommended for the child only, for the alienator, alienated or the entire family. The most dramatic situation is when alienation is severe, in which case, custody may be reverted and usually the alienator parent refuses therapy and does not comply with the court decisions. It is known that the immediate effect of alternating custody is negative for the child, but the decision is made with the expectation of positive effects in the long term.

Canadian judges have resisted changing the custody of adolescents who are severely alienated due to the difficulty of adaptation. There are no studies addressing the consequences of these changes in the lives of children and adolescents.

The attempts to include parental alienation in the DSM-V failed due to a poor operational definition of the concept and its variables, in addition to the small number of empirical studies assessing the theoretical statements of researchers (Tapias, Bobadilha, & Torres, 2013). The higher incidence of causal determinants of parental alienation among women, the occurrence of false accusations of sexual abuse as a way to impede contact and denigrate the targeted parent, the relationship between rejection due to rational reasons compared to parental alienation, the percentage of mild, moderate and severe cases of parental alienation, the psychological effect of alienation on victims, the psychological profiles of alienators and targeted parents, the incidence of personality disorders among alienators, appropriate forensic instruments to measure the phenomenon, and the consequences of alternating custody in severe cases of alienation, among other considerations, are objects of research that deserve investigation in the field.

Parental alienation occurs when custody and visitation are disputed and severely harm victims (Boch-Galhau & Kodjoe, 2003). Ignoring the phenomenon due to the difficulty in defining it or due to its misuse is harmful both to forensic psychology and the exercise of the law. The field is rich but challenging. Rand (2011) considers a great advancement to have been achieved in research addressing parental alienation in recent years, but various aspects remain obscure. The next decade is expected to bring clarifying information to better ground understanding of and reaction to the phenomenon.

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5 Cultural practices are hard to change[1]

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One of the themes on Behavior Analysis of culture is the idea that cultural practices can be planned and that its effects fall on the strength (in survival terms) of the cultures. Radical Behaviorism and Behavior Analysis present descriptive aspects that can predict which cultural practices are more likely to produce the expected consequences and how to establish such practices in environments involving contingencies with varying degrees of complexity. Furthermore, Radical Behaviorism presents prescriptive aspects (ethical aspects) that show well-planned cultures are those that consider the culture's well-fare as well as the individual's well-fare (Melo, Castro, & de Rose, 2015). Thus, when proposing changes in cultural practices, the behavior analyst must be aware to the descriptive aspects that define the planning linked to the prescriptive aspects of the theory (the ethics involved in cultural designs).

When planning cultural practices, we have to deal with the processes of variation and selection. Skinner, the main theorist on Radical Behaviorism, pointed out in some of his works (e.g. 1987, 1990a, 1990b) that one of the problems arising from the selective processes relies on the fact that variations

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(genetic and behavioral characteristics and cultural practices) which have been selected are related to the environmental contingencies present at the time of its selection. For him, this would be a "failure" in the selection process (Skinner, 1990a). Thus, cultural practices that were effective at some point in History and are maintained, may not favor the survival of cultures nowadays. As Skinner mentioned (1987, p.3): "Operant behavior, like natural selection, prepares the organism for a future, but it is only a future that is similar to selecting past". Hence, the planning of cultural practices would be one of the main solutions suggested by the author in order to deal with the problems faced by cultures, including those in the future.

By understanding culture as a product of the third level of variation and selection by consequences, Skinner (1971/2002, 1978, 1981) also showed a direction for cultural planning: working with "both poles" of the selection process. This is because a culture is more likely to survive when it stimulates variability (it allows the emergence of new cultural practices) while stimulating stability (it allows the selection of cultural practices that will strengthen it).

Besides the "failures" in the selection process, the planning of cultural practices and of culture as a whole faces other problems. The control of human behavior and cultural practices, in most societies, is established by control agencies (e.g. governments). These in turn have their planning practices controlled by contingencies that promote the maintenance of the agencies themselves, and not by the welfare of the subjects that will be exposed to the effects of such planning, the counter controlled ones. The author writes:

> If the futures of governments, religions, and capitalistic systems were congruent with the future of the species, our problem would be solved. (…) Unfortunately, the futures are different. Nuclear weapons are made to guarantee the survival of governments and religions, not the species. (Skinner, 1987, p. 7)

In this regard, some groups may be less committed to maintaining their own power and more committed to the establishment of cultural practices that will favor the subjects' welfare in balance with the cultures'. For Skinner (1987), those groups are formed by scholars, researchers, teachers and media writers. Although Skinner's argument may still be questioned (e.g. Melo, Castro, & de Rose, 2015), this is how Behavior Analysis, as a behavioral science, may contribute to the design of cultural practices through behavioral technologies and this contribution must necessarily include the ethical and political debate.

According to Morris, Smith and Altus (2005), JABA (Journal of Applied Behavior Analysis) was the first Behavior Analysis journal to publish experimental work involving Behavior Analysis applications to social problems. These authors argue that Skinner's earlier works (e.g. Skinner, 1948/2005, or even 1953/1965) can envision some unfolding to the applied field. According to this perspective, Skinner presents a systematic science which is behavioral, analytical, technological, quantifiable and with accurate measures.

In *Walden Two*, Skinner (1948/2005) was concerned with the planning of a culture, or rather of communities in the post-war period. He described how the Experimental Behavior Analysis principles could establish the guidelines for cultural experimentation. According to Morris et al. (2005), when questioned about what young people should do during this period he answered:

> They should experiment: They should explore new ways of living, as people had done in the communities of the nineteenth century.
>
> (…) Young people today might have better luck. They could build a culture that would come closer to satisfying human needs than the American way of life (Skinner apud Morris et al., 2005, p. 107).

Walden Two presents Skinner's interest in transposing the human behavior science to cultural planning before his lack of satisfaction to the current status

quo (Morris et al. 2005). Thus, the book describes a way of life in which every cultural practice is experimented and evaluated for its effectiveness in strengthening a culture that is concerned with its survival, in balance with the welfare of the individuals who belong to it (Melo, Castro, & de Rose, 2015). Experimentation is applied in all fields of the culture and that culture is planned considering educational sectors (e.g. everyone in the community is responsible for the kids' education. Learning is based on learning to think and so on), work sectors (e.g. the types of job are handled by a credit system in which "less desirable" works get more credits and vice versa), environmental sectors (e.g. the development of sustainable agriculture).

However, Morris et al. (2005) argue that the book had little influence on specific behavioral technologies for cultural practices planning derivation, implementation, and validation, possibly because the book only describes already established practices. Skinner's proposal was that planned communities should have an empirical approach in order to discover and demonstrate cultural practices that have worked according to the objectives proposed in the cultures.

On this subject, it can be affirmed that the practices described in *Walden Two* are contingent to what would possibly work in the historical context of that period American community. Since they are not essentialist practices, the only constant would therefore be experimentation. That is, Skinner did not describe his vision of particular cultural practices, but an empirical approach to derive, implement and validate practices that work. In Skinner's words: "The actual achievement is beside the point. The main thing is, we encourage our people to view every habit and custom with an eye to possible improvement. A constantly experimental attitude toward everything-that´s all we need" (Skinner, 1948/2005, p. 25).

Morris et al. (2005) state that the constant described in *Walden Two* has been a premise for applied behavior analysis. In work with autistic children, for

instance, the interventionist practices used are those that have been effective in a biological, individual, social, and cultural context as well as validated by experimental behavior analysis. Consequently, there is no “applied behavior analysis intervention”, but interventions that have been discovered and proved effective through of experimental research.

Walden Two practices were evaluated by measuring their efficiency and its inhabitants’ satisfaction and, accordingly, presented an applied and efficient dimension. Applied, meaning the behavior, stimulus or organism is chosen to be studied due to its importance to human being and to society, instead of its importance to the theory; and effective, denoting that an application can sufficiently change the behavior to be socially important. Thus, Morris et al. (2005) declare that Behavior Analysis provides an empirical basis for the derivation of behavioral technology that may contribute to the planning of cultural practices.

Behavior Analysis contributions to the resolution of wider human problems should also be disseminated. According to Los Horcones (2002), *Walden Two* offers us directions of how Behavior Analysis can be well spread. Behavior Analysis presented considerate dissemination in certain areas (e.g. widely cited works are those with autistic children), however, wider dissemination has been obstructed by a western mentalist culture.

According to these authors, there are some western macrocontigencies that act against the progress of Behavior Analysis, such as the ample social control exercised by institutions opposed to a face-to-face control (the kind of social control prescribed by Skinner, e.g. 1948/2005); in institutions, the practices are mainly maintained when they generate empowering consequences for the institution itself and not to the people who compose it, meaning they operate for their own benefit. Thus, Applied Behavior Analysis has been affected by typical Western practices, focusing more on the repair of personal and social problems than on prevention. Hence, the West essentially

presents reactive and not proactive macrocontigencies, opposed to Skinner's propositions in *Walden Two*.

Behavior Analysis is also inserted in an elitist macrocontingency, i.e., the knowledge it produced is disseminated to communities of behavior analysts or to Psychology and rarely for the lay population in general. Los Horcones's (2002) proposal is not to disseminate Behavior Analysis to the general public by using mentalist jargons, but to apply the principles of this science in a way to model behaviorist repertoire in lay people and, thereby, promote effective advertising of the area as well as contribute to more effective planning of cultural practices.

Such writers, for instance, argue that Behavior Analysis should be more accessible for the general public, since, if reinforcing for that audience, the probability of being spread to other contexts – such as educational institutions, would be increased. Making Behavior Analysis more friendly and accessible is a priority in *Walden Two*. At *Los Horcones* community, for example, children are taught under the laws that control behavior even in preschool. The members in this community have created a book in PSI (Personalized System of Instruction) in order to teach Behavior Analysis for preschoolers.

Behavior analysts should promote experimentation in order to find better ways to disseminate the science. The *Los Horcones* community is an example of experimentation in promoting cultural planning to evaluate which practices work. Aiming at learning if a *Walden Two* community would work, *Los Horcones* was created as a kind of lab, as an experimental culture:

> But the lab we needed was not a place in a building. It was an experimental space at a cultural scale. We needed a group of people who could live 24 hours in this lab for many years, designing cultural practices, observing and measuring their effects on their own and their children's behavior and on the rest of the environment. In October 1973, we started such laboratory. Some years later, we realized that

> the very activity of designing a cultural lab became the most relevant subject matter of our research project. (Los Horcones, 2002, p. 205)

Walden Two has not only inspired the creation of an experimental culture like *Los Horcones*, the novel has also inspired many works on Behavior Analysis. One of the most important topics addressed by Skinner (1948/2005) in *Walden Two* was about the sustainability of that culture. It's interesting to note that in 1948, Skinner predicted some of the problems humanity would face. According to Gusso and Sampaio (2011), *Walden Two* has all of its cultural planning oriented to the development of practices that promote sustainability, such as the rational use of natural resources, waste reduction and the manipulation of varieties that improve the living conditions of the population; on this subject, *Walden Two* is a future-oriented society. According to these writers, Skinner's discussions about sustainability in *Walden Two* predate the more systematized debates scientists have conducted around the world.

Melo (2008) emphasized that Skinner's concern when writing a novel like *Walden Two* or discussing about behavioral utopias suggests that the technology used in "speculations" of this kind may perfectly become true in spaces of society in general. The author says: "In the long run, of course, we must dispense with utopian simplifications, for the real test of culture is the world at large" (Skinner, 1969, p. 47).

Thus, despite the difficulties in planning and implementing cultural practices that contribute to the strengthening of cultures and the survival of the humanity, always considering the ethical and political aspect of planning (which necessarily includes questions about the culture or cultures we are speaking of?), scholars have proposed and discussed cultural designs founded in Behavior Analysis principles. This science has shown constant concern with broader human problems. The following are some examples and possible directions that can base effective changes.

Interventions in Cultural Practices Proposals: Behavior Analysis Contributions

When discussing social issues according to a Behavior Analysis perspective, some studies argue that broader cultural changes must involve a molar analysis of the culture. However, great part of the proposals of intervention in social problems mainly focuses on individual behavior changes, in molecular analysis, which can generate cultural consequences. There are theoretical and practical implications depending on the chosen perspective. According to the assumptions of Radical Behaviorism, culture is not distinct from individual behavior; it isn´t transcendent, immaterial, as Skinner affirms in several of his texts:

> A culture is not the product of a creative “group mind” or the expression of a “general will”. No society began with a social contract, no economic system with the idea of barter or wages, no family structure with an insight into the advantages of cohabitation. (Skinner, 1971/2002, p. 134)

However, the fact that a culture does not present distinct nature of individual behavior does not imply that it is the sum of many individual behaviors and that the work of cultural practices changes should focus only on individual behavior. Some studies have sought broader cultural changes that may reach molar contingencies.

Dagen and Alavosius’s work (2008), for instance, dealt with the problematic of accidents caused by cyclists and drivers collision. The authors affirm that this results from flaws in interlocking behavioral contingencies.

The writers suggest a research agenda directed to the safety of cyclists in the context of interlocking behavioral contingencies, aiming to obtain cultural change. They examined individual and cultural contingencies that could

contribute to tow large-scale initiatives with individual behavioral changes, besides relating current contingencies with the establishment of additional contingencies that would provide long-term safety behaviors related to the subject in question. According to Dagen and Alavosius (2008), systematic cultural changes occur when molar contingencies are altered and, due to a cascade effect, can change individual behavior; meantime, this type of change does not happen every day and, therefore, additional contingencies planning would be made necessary.

According to these writers, the analysis of the possible variables that determine collisions between drivers and cyclists suggests that both have their behaviors under the control of different variables, as well as among cyclists, different variables affect each individual's behavior. In other words, there are multiple and desultory contingencies between the drivers' and the cyclists' behavior. There are also differences in the technological field: the development of safety equipment has evolved considerably in the case of drivers, but not in the case of cycling. Furthermore, neither group uses any type of the safety technologies.

Frequently, drivers and cyclist transit on the same lane, a fact that that creates a common environment for both and may increase accidents. Therefore, transit engineers have proposed the construction of exclusive lanes for cyclists. However, totally distinct environments for cyclists and drivers present higher construction costs. On the other hand, behavioral solutions do not require environmental separation or high costs associated with large-scale environmental engineering (Dagen & Alavosius, 2008).

In order to develop a suggested research agenda that may prescribe the antecedents and consequences to increase the probability of safety behaviors and decrease the probability of risk behaviors, the authors argue that a molar analysis should be integrated with a molecular analysis including both types of transportation. Hereof, the relevant agencies need access to the appropriate

data to create social contingencies that will generate safety-related behaviors. Among them could be bicycle manufactures, advertisers, media, school systems and sports celebrities that could collaborate to promote safe-bicycling behaviors. However, most of these studies aiming the diminution of accidents focus on individual attitudes and beliefs, directing the explanation to hypothetical mental traits.

A molar analysis suggests that the agencies dedicated to increasing cyclists' safety behaviors lack the power to achieve relevant sectors that might contribute for the solution. Besides, few behavior analysts have been devoted to proposing broader cultural changes as much effort is focused on localized solutions to relatively smaller-scale problems. One of the most critic behavioral change proposal, considered by the authors as a molar analysis, was given by Frasier in *Walden Two* (Skinner, 1948/2005).

For Dagen and Alavousis (2008), proposals that consider only one research priority may yield inefficient and even catastrophic interventions. One evaluation of public politics, such as the mandatory use of helmets, is frequently based on molar level measures (e.g. collision rates) and may therefore obscure the relevant data on molecular levels (e.g. variability in bicycling performance, stimulus generalization, and consequence management). As a result, an appropriate research agenda should include increasingly precise behavioral measures and better tracking systems of complex interactions between many individuals' data.

The authors conclude that Behavior Analysis works related to the safety of individuals in society frequently analyze the individual behavior isolated from its context. However, there is a mighty but incipient behavioral technology available for cultural changes to occur more widely and this must be further developed and applied. In this regard, they propose that researchers should create the necessary contingencies to support large-scale adoption of some cultural practices. An attempt is to promote that the relevant data obtained from

both molar and molecular cultural analysis is available to social groups who have the power to promote large-scale changes, such as the government, educational systems, and the media.

Also for Hobbs (2008), Behavior Analysis has only a fledgling behavioral technology in the field of broader cultural problems. In the early decades of Behavior Analysis, Skinner (1968/2003) attempted to revolutionize the educational system with the individual programmed learning and the “teaching machines”. However, as pointed by Hobbs (2008), radical behaviorist concepts are not present in education the way Skinner expected, although it may be possible to argue that some benefits to the educational systems emerged from the work on programmed learning. According to this author, most recently, one relevant Behavior Analysis contribution has been promoting better life conditions for children diagnosed with autism, for instance. Moreover, it is a field where the area became highly popular.

Meantime, when increasing its scope of study to culture, Behavior Analysis faced new problems. Hobbs (2008) argues that working with social problems seems to be more complex and difficult than working with individual behavior problems. For this author, many behaviorists engaged in solving social problems use Behavior Analysis procedures to modify individual behavior. However, such attitudes may underestimate the complexity of broader social problems. The problem with child labor is an example given by the author.

According to Hobbs (2008), there is strong evidence that child labor is present throughout the world. Experts in the field refer to possible psychological harm to these workers; however, there is a negligible number of research in Psychology that contributes to the resolution of this problem. A question for Behavior Analysis is how to define the goals to be achieved when it comes to child labor. When there is a comparison with the intervention performed in the work with autistic people or even education, the behavioral objectives seem clearer. When working with autism, the central objective of an intervention is

frequently modifying the behavior towards the effectiveness of the child's daily routine; and when it comes to education, the essential objective is promoting the learning of certain skills.

The initial and central difficulty of child labor, as a change in cultural practice, consists of getting the children to trade the factory work for the school, for instance. It is important to define educational behavioral objectives, since the parents frequently resist taking the kids to school rather than to the factory. This does not happen by chance, child labor is frequently associated with extreme poverty contexts and, thus, the wages earned by the children are an important source of income for the family. Besides, even where there are schools available, children and parents may prefer the factory work because the quality of education provided is poor. Another important variable is how much the children's schooling will actually influence their later employment and life quality. In this case, because it involves long-term consequences, it may be difficult to be demonstrated to the family (Hobbs, 2008).

Measures taken to diminish child labor may also lack viable alternatives for the families involved. According to Hobbs (2008), an example of this happened in Morocco with contrary publicity to the factories that used child labor. As a result, the children were fired but the kids' life quality got worse rather than improve. In this regard, changes in complex cultural practices should involve the articulation of various sectors of the society, including governmental measures, so that the change in a practice, such as child labor, happens in a sustainable way. In other words, the children's dismissal from the factories should be contingent to better life conditions for them and for their families, and not the opposite.

Hobbs (2008) affirms that the discussions and goals included on the listserv arisen by the "*behaviorists for social responsibility*" do not include high complexity cultural problems, as it is the case of child labor. For this author, behaviorists who contribute to such discussions usually do not have direct

intervention experience in major social concern. Besides, they frequently emphasize the need to redefine the social problems in terms that enable solutions through behavioral technologies proven successful in other fields. This may not be the best direction, and, thus, cultural intervention innovations are necessary. Among them, Hobbs (2008) defends that the area should have more persuasive theoretical arguments in order to promote behavior technology, what requires being aware that some cultural forces must be overcome, which, for her, includes the misinterpretation on the scientific field that Behaviorism was overthrown by a “Cognitive Revolution”.

Regarding sustainability, Lehman and Geller (2004) point out that in the 1970s, some Behavior Analysis publications reported interventions on environmental problems and showed the efficacy of using behavioral technology towards problems such as waste recycling, proper use of public transportation, and so on. According to these authors, some of the main strategies used by behavior analysts in relation to environmental issues involved: 1) antecedent-oriented strategies, 2) consequence-oriented strategies and 3) variation of the methodologies used on interventions and on applied research.

The antecedent-oriented strategies use the relations of already existing stimuli control and act as motivating operations that can make the occurrence of pro-environmental behaviors possible. One example is making available relevant information about the social problems and each individual’s behavior in relation to it. Although the authors emphasize that information about the environmental problems alone is little effective to change behavior, studies have shown that it increases the probability of the pro-environmental behavior after specific interventions.

The use of signs, signals, prompts is another kind of antecedent strategy that signalizes the occasion in which the behavior needs to be presented (prompting strategies). This kind of strategy is extremely useful “when the target

behavior is relatively easy to perform, clearly defined, and when the message is displayed in close proximity to the place where the target behavior can be performed" (Lehman & Geller, 2004, p. 19). One example is the study made by Miller, Meindl and Caradine (2016) that manipulated bin proximity and visual prompts on recycling. Both interventions reduced the quantity of recycled material thrown in common bins, showing that visual prompts plus bin proximity were slightly more effective than bin proximity alone.

Modeling strategies may also be regarded as antecedent-oriented events, since they use demonstrations that present pro-environmental behavior. Lehman and Geller (2004) cite one of Winett's studies that made use of this strategy to increase energy conservation in households. In the latter study, the participants who watched a 20-minute video showing energy conservation behaviors had their consumption decreased when compared to the control group.

Another strategy described by the authors is "committing". Researches suggests that "committing" to something increases the probability of the subject engaging in behaviors related to what he/she established as a commitment. Committing may occur in vocal or written form and is more effective when it is active, public and perceived as volunteer. This strategy may be considered as a type of rule-governed behavior in which fulfilling a promise takes to positively reinforcing consequences and the opposite may lead to aversive consequences.

Lehman and Geller (2004) cite some studies showing the efficacy of committing to the change of pro-environmental behaviors. The work of Pardini and Katzev (1983-1984) for instance, showed that the groups invited to commit (vocal or written) showed significantly higher newspaper recycling rate than the control group. Moreover, their results showed that the written commitment lasted longer than the spoken one. DeLeon and Fuqua's study (1995) showed that the public commitment to recycle paper resulted in a 40-per-cent-increase

in the weight of recycled papers for those living in a building – in this case, the participant names were published on a local newspaper.

The last antecedent-oriented strategy, cited by these authors, is the environmental design in order to favor the occurrence of pro-environmental behaviors. The study carried out by Brothers, Krantz and McClannahan (1994), for instance, aimed at increasing waste recycling of an office; for such, they first placed a recycling container in a central area of the office, which generated a 28% recycling rate. Later, they placed recycling trays close to the employees' desk and observed that the recycling rate increased to 85-94%, and this was maintained for a seven-month period.

The previously cited strategies relate to the events anteceding the behaviors and they work because they signalize the consequence that may follow the environmentally relevant behavior. However, the manipulation of the consequences that determine the behavior may also be a powerful strategy of change.

The authors present two main kinds of consequence strategies to pro-environmental behaviors described in behavioral-analytic literature: the use of rewards and the use of feedback. The use of rewards is mainly characterized by its opposition to the use of punishment, since punishment may generate negative attitudes as well as pro-environmental behavior counter control. According to Lehman and Geller (2004), during the 1970s, 50% of the interventions published on the journals of the area made use of rewards for the environmentally relevant behaviors (e.g. monetary rewards, raffle coupons, toys, movie tickets and coupons for free beverage). However, the use of rewards decreased to 27% during the 1980s and to 13% during the 1990s. The studies suggest that, although interventions have produced significant effects on the establishment of pro-environmental behaviors, after the removal of the rewards, the behavior returned to the baseline conditions. One explanation for this occurrence is the fact that the interventions took place in a relatively short

interval of time, not favoring that the “inner” positive consequences to the pro-environmental behavior had effect, once the rewards, when function as positive reinforcers, generally operate as arbitrary reinforcers.

The use of feedback is another type of strategy described by the authors. This strategy consists of informing patients about the consequences of environmentally relevant behaviors, thus, making the distant consequences of such behavior more salient, increasing the likelihood of a corresponding behavioral change. Such change would have little chance to occur without a social intervention, once some posterior events do not control the behavior unless additional consequences are established (Lehman & Geller, 2004). The feedbacks may be issued in written or spoken ways, in graphs, individual or collective and in different reinforcement schedules.

Lehman and Geller (2004) cite a study carried out by Jacob Keller when he was ten years old[2]. He provided written recycling rates feedback to his neighbors, promising food donation to a homeless shelter when the target recycling rates were met. The last increased about 19% in the area where the intervention took place when compared to an area established as control. This study suggests that interventions that use feedback may be easily applied by those who are not part of the academic field.

Other studies have suggested the efficacy of strategies oriented to consequent events. One study by DeLeon and Fuqua (1995) showed that when feedback regarding paper recycling behavior was given to apartment residents, the weight of recycled paper increased 25% when compared to controls. Therefore, such studies indicate that behavior-based interventions may increase the likelihood of relevant behaviors in a social scale, thus, producing new

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2. This study was carried out by Jacob Keller, grandson of Fred Keller and published on the Special Issue on Behavioral Community Intervention do JABA de 1991. Keller, J. J. (1991). The recycling solution: How I increased recycling on Dilworth Road. Journal of Applied Behavior Analysis, 24, 617-619. Doi: 10.1901/jaba.1991.24-617

cultural practices. As observed by Lehman and Geller (2004, p. 22): “Although the impact of the interventions varied, the large-scale adoption and application of behavior analytic principles could ameliorate the negative impact human behavior has on the environment. Still, there is much more that could be done”.

The choice of behavioral targets to develop sustainability is another important issue discussed by the authors. According to Lehman and Geller’s position (2004), the works performed by behavior analysts have limited targets (as pointed out by the aforementioned studies), focusing mainly on three aspects of sustainable development: increasing recycling-related behavior, decreasing residential energy use, and reducing environmental litter. These are “convenient” targets for behavior analysts since they can be easily measured. Litter and recycling, for example, can be measured and weighed and home energy spent can be metered by some specific device. However, the authors argument that other behavioral targets still to be addressed would bring important challenges for behavior analysis interventions.

The authors suggest section interventions, which might promote changes with greater impact, should be one of the objectives for research in Behavior Analysis. Working, for instance, with those who hold the power in big companies may produce large-scale changes. One example could be the use of minimal packaging and cleaning products without harmful chemicals. If this practice produces advantages to the company, it will surely be incorporated (Lehman & Geller, 2004).

It is interesting to notice that every study the referred authors cite describe and discuss punctual modification to individual behavior. Hence, they present one of the ways Behavior Analysis has dealt with social problems, i.e. the modification of many individuals’ behaviors. Broader changes, which could be considered cultural changes, are scarce in the literature. Companies, for instance, are responsible for larger environmental degradation than that caused by individual behavior, and, in this sense, changing individual behavior is only

part of the solution to cultural problems concerning sustainability. As reported by the authors:

> By promoting source reduction through purchasing behaviors, psychologists would support a form of consumer activism that begins to address this problem. Although it would be a radical departure from past targets, perhaps a broader form of social activism should be a target for future interventions. For example, implemented on a large scale, interventions that encourage citizens to limit their stock investments to green companies, vote for pro-environment candidates, and boycott the most serious polluters could contribute to making corporate behavior more environmentally friendly. (Lehman & Geller, 2004, p. 23)

Another problem of interventions with a behavioral analytical approach is the maintenance of the behaviors over a long period of time. Most studies use a relatively short intervention period and, therefore, when the intervention is suspended, the target behavior often returns to baseline levels. This may be one reason why interventions based on the principles of Behavior Analysis have not attracted interest in other areas of expertise. Focusing on behaviors that do not require maintenance, establishing maintenance responses and planning interventions that can continue indefinitely are possible solutions to this problem (Lehman & Geller, 2004). For this, some authors have pointed out that in cultural interventions, strategies for change of behavior control from arbitrary consequences to “natural” or intrinsic consequences should be proposed (e.g. Souza & Carrara, 2013; Carrara et al., 2013).

There are differences, for example, in behaviors that minimize the resource and behaviors that produce the use of resources in more efficient

forms. The first requires maintenance contingencies, the latter needs contingencies only to their establishment, thus, being maintained for long periods of time. Using public transport instead of a private car is an example of the first type of behavior whereas replacing the common lamps at home for economic ones, such as LED lights, or buying a less polluting car are examples of the second type of behavior. In the latter case, after the establishment of the behavior few additional contingencies are necessary for its maintenance. Thus, Behavior Analysis lacks research and interventions that increase the likelihood of effective behaviors and of the use of more efficient technologies. The use of such technologies is ultimately a behavioral problem.

Regarding the establishment of maintenance responses, the central question is how to make the behavior under the control of intrinsic consequences or under the control of rules, rather than arbitrary consequences (see, for example, the study by Souza & Carrara, 2013). Regarding the continuity of interventions, Lehman and Geller (2004) suggest that researches that developed and demonstrated the effectiveness of certain interventions (e.g. the use of rewards or feedback to environmentally relevant behavior) should have their utility demonstrated to those who hold the power to change large-scale contingencies, for example, some behaviors could always be followed by economic advantages for the individual (e.g. the allocation of “bonus” for those who consume less energy in their households).

The authors emphasize the importance of disseminating the results of studies in culture behavior analysis to promote greater impact on the establishment of new cultural practices focused on sustainability. Geller (1989) suggests, for such, an integration between Behavior Analysis and Social Marketing; the formation of an interdisciplinary network of researchers, professionals, business leaders, community representatives and government people engaged in the issue in question; the development of clear language with practical information on working with politicians and legislators; the

publication of research results and interventions in ways that reach the people who are concerned with the target problem; the use of the media to sell interventions that have an effective cost-benefit ratio. Thus, these authors conclude that environmental conservation can be one of the most important social issues of our time.

In Brazil, some works that aimed changes in cultural practices deserve highlight. The study by Bortoloti and D'Agostino (2007) used the concept of metacontingency to analyze a set of interlocking behavioral contingencies in establishing coordinated actions, which were aimed at promoting reproductive control of dogs and cats, and responsible ownership of these animals by the inhabitants of a city in the state of São Paulo/Brazil. The authors identified the interlocking behavioral contingencies and the aggregated products involved in the practices established by this program. This program involved various sectors of the society and required the planning consolidated cultural practices changes; so, the program was characterized as a work of "behavioral engineering".

The relationship between the likely antecedents, the actions and the likely consequences of the activities carried out by animal protection authorities, the municipal government, the veterinarians and owners of dogs and cats have been described at the individual level. These agents were considered as directly responsible for the practices of reproductive control of domestic animals in the city. Some of the actions performed by animal protection organizations were: the pressure to end dog catching, the raise of resources for castration surgeries, the pressure for building shelters and hiring veterinarians, the establishment of agreements with private clinics, the joint efforts for castration, the monitoring of attended animals and educational programs. These actions occurred followed by the possible antecedents such as the gathering and sacrifice of healthy animals by the government and the excess of animals in the streets. The likely consequences produced by the actions were: the abolition of

dog catchers by the government, fewer abandoned and street animals and better conditions for those who still live in street, besides the growth of the entities, a fact that allowed greater social visibility and political prestige, which allowed a greater power of those involved in cultural change with the municipal government.

Among the actions carried out by the cultural agents of change the facts that stand out are that the government built a shelter for animals, hired veterinarians, began to provide material for castration surgeries at associated clinics, and also provided financial support for free castration surgeries. The likely consequences of such actions were the reduction of animals on the streets, of accidents with aggressors, and traffic accidents, the avoidance of pressure from animal protection organizations and the population and political support at the town hall.

Veterinarians, who are agents directly related to reproductive control of the city's animals, started to carry out castration surgeries in dogs and cats at reduced prices. The likely antecedents of this practice were the supply of surgical equipment to associated clinics, the pressure made by animal protection organizations for the adherence to the program and impractical competition of prices. The likely consequences produced by the actions of veterinarians were a greater number of surgeries performed and of potential consumers of other services and products offered in the clinic, advertisement and the avoidance of social disapproval for "non-compliance" to the program.

Regarding the owners, another group of cultural change agents, the action of subjecting the animals themselves to castration surgery occurred followed by the likely antecedents: low-cost castration surgeries, cost-free castration for pets belonging to low-income families, and advertising and educational campaigns. The likely consequences produced by the owners’ actions were animals with more appropriate behaviors to human interaction, avoidance of disorders of unwanted offspring and of the abandonment of puppies.

The description of each of the agents' behaviors, carried out by Bortoloti and D' Agostino (2007), presented how the behavioral contingencies are interlocking, because: "The actions of each type of agent involved helping to establish the occasion for the actions of others and/or providing consequences to those actions" (p.23). This interlocking behavioral contingency is what probably established and maintains the practices of each agent.

The authors have also identified and analyzed three possible aggregated products: the increasing number of castration surgeries, the reduction of the number of abandoned puppies and the increase in life expectancy of dogs and cats in the municipality, besides other possible consequences of the practices carried out by the four analyzed agents. With castration, animals no longer flee to mate, which also reduces the risk of accidents by territorial disputes, the barks and howls and consequently decreases the amount of poisoning by neighbors who feel bothered by such behaviors. Another effect of the interlocking contingencies was in relation to the owners, who have fostered over the health of these animals following the guidelines received from the veterinaries during the process of castration. These consequences, as a result of the practice of castration of dogs and cats, showed a steady and consistent increase. Thus, this study suggested that "it is possible to establish contingencies that promote large-scale neutering and responsible ownership of pets with benefits for the whole community involved in the process" (Bortoloti & D'Agostino, 2007, p. 27).

Another study that used the principles of Behavior Analysis for the description and analysis of social phenomena was the study by Lé Sénéchal-Machado and Todorov (2008). This study described the actions of social agencies in the city of Brasília/DF/Brazil in a cultural intervention that resulted in the cultural practice of respecting pedestrian crosswalk. The study reviewed documents and conducted interviews to reconstruct the history of the campaign called "Campaign for Peace in traffic and by the respect to the

pedestrian crosswalk”, in order to identify, analyze and interpret the interlocking behavioral contingencies responsible for cultural intervention.

As in other large Brazilian cities, Brasilia showed alarming rates of traffic violence in 1995 and 1996; about 50% of deaths from traffic accidents were due to pedestrians being run over. However, since 1997, there has been respect for the pedestrian crosswalk by the public after a social mobilization promoted among the local media, the government and the civil society. The “Campaign for Peace in Traffic” was started in 1996 by a local newspaper. In 1997, the conduction of the campaign was sent to the University of Brasilia (UnB) and the Permanent Forum for Peace in Traffic was created. Moreover, the campaign for "Respect for the Pedestrian Crossing" was implemented. This campaign provided the establishment of significant changes in the behavioral repertoire of drivers and pedestrians in this city (Lé Sénéchal-Machado, 2007).

According to Lé Sénéchal-Machado (2007), in 1995, the Government of the Federal District created the “Security Program for the Transit” that was extended for the “Program for Peace in Traffic”. The program was proposed in order to implement action measures, such as eliminating excessive speed, eliminating the excessive use of alcohol by drivers, enforcing traffic regulations, intensifying education activities in traffic, increasing safety conditions on the road network, improving health care to traffic accident victims, keeping the vehicle in proper conditions of safety, improving traffic law, standardizing the statistical monitoring, prioritizing pedestrian, cyclists and public transportation movement, creating equity instruments for the citizens to combat violence in traffic and organizing advertising campaigns for public awareness regarding the problem of traffic. In addition, the local newspaper launched its own campaign, in August 1996, against violence in Brasilia traffic and, in 09/15/1996, a march organized by the same newspaper gathered more than 25,000 people in the campaign for peace in traffic. A sticker with the symbol of the campaign was created and people started to use it in their cars to show adherence to the

movement. The University of Brasilia (UnB) was asked to coordinate a "Permanent Forum for Peace in Transit", which was born in December 1996 and was characterized as one of the most important consequences of the campaign, because it made possible the continuity of results.

The study of these authors discussed the cultural intervention in two main cultural practices: the practice of drivers not respecting the pedestrian lane and, in turn, the practice of pedestrians not crossing on the crosswalk. The articulation of sectors of society such as the church, the police, the traffic department, the media and the University of Brasilia generated decisions made in the "Permanent Forum for Peace in Traffic" and the implementation of such decisions by each agency producing changes in cultural practices. The practices were modified, since the drivers began to respect the crosswalk and the pedestrians started using it; these were new practices that resulted in the significant reduction of trampling rates. According to the authors, although the "Forum" ended in 1999, the respect to the crosswalk still occurred in Brasilia until the date of the study. According to Westin (2012), in an article published in the Jornal do Senado, even after 15 years of the campaign, drivers stop at crosswalks when prompts by pedestrians are made and it is still observed nowadays.

The Brazilian studies described suggest changes in cultural practices that have been maintained, which allow us to state that such practices have been selected. As noted above, an important issue when dealing with cultural practices that may generate relevant consequences for a culture is to analyze it according to the model of selection by consequences, which implies discussing variation and selection. Variation occurred in the communities described by the studies, as new cultural practices have been established: the proper care of domestic animals and the change in the behavior of citizens in Brasilia regarding the crossing in the crosswalk are good examples. In addition, there is strong evidence of the selection of such practices, since at least some of them

have been maintained to the present day. These studies seem to suggest that when cultural changes occur more broadly, involving various sectors of the society, which would include some control agencies (e.g. government, education and media), the probability of changes to be roused and mostly kept appears to be greater. However, there still remains the challenge that changes in cultural practices through planning are difficult to be reached and maintained, because the contingencies are multiple and complex. A well-established practice can be completely changed with the change of government, for example, when these fail to maintain necessary contingencies (e.g. economic) to maintain a cultural practice.

Another direction of Behavior Analysis studies has been to analyze the effect of the laws over the establishment of cultural practices, since they are one of the attempts of government control agency to promote cultural changes. In this field, Behavior Analysis helps to specify which variables enable a behavior to be governed by a rule (in this case the law). Todorov (2009), for instance, exemplifies this by analyzing the text of the ECA (Estatuto da Criança e do Adolescente/Child and Adolescent Statute). The ECA prescribed, in Brazil, new cultural practices regarding the treatment of children and adolescents. According Todorov (2009, p. 12), laws are descriptions of contingencies (for example a reinforcement contingency composed of three terms) and may also be seen as the description of a metacontingency (interlocking behavioral contingencies, its aggregate product and the cultural consequences arising from this unit, e.g. Glenn & Malott, 2004), i.e., “law as a written statement of interlocked contingencies that control individual behavior”. The author argues that this type of analysis may contribute to the understanding of how, when and why the laws control the behavior of members of a group.

In this control, Todorov (2009) points out that the laws are often unclear and described only incomplete contingencies, which allows a wide margin of interpretation and can reduce the control that the law would have on behavior.

An interesting example is one of the ECA's articles (number four), which prescribes that it is the duty of the family, local community, society and the government to ensure children's rights to food and health. For Todorov, the article is so vague and without specification of what consequences would be contingent to these practices that it has no power to establish behavior control. In addition, there are other cases where protective measures determined by law depend on many financial resources and manpower that they are not executed. In this scenario, the author argues that an external control to the law enforcement agency should be carried out by the society, by the educational systems and by the media. Thus, the analysis of the ECA as a description of contingencies and metacontingencies suggests a way to study some of the variables that affect the emergence, implementation and maintenance of cultural practices.

It is understood that, discussing problems presented by the described studies, such as the question of transit, child labor and issues related to child and adolescent protection, sustainability in environmental issues and the proper care of domestic animals even though they have specific themes, enables the discussion of how Behavior Analysis deals with social problems. The work of these authors raises broad questions regarding social problems. However, they note that behavioral technology has still worked with limited social problems.

Therefore, a relevant question to the behavior analysts who are concerned with the resolution of wider human problems is that the transposition of knowledge and techniques that have been effective in the individual behavior field may not be enough when dealing with culture and social problems involving harmful cultural practices. Changes in cultural practices involve working with networks of complex relationships between individuals behaviors, network of relationships of cultural practices and network of relationships between cultures, which is not the same as working only with the behavior of an individual in its relations with the world (Melo & Rose, 2013).

Skinner (1981) talked about cultural practices in a third level of variation and selection; when dealing with the first level, the phylogenetic, he did not dismiss the idea that despite being a process of variation and selection, the mechanisms involved in natural selection may be different from those involved in the ontogenesis. When he discussed, for example, the "phylogenetic shaping of behavior" in 1974, he held a parallel with the ontogenetic shaping. This parallel is certainly a metaphor. In the case of culture, this would be one direction, i.e., there are similar processes to the operant level, but researches in behavioral analysis of culture are important to the understanding of the processes involved specifically in this level of selection.

Guerin's Intervention Proposal

Guerin's analyses (1992, 1994, 2001, 2004, 2005) on cultural issues are interesting because they present a constant dialogue of Behavior Analysis with other areas of knowledge, especially with parts of Anthropology and Social Psychology. This approach can contribute to the development of behavioral analysis of culture. Many studies have been done by anthropologists in relation to research on the functioning, the study methodology and ways of intervening in the cultures. Although some anthropological theories can present insurmountable epistemological barriers with Radical Behaviorism, others can clarify our understanding of human cultures (interesting examples can be seen in the similarities between the proposal of the anthropologist Marvin Harris and Radical Behaviorism, as in the researches studies by Glenn 1988; Harris, 2007; Malagodi, 1986; Malagodi & Jackson, 1989; Malott, 1988; Melo & De Rose, 2012; Vargas, 1985).

Guerin's (2005) proposed intervention in communities argues that the analysis of the context is, in the case of cultural interventions, a crucial element.

Some communities' intervention strategies can be used by all disciplines and approaches that work in an interdisciplinary way in the social sciences.

For Guerin (2005), the intervention in communities focuses on promoting adjustments in social relations. To this end, several steps are important and necessary for an intervention to be effective. So, to know about the cultural, economic, environmental and historical contexts to which a community belongs is of crucial importance. The author illustrates that social relations in the West often involve relationships with strangers, therefore, interventions in Western societies by stranger agents, such as a psychiatrist, psychologist and educator can work very well while in other societies or groups, as some indigenous or tribal communities, this type of intervention could be completely ineffective and not promote significant changes[3].

In Western societies, people prefer to pay for strangers, such as psychologists, to help them solve personal relationship problems while this practice would be inconceivable in other social groups. So the first step to analyze a community is to know about their social context. According to Guerin (2005, p. 14):

> Like any analysis of behavior, you need to know the behaviors or activities with which you are dealing, the social contexts or situations in which they occur, and what the typical consequences have been in the past for those activities in those contexts.

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3. An interesting study about this aspect can be found in Guerin, B., Guerin, P. B., Diiriye, R. O., & Yates, S. (2004). Somali conceptions and expectations of mental health: Some guidelines for mental health professionals. *New Zealand Journal of Psychology*, 33, 59-67.

In order to know the social context, Guerin (2005) argues that the professional should spend as long as possible in the community, informally observing, talking to experts and especially with community non-experts. He should also integrate the information provided by community members together with the information derived from direct observation. This step, when done well, allows the definition of intervention activities, which will be the changes made in that context and the possible consequences of such changes.

Important questions that can contribute to the intervention context understanding and, thus, contribute to the research on cultural contexts are: What do people commonly do in these situations? What would happen if the situation changed? Are there results that are likely to maintain the situations? What is the historical context of that situation? Has any intervention been carried out by researchers or professionals? (Guerin, 2005, p. 16).

Other issues set out important differences that should be raised when studying communities. Is the work carried out with individuals or groups? As discoursed throughout this chapter, working with the behavior of individuals modifying the environment and teaching new behaviors could be different than working with social groups such as families, the neighborhood, and an entire nation (Guerin, 2005).

Do people have or not the appropriate language skills? Working with people who follow verbal instructions and have fluency in a common language is different than working with people who do not speak a language due to intellectual disability issues, age or even a foreign education.

Do the interventions aim to provide people to do or say something? This author distinguishes between the doing and the speaking, thinking or believing in something. In the first case – the doing – people learn a new physical skill or stop doing any physical action whereas in the second case – the talking, thinking or believing in something – people are taught to say something, believe in something, follow certain instructions, give certain instructions or stop saying

things. However, the author does not defend that there is difference in the nature of such phenomena, but there are different methods of intervention. Intervening for people to use condoms during sexual intercourse is an example to provide people to do something; another example is to provide an individual to cease to think he will be killed (e.g. to provide people to think of something).

Another interesting question is about the types of social relations established between individuals in a group. For the author, depending on the type of social relationship, the relevant social properties are different, which may affect the designing of new cultural practices. Social relations are different in relation to societies (e.g. Western or other societies) if they are strangers, whether they belong to the same nuclear family, if they are close friends and so on. So, Guerin (2005, p. 22) sets out three main types of social relations: 1) relationships not based on kinship ties (non-kin-based); 2) relationships those are or are not based on kinship ties (kin – or non-kin-based) and 3) relationships based on kinship ties (kin-based).

According to Guerin (2005), the management strategies of the relationships and so of the interventions are different if interventions are to strangers, with the nuclear family or with friends. An interesting example given by the author is that, in Western societies, the interventions by strangers are more effective than it they would be if carried out by people who are close (e.g. the physician, the psychologist are strangers and are paid to carry out their activities), but kin-based communities would not understand an intervention in which a stranger, such as a psychologist, gets paid to solve their problems.

The author points out that most cultural interventions described in the literature is intended to Western societies and focuses on the social relations that are present in the western lifestyle. In most cases the results attest to the universality of interventions with the exception of its non- effectiveness for a “small portion of communities”. However, the author stresses that this “small portion” may be due to the types of social relations that are not common in the

West. For the behavior analyst, investigating the kinds of social relations may indicate the function and contingencies (behavioral and/or cultural) involved in the maintenance of some cultural practices.

According to this author, in Western societies it is common for an intervention to be sold to people; this kind of intervention works because Western social relationships are most often mediated by money. Certainly, in communities where relations are very close, this type of intervention would not work; in this case, establishing social relations with its members may be part of the intervention. Furthermore, when an intervention is carried out with closed community's individuals, intervening in the behavior of a single individual produces changes in the group as a whole: "(...) **interventions with individuals in strongly kin-based groups <u>are</u> community interventions** – whatever changes are made impact beyond the single individual, and this can work in your favor or against it" (Guerin, 2005, p. 25, author´s emphasis).

Guerin's intervention proposal (2005) can bring important contributions to the behavioral analysis of culture. Behavior Analysis does not establish general types of social relations occurring in cultures, since, according to the assumptions of such science, the function of each social relationship in the lives of individuals and their impact on the group should be investigated. However, the type of description of social relations held by Guerin (2005), also present in the work of much of Anthropology, before suggesting essential or of the nature differences of social relations, may indicate neglected characteristics by the behavioral analysis of culture. The peculiarities of each type of social relationship may suggest another important point about the phenomena occurring in the culture.

The way people relate to the world depends on the types of social relations they establish throughout their lives; it is also an analysis of contingencies. Culture, in this sense, models types of social relations. Thus, closed community's individuals establish different relationships with the world

when compared to Western societies ones. This statement can be deduced from studies that demonstrate the existence of conflict when individuals of closed communities migrate to Western societies, i.e. a society of strangers (e.g. Guerin, et. al. 2004). Indeed, the interdisciplinary study of culture can bring contributions to science that could not be achieved otherwise and, therefore, Behavior Analysis must dialogue with other disciplines that address cultural phenomena.

Final Considerations

This chapter pointed out that a behavioral analysis of a wider form of culture, which contemplates interventions in cultural practices, has been the subject of fruitful discussions with the formulation of new concepts, such as the concept of metacontingency (e.g., Glenn, 2004; Glenn, & Malott, 2004; Malott & Glenn, 2006) and deeper exchange with other areas of knowledge. Behavior Analysis is a scientific field that has enabled a program of study, formulation of questions and possible answers not only to the behavior of individuals or organisms of different species, but also for the establishment and maintenance of cultural practices and for the analysis of the effects of these practices on the strength of cultures.

However, regarding this field, it can be argued that the questions are only in the early stages. Skinner formulated the theoretical basis for the analysis of culture and suggested the importance of deep-studying them if we are to better understand human behavior and, in addition, address and solve broader human problems.

Radical Behaviorism and Behavior Analysis have a plausible, pragmatic and parsimonious explanation for culture. For it emergency, maintenance and permanence. That is, the processes of variation and selection are evolved processes that made possible the survival and reproduction of the species.

Human culture must have been developed by small variations, among them the emergence of verbal behavior, which enabled a much greater chance of survival and reproduction of the human species when compared to organisms that did not show the variations, behavioral or biological, necessary for evolution of culture. Therefore, there are no ideas of a group, a collective unconscious or collective mind, to conceptualize culture as being of distinct nature of the behavior of individuals. For the Radical Behaviorism, culture is the result of the same processes (variation and selection) and has the same nature as all other behavioral and biological phenomena (Skinner, 1971/2002, 1981).

Studies in behavioral analysis of culture, as described throughout this chapter, suggest that most of the works performs what is considered "molecular" analysis of the culture. That is, to describe the processes involved in social phenomena, in the description of cultural practices, and, especially, in culture intervention works, Behavior Analysis focuses on individual behavior. The analysis and intervention on "molar" contingencies are still very scarce. The study of Lehman and Geller (2004), for example, pointed out that the work carried out by behavior analysts in the theme of sustainability have limited goals.

The studies previously described also suggest that when cultural interventions are performed in order to achieve wider contingencies, the change in the practices of a culture occurs more consistently and in long lasting way. The practice of pedestrians and drivers in respect to the crosswalk was a cultural change that took place in Brasilia, involving major sectors of society, in order to establish and maintain a new cultural practice. The contingencies that were manipulated can be considered cultural because the change was mainly in control agencies. One can extrapolate from these data, that the control agencies should be the focus of a behavioral analysis of culture in our societies.

Fruitful advances can occur when exchanges with other areas of knowledge are established. An example of this is the Guerin's (1992, 2004,

2005) proposal that primarily interacts with Social Psychology and uses a research methodology close to ethnography.

It is possible to conclude that the debate is extensive and still recent. Looking into cultures and extracting theoretical implications and useful technology from the data is a fundamental attitude in building a science concerned with social issues, such as Behavior Analysis. An inductive approach as advocated Skinner (1950), a referral to a behavioral analysis of culture.

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6 Conservation and transformation of cultural practices through contingencies and metacontingencies[1]

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> The cultural system is a processual entity – a thing in being. Because such systems are constantly forming, dissolving, dividing, merging, reproducing, growing, and shrinking, the definition of cultural systems poses formidable problems. (Beals, Spindler, & Spindler, 1967, p. 11)

The experimental analysis of operant behavior originated by the failure to explain instrumental behavior through the language of Pavlovian conditioning (Skinner, 1935; 1938). The contingency, a conditional relation between behavior and consequences, has been an instrument for experimental, functional and conceptual analyses in behavior analysis (e.g., Skinner, 1957, 1969, 1987). In spite of the fact that both major periodicals dedicated to research concerning operant behavior state a dedication to the experimental analysis of individual behavior, the social aspects of the field were obvious from the beginning in works like *Science and Human Behavior* (Skinner, 1953).

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Cultural practices are maintained by social contingencies that prevail in a given society, group, or organization (Skinner, 1953). They may be in vigor for variable lengths of time, from some months, as in fashion, to some centuries, as contingencies that are part of the identity of ethnic groups. Practically all human operant behavior may come under the classification of cultural practices. Even behaviors common to all humans, like eating, are linked to social contingencies that determine what and how to eat. Such behaviors are acquired by newcomers to any given group, either a child or a stranger, by learning processes that may involve modeling, rules, and/or direct exposure to the contingencies. A child will acquire behaviors that will be maintained by social contingencies through interactions with her mother, family, caretakers, and controlling agencies like school and church. It is a long process that usually respects the child's biological development. It may be so smooth that control by contingencies is not easily perceived. The stress associated to each new acquisition shaped by cultural consequences is diluted through years or decades. The aversive character of control by contingencies becomes part of life (e.g., Biglan, 1995; Ellis & Magee, 2007; Glenn, 1991; Guerin, 1992; Lamal, 1991, 1997; Lamal & Greenspoon, 1991; Malagodi, 1986; Malott, 1988; Malott & Glenn, 2006; Mattaini & Thyer, 1996; Rakos, 1983; Ulman, 1998, 2006).

The arrival of a stranger who joins a given group or organization shows more clearly how social contingencies may vary and how aversive is the adaptation to new rules of cultural selection. Discriminative stimuli in the new culture will exert control over the stranger's previous behavioral repertoire. Without explicit rules or modeling, direct exposure to new contingencies will generate extinction and/or punishment in cases where similar discriminative stimuli control different responses in each culture. In other instances new discriminative stimuli may have no control over any behavior given how different are the sets of social contingencies. A new repertoire will require frequent exposition to stressful situations. Escape and avoidance may be related to

foreigners' less than optimum adaptation to a new culture: Efforts will cease when a new repertoire is enough to get by.

Anyone with experience with the learning process, be it on the laboratory or on applied settings, know that it takes reinforcement that is more frequent and of larger magnitude to shape new behavior. The learning situation is more stressful also. When stability is reached, i.e., behavior show no significant change as a function of continued exposition to the contingency, reinforcement may be much less frequent and of lower magnitude (e.g., Sidman, 1960, pp. 389-390). New behavior may be shaped through aversive consequences. Escape is learned more easily than avoidance responses (e.g., Ferrari, Todorov, & Graeff, 1973), but by its nature situations involving escape are always stressful. Stable avoidance behavior however may show surprising effects. There is no stress in taking an umbrella when clouds signal impending rain. Escaping an embarrassing social situation is stressful; learning to avoid embarrassment is a relief.

Direct exposition to stressful contingencies is avoided by learning to follow rules and to observe others behaving. So life in any society is regulated by rules, and some very special rules are called laws, a kind of social control exerted by the government (Black, 1976, 1998). Laws are made to control behavior: To promote desirable (for society) behavior and eliminate undesirable and deleterious (for society) actions (e.g., Chriss, 2010). The triple contingency – antecedent, behavior and consequence – is easily found in laws, decrees, etc. (e.g., Skinner, 1953; Todorov, 2005). The triple contingency refers to a single action, but a law usually deals with a set of actions, especially when it is destined to promote new living conditions. A set of interlocked behavioral contingencies is needed to guarantee that a change in cultural practices in society will occur and be maintained (e.g., Black, 1998; Ross, 1901/2012; Todorov, 1987). A metacontingency is the relation between a set of interlocked behavioral contingencies necessary for the production of a given aggregate

product and the consequences provided by a selecting cultural environment (Glenn, 1986; Glenn & Malott, 2004; Malott & Glenn, 2006).

As it happens, laws are not written by behavior analysts. Since Hammurabi laws are the product of other experts. When a new law just specify ongoing cultural practices conformity to it is more easily obtained. Laws approved to change current practices are a set of rules concerning the intentions of the government and its legal bodies. Cultural practices will change more rapidly when past laws and decrees were strictly enforced, i.e., when consequences followed behaviors promptly and accordingly to the legal texts (Todorov, 1987; Todorov, Moreira, Pereira, & Prudêncio, 2004).

A set of laws is a good source for the study of the kinds of contingencies in vigor in any given society. As control was not invented by behaviorists, behavior analysis may have much to learn from many centuries of technological development in legislation. Until Sigrid Glenn presented the concepts of ceremonial and technological metacontingencies (Glenn, 1986) and of macrocontingency (Glenn, 2004), behavior analysts had only the triple contingency as a tool to understand how laws could control behavior (Marr, 2006). However, outside the laboratory or controlled clinical interventions, only rarely we find any regulation of behavior by only one independent variable.

Using the definition of metacontingency advanced by Houmanfar and Rodrigues (2006), in a given situation (cultural milieu – M), an aggregate product (P, resulting from some interlocked behavioral contingencies) will have as consequence (C) some alteration in the environment scheduled by a selecting cultural environment. A metacontingency may be qualified according with some of its characteristics. Glenn (1986) used the information about reinforcers to classify metacontingencies:

Ceremonial. For Glenn (1986) “ceremonial contingencies... involve behavior that is maintained by social reinforcers deriving their power from the

status, position, or authority of the reinforcing agent independent of any relation to changes in the environment directly or indirectly benefitting the behaving person" (p. 3). As defined the adjective *ceremonial* applies to behavior contingencies also; examples are easily found in the early education of youngsters.

Technological. "Technological contingencies involve behavior maintained by non-arbitrary changes in the environment. The reinforcers entering into technological contingencies derive their power from their usefulness, value, or importance to the behaving person as well as others." (p. 4).

In Glenn (1986) ceremonial and technological metacontingencies were classified according with reinforcers involved. Among other possible ways to classify metacontingencies there is the character of the aggregate product (irrespective of the reinforcers involved).

Conservative. Contingencies and metacontingencies are conservative when behavior in the contingency and aggregate product in the metacontingency are closely specified, with little room for variation. Ways to salute (behavior in a triple contingency), in the army, and folk dances like the "*Bumba Meu Boi*" (aggregate product in a metacontingency), in Brazil, are examples. In the first example, saluting is both conservative *and* ceremonial

Transformative. Sometimes, in certain circumstances, or from some organizations, society requires originality as a characteristic of the aggregate product in a metacontingency, here called *transformative*. A scientific paper produced by a single author is the result of behavior component of a triple contingency; two or more authors collaborate in an aggregate product required by society to be original. A group of behavior analysts working on applied research may behave according with metacontingencies that are both technological and transformative. Their collaboration is supposed to result in

new solutions to social problems and their behavior is not under control of social reinforcers controlled by authorities.

The behavior analysis of cultural practices may be only beginning and much work with the behavioral contingency is necessary (e.g., Branch, 2006; Marr, 2006), but that should not be in the way of the development of new concepts like the metacontingency (Todorov, 2009). A new line of experiments on social behavior shows promising new data to sustain theoretical analyses of the last 20 years (e.g., Costa, Nogueira, & Vasconcelos, 2012; Franceschini, Samelo, Xavier, & Hunziker, 2012; Morford & Cihon, 2013; Neves, Woelz, & Glenn, 2012; Ortu, Becker, Woelz, & Glenn, 2012; Smith, Houmanfar, & Louis, 2011; Tadaiesky, & Tourinho, 2012; Vichi, Andery, & Glenn, 2009). A substantial amount of data has been generated by students in graduate programs at the Pontifícia Universidade Católica de São Paulo, Brazil (Amorim, 2010; Buellerjahnn, 2009; Brocal, 2010; Caldas, 2009; Dos Santos, 2011; Nery, 2008; Oda, 2009; Pereira, 2008; Teixeira, 2010; Vichi, 2004; Vieira, 2010), at the Universidade Federal do Pará, Belém, Brazil (Leite, 2009; Lopes, 2010; Tadaiesky, 2010; Vichi, 2012), at the University of North Texas, Denton, TX, USA (Neves, 2012; Ortu, 2012) and at the Universidade de Brasília, Brazil (Andreozi, 2009; Baía, 2008; Costa, 2009; Martone, 2008; Nogueira, 2009; Nogueira, 2010). Empirical, although not experimental, work is represented by Pereira (2005), Prudêncio (2005), Sénéchal-Machado (2007), Sénéchal-Machado & Todorov (2008), Silva (2008) and Todorov, Moreira, Pereira, & Prudêncio (2004).

Procedures and processes

> It should be noted that (...) "if, then" statements (...) merely define independent variables; they are not empirical propositions (e.g., if a response produces an electric shock, the response will decrease in

> frequency) where only the "if" clause specifies the independent variable and the "then" clause specifies the dependent variable (Weingarten & Mechner, 1966, pp. 447-448).

A contingency is a conditional relation. If behavior X occurs, then X will be followed by consequence Y. Behavior X will be called an *operant* if changes in the contingency will result in changes in some parameter of X, like frequency, duration, force, topography, etc. If only in the presence of situation Z behavior X will be followed by Y we have a *discriminated operan*t. However, we don't say that a triple contingency *is* a discriminated operant. The definition of triple contingency helps in programming experiments and in the observation of discriminated operants outside the laboratory. A contingency describes a *procedure* that may or may not begin, maintain or end an interaction *process*.

Contingencies are "If ..., then ..." descriptions of relations between events used as independent variables in the experimental analysis of behavior (Weingarten & Mechner, 1966) and in pavlovian conditioning (Todorov, 1991). Relationships among events as independent variables also may be used in experimental studies of the behavior of persons in groups and of groups of persons (e.g., Vichi, Andery, & Glenn, 2009). When the triple contingencies describing individual behaviors are interlocked an aggregate product may result – an effect on the environment that would not occur as consequence of only one person's behavior. An aggregate product is the result of interlocked behavioral contingencies involving at least two persons. The term *metacontingency* has been used to refer to rules that specify what consequences a given aggregate product will bring to the group of persons, to the organization, etc. (Malott & Glenn, 2006; Todorov, 2006, 2010).

Choices and preferences, for instance, may be studied through the manipulation of independent variables in concurrent schedules (Skinner, 1950).

However, choices are not concurrent schedules; preference for responding in certain circumstances and not in others isn't concurrent schedules. Choices, decisions and preferences may be studied with the help of the manipulation of independent variables arranged in concurrent schedules. But choices, decisions, and preferences are *processes*; the manipulation of variables in reinforcement schedules is described as a *procedure*.

An operant is a *process* if, when and while an action is modified by its consequences. "If X, then Y; if not-X, then not-Y" is a procedure.

A *procedure* is arranged and manipulated by the experimenter; a *process* involves a behavior-environment interaction in a given context, an event in time that has a beginning, certain duration and an end, or a new beginning. A well-known *procedure* is the fixed-interval (FI) schedule of reinforcement - if a given response occurs after some time t marked from the last reinforcement, a reinforcer will be delivered. The *process* involved in the development of the typical response pattern – the scallop – is not described, nor predicted, by the *procedure*.

The differential reinforcement of other behavior (dro) schedule, when described as a conditional relation, reads as "If X, then not-Y; if not-X. then Y." Applied to mother-child relationship would mean "give attention when well behaved, not when misbehaving." The *process* generated by the dro *procedure* may depend on a context not included in the *procedure*.

"If..., then..." statements may refer do independent variables or to empirical relations (Weingarten & Mechner, 1966). As independent variables for the study of operant behavior, contingencies may have two terms, as in the sentence "If response R occurs, consequence C will follow". A related empirical statement will be "If response R is followed by consequence C, the frequency of response R will increase (Weingarten & Mechner, 1966). The identification of the independent variable describes a **procedure**. The related empirical statement

identifies a **process**. So why sometimes both procedure and process receive the same name?

Extinction, reinforcement, discrimination, etc., are terms used both for procedures and processes, generating confusion for beginners in behavioral analysis. In the extension of behavior analysis to the study of culture the introduction of the concept of metacontingency has generated misconceptions that could be avoided by naming differently different procedures and processes. In 1986 metacontingency was first described as a given process (Glenn, 1986), modified in 1988 as a somewhat different process, and presented in 2006 (Malott & Glenn) as a unit of cultural selection similar to the operant.

However, at the third level of selection by consequences (the cultural level), other concepts have already been advanced, as Ulman's (1998) *macrocontingency*:

> Macrocontingency may be defined as a set of differing actions (topographies) of different individuals under common postcedent control. Postcedent refers to events that follow actions 4 In operant terminology, postcedents that increase the actions they follow define reinforcing events; those that decrease the actions they follow define punishing events; and those that have no effect on the actions they follow are neutral or ineffective (and therefore do not exert postcedent control). Because this matrix of two-term contingency relations that defines the macrocontingency may involve any number of individual or collective action--verbal as well as nonverbal and covert as well as overt-under the same postcedent control, the complexity of the contingency relations constituting a macrocontingency is unlimited. That is, the flexibility of the definition of the macrocontingency allows for descriptions of real correlated actions among any number of individuals and with any degree of complexity. Hence, as defined here,

> the concept of a macrocontingency is elastic--expanding or contracting with increasing or decreasing complexity so as to describe the actual material conditions as can best be determined from an empirical analysis of the nexus of contingency relations (consequences and other events) constituting the real sociocultural phenomenon under investigation (Ulman, 1998, p. 209).

So defined, *macrocontingency* is a generic term encompassing all social contingencies associated with group behavior, or the associated behavior of persons in groups. It remains to be investigated, experimentally or otherwise, the possible social contingencies falling under the umbrella of Ulman's macrocontingency. *Macrobehavior*, then, can be used to denote what has been called macrocontingency (Glenn, 2004; Malott & Glenn, 2006), as suggested by Mattaini (2007) and Houmanfar, Rodrigues and Ward, 2010). Interlocked behavioral contingencies, multiple independent behavioral contingencies (producing a social effect), and the several procedures that have been called metacontingencies (Malott & Glenn, 2006; Todorov, 2012) may be called examples of macrocontingencies (Ulman, 1998; 2006), or schedules of cultural selection (Todorov, 2010).

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7 Stimulus control and verbal behavior: (in)dependent relations in populations with minimal verbal repertoires

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Many studies on verbal behavior have stimulus equivalence as their main line of research. In the methodology and application settings, the model of stimulus equivalence has demonstrated that after establishing at least two listening relations based on selecting the same auditory stimuli, speakers with normal hearing show equivalence relations between selected visual stimuli, as well as naming. Considering the wide scope of this model for people with minimal verbal repertoires, recent researches have demonstrated the conditions in which listener repertoires may be established by different teaching procedures (exclusion, trial-and-error and blocked-trial procedure) and how they share equivalence relations. Initial studies found that establishing equivalence relations was not sufficient to the emergence of naming visual stimuli with an exact correspondence to conventions of the verbal community. After several different opportunities of oral (tact, textual and echoic) production due to experimental procedure naming showed gradual changes until greater precision was reached. For children who can read, naming precision has been obtained through extended control of textual stimuli to figures, after equivalence classes were established.

Verbal behavior analysis occurs as other operant behaviors, that is, according to the same principles of acquisition, maintenance and extinction (Barros, 2003). Verbal behavior may be defined as (1) behavior that initially alters the behavior of another organism, (2) which produces consequences to the verbal action mediated by the other organism that is present when such action occurs, and (3) the verbal action is only understood and enables the person to mediate posterior consequences because verbal practices are a convention shared by members of the same community (Passos, 2007; Skinner, 1987)[1].

Studying verbal behavior is relevant for many reasons, but especially because, it became under operant control. The use of verbal behavior permitted us to describe behavior, which in turn enabled members of a verbal community to emit responses even without going through a situation where that response would have been necessary (Machado, 1997). It was indispensable for this to be acquired throughout an individual's life (ontogenetic selection) and for it to be transmitted through generations (cultural selection). This ontogenetic sensibility for verbal behavior and its survival value is exclusive to the human species (Skinner, 1990).

Considering the levels of selection, research in phylogenesis allows us to examine how variation and selection processes enabled anatomic structures to emit several sounds; on the other hand, studies on ontogenesis may verify the necessary precursors of learning verbal behavior and how vocal musculature can be brought under operant control. Central nervous system structures, which are responsible for language and grammatical organization, have developed by means of natural selection (Pinker & Bloom, 1990). Moreover, the ability to learn and interact with other members of our species in a verbal

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1. Skinner called individuals emitting verbal responses "speakers", and the audience, who reinforces and differentially selects the speakers' behaviors, "listeners". His requisites for verbal behavior do not exclude other forms of behavior, such as sign language, figure systems, or synthesized voices (Horne & Lowe, 1996; Greer & Ross, 2008).

manner had an important impact on human evolution, since it increased conceptual and symbolic repertoire (Campos, Santos, & Xavier, 1997). It is likely that vocal emissions evolved from non-specific gestural emissions. Vocal emissions have been selected over gestural emissions probably due to the former being more accessible to more people than the latter. Expressing imminent danger through sound stimuli (e.g. warning about a predator) can affect many more people than a gesture (Borloti, 2005, cited by Hübner, Borloti, Almeida, & Cruvinel, 2012). Our culture has probably selected listening and speaking behaviors more frequently than other topographies of verbal behavior (e.g. gestures, such as sign languages present in deaf cultures).

For typical oral verbal behavior to occur, different components must be ensured, such as nervous system maturation, exposure to environments with oral stimulation and integrity of physiological structures responsible for sensory systems, especially the auditory system (Geers et al. 2002). Hearing has a special role in the development of oral language inasmuch as it directs and establishes relationships between sounds (phonemes) and their corresponding phonoarticulatory movements (or vocal topography) (Melo, Moret, & Bevilacqua, 2008). All this considered, people with limited auditory perception, especially those with congenital impairment – that is, before developing oral verbal behavior –, will have notable difficulties in oral verbal acquisition. These difficulties will occur when individuals are in the role of listener, since they will not select and maintain speakers' verbal emissions, as well as when they are in the role of speaker, since opportunities for their verbal emissions to be shaped and maintained are scarce.

Extreme cases of auditory deprivation established before language acquisition, with rehabilitation by cochlear implant (CI), are an important opportunity to study stimulus control and verbal behavior, (in)dependent relations between verbal operants, and the conditions under which interdependency may be programmed. Cochlear implants are devices that

promote auditory rehabilitation through a cirurgical insertion of electrodes in the cochlea that assume the function of damaged stereocilia. Most users of CI experience great improvement. However, to take better advantage of the benefits offered by the device, it is important to investigate how they learns to behave as speaker and listener (Almeida-Verdu, da Silva, Golfeto, Bevilacqua, & de Souza, 2014). The CI promptly reestablishes sound detection, on the other hand, comprehending sounds and to produce an intelligible speech requires learning.

Among many variables related to establishing oral verbal behavior in children with cochlear implants, one may include those related to the organism, to the device, and to learning (Boons et al., 2012). This chapter proposes an analysis and discussion of variables related to learning verbal relations in children with CI, and considers their implications for analyzing independence relations and conditions for the interdependency of verbal operants.

Relations between stimuli and control of verbal behavior

Verbal behavior is under control of stimuli and of relation between stimuli. Skinner (1957) described six categories of verbal operants in which verbal behavior is directly controlled by antecedent stimuli: echoic, tact, mand, intraverbal, transcription (copy and dictation), and textual. In each case, Skinner's (1947) categories highlight different controls exerted by stimuli that precede verbal response. For example, saying "bag", may: (1) function as a *tact*, when the speaker informs the listener about the environment (in this case, the antecedent stimulus is the bag itself); (2) function as a *mand*, when there is a motivational factor specified by the speaker (to have access to the bag, for instance, or carrying heavy shopping bags and having to put them down); (3) be a mere repetition of the word (in this case the antecedent stimulus is someone saying "bag"); (4) be a *textual* verbal operant when reading (the antecedent

stimulus is BAG in print and the response is the corresponding oral topography); (5) be an *intraverbal* if, for example, someone replies “Bag” to the question “Where may I place these fruit?”. Different verbal functions may be assigned to topographically similar oral emissions, and can be produced different effects on the listener. Analyzing the relationship between a verbal response and the environment has brought important contributions towards programming contingencies for teaching verbal repertoire to different populations (Souza, Almeida-Verdu, & Bevilacqua, 2013). Moreover, this has produced advances in the research area, with investigation that culminated in different programs for teaching verbal operants (Greer & Ross, 2008; Sundberg & Michael, 2001; Petursdottir, Carr, & Michael, 2005; Tsai & Greer, 2006). For example, a typical speaker and listener may learn to respond to antecedent stimuli from a direct relation with them learning the verbal response “doll” when this toy is available by using shaping or teaching echoic behavior with transfer of stimulus control to tact. One may also learn to respond verbally to stimuli (textual, figures, or minimal components of these stimuli) by relational learning, that is, by matching two stimuli and requiring a response in their presence. This response may be based on either selection or topography (Michael, 1985; Sundberg & Sundberg, 1990). These are relations between stimuli; that is, more than one antecedent stimulus (or the relation between them) may control one response and this response can be verbal. Thus, stimuli that control tact (object properties), echoic (dictated word), textual (printed word), and transcription (printed or dictated word) responses may share mutual substitution relations if they have been matched to each other.

Regarding to that, Murray Sidman (1990 and 1992) contributed with research on the semantic aspects of language. He investigated how different stimuli and verbal responses could operate symbolically, which may be operationalized as mutual replacement relations between different events (such as dictated words, figures, written words) and stimuli or responses (speaking,

composing and writing) (de Rose, 2005), showing that verbal operants may relate by equivalence.

Sidman (1971) presented a model of control by relations between stimuli. He questioned how it would be possible to learn to behave similarly in the presence of a spoken word, a written word, and the objects to which they refer, since these stimuli are so different. Sidman proposed that to comprehend reading involves different types of responses to printed material (e.g., pointing to a textual stimulus when a dictated word is presented, or when a figure is presented, and producing a spoken word when facing a textual stimulus). Therefore, he investigated whether control established by oral words could be transferred to printed words. In his original study from 1971, a 17-year-old with microcephaly had a previously established repertoire of naming figures (tact) and of recognizing dictated words by pointing at figures. Sidman taught the boy to point to printed words on hearing the dictated word, and then evaluated his performance in a task of relating printed words and figures, which had not been taught directly. This repertoire was called reading with comprehension by Sidman, originated from equivalence between objects and their dictated and printed names (Sidman & Tailby, 1982), and between stimuli and responses as described in a later paper (Sidman, 2000).

According to Sidman (1982, 2000), when three-term contingencies are under conditional control, they depend on an antecedent condition (conditional stimulus). A conditional stimulus establishes the context for the (discriminative) stimulus that precedes an operant response, which will only be reinforced when a specific conditional stimulus is present. This is known as conditional stimulus control. The most common procedure for establishing conditional relations is matching to sample, which involves displaying sample stimuli (conditional stimuli) and two or more comparison stimuli (one of which is a discriminative stimulus and the others neutral stimuli). Each sample stimulus, from a set of stimuli, relates conditionally to a comparison stimulus from another set. The

correct choice is conditional to the sample stimulus, thus, reinforcement will be contingent to the correct choice (Sidman & Tailby, 1982).

For example, a daily school task may involve conditional relations and matching to sample. In a multiple choice task, selecting from (a) The Nile River, (b) The Amazon River, and (c) The Mississippi River, is conditional to the question asked; for example, “Which is the longest existing river?”. If the response is correct, the following relation is established: [Longest river: Nile River]. Tasks involve teaching if there are differential consequences for correct and incorrect responses and testing when there are no differential consequences for responses.

Tasks must be arranged in a specific way for equivalence relations to emerge from training; there should be at least two conditional relations with one element in common. As an example of a second conditional relation, the response of one of the options: (a) African, (b) North American, or (c) South American, is conditional to the question: “Which continent is the River Nile located in?”. In this case, if the response is considered correct, then the relation established is [Nile River: African Continent].

The fact that students are able to respond to both these tasks may offer conditions for them to present new repertoires, which are not taught directly, such as responding to the question “Which continent contains the longest river?”. The answer must be the African continent, represented by the relation [Longest river: African Continent]. In this example, the common element in both conditional relations between question and correct response was [Nile River]. According to the formal properties of stimulus equivalence described by Sidman and Tailby (1982), the last example would be a transitive relation. Other relations could also emerge, demonstrating other properties of equivalence relations, such as symmetry [Nile River: Longest river] and [African continent: Nile River], or even reflexivity, which implies that an element relates to itself [Nile River: Nile River].

If these properties, namely reflexivity, symmetry, and transitivity, are present, we may say that the stimuli [Longest river], [Nile River], and [African continent] – designated A1, B1, and C1[2] respectively – form a stimulus class and share equivalence relations (Sidman & Tailby, 1982). A learner's performance that shows these properties attests to true symbolic functioning. If additional tests are conducted to verify whether the stimuli (texts or figures) emerge an oral naming response, with exact correspondence between the stimuli and the dictated words, they may demonstrate that oral production responses are included in the equivalence class (Sidman, 2000).

Sidman's (1971) original research, as well as the formal properties of equivalence relations (Sidman & Tailby, 1982), raised an extensive and systematic series of experimental research. These subsequent studies investigated how emergent relations would be obtained from a history of reinforcement of a few relations between stimuli, or between stimuli and responses, and developed individualized programs for teaching reading and writing (de Rose, de Souza, & Hanna, 1996; Hanna, de Souza, de Rose, & Fonseca, 2004; MacKay, 1985; Stromer, MacKay, & Stoddard, 1992).

Since then, many studies replicated teaching conditional discriminations and testing for formation of stimulus classes according to these criteria with different populations - including human participants with scarce linguistic repertoire (cf. Carr, Wilkinson, Blackman, & McIlvane, 2000) - and different stimulus modalities.

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2. Alphanumeric notation has frequently been adopted to generically designate stimuli, conditional relations and formal properties according to the model of stimulus equivalence.

Functional Independence between verbal operants and studying individual with auditory impairment and cochlear implants

The stimulus equivalence paradigm was extended with studies by da Silva, et al. (2006) and Almeida-Verdu, et al. (2008) who investigated symbolic functioning in individuals with diagnosis of severe hearing loss and who were able to detect sounds using cochlear implants. This research was supported by the Brazilian Program for the Support of Excellency Nuclei (Programa de Apoio a Núcleos de Excelência - PRONEX, created through Decree nº 1857 of 10/4/96) from a partnership between the Foundation for Research Support of the State of São Paulo (Fundação de Apoio à Pesquisa do Estado de São Paulo - FAPESP), the National Council for Scientific and Technologic Development (Conselho Nacional de Desenvolvimento Científico e Tecnológico - CNPq) and the Brazilian Ministry of Science and Technology (Ministério da Ciência e Tecnologia - MCT).

Initially, da Silva et al. (2006) extended the method used in equivalence to study electrical stimulation received by participants with hearing impairment and cochlear implants who suffered hearing loss after language had developed (postlingually deaf). Later, Almeida-Verdu et al. (2008) demonstrated the paradigm's potential for participants with congenital hearing loss, before development of language (prelingually deaf). Participants showed emergence of equivalence relations involving visual-visual (conventional and non-conventional figures) and auditory-visual relations (non-conventional dictated words and figures; direct electrical stimulation on the cochlea and Greek letters). Therefore, this study extended the paradigm for investigating equivalence classes with individuals with prelingually hearing impairment. On the other, oral naming tests that followed equivalence tests revealed something interesting. Most participants named the stimuli consistently (different stimuli that were related between themselves through teaching contingencies were named with the

same vocal topography), however, the response topography in naming tests had no direct correspondence with the word dictated during learning tasks.

In Almeida-Verdu et al. (2008) results from naming tests were consistent with results from equivalence tests, since the same verbal response was emitted when equivalent stimuli were presented. However, these responses had many distortions and omissions of minimal units or even words. Teaching conditional discrimination with non-conventional dictated words (e.g., pafe, xede, zigo) doesn't seem to have been enough for participants to correctly name the corresponding figures that were not trained directly (examples of oral productions for pafe, xede and zigo, respectively: pa, gaura, nida). This is further evidence of the functional independence between verbal operants.

Scientific literature presents evidence that teaching a verbal operant topography is not a necessary condition for the same topography occur. For example, there are studies in which the emergence of mands was verified after learning tact (Alves & Ribeiro, 2007; Córdova, Lage, & Ribeiro, 2007; Haal & Sundberg, 1987; Lamarre & Holland, 1985; Twyman, 1996). Results however, seem to be inconsistent, since some indicate functional dependence between verbal operants (Alves & Ribeiro, 2007) while others are compatible with Skinner's (1957) proposal regarding functional independence between tact and mand (Córdova, Lage, & Ribeiro, 2007; Haal & Sundberg, 1987; Lamarre & Holland, 1985; Twyman, 1996). Regarding relations between listening and speaking, studies have demonstrated independence between these operants, whether verbal or verbally controlled (Guess, 1969; Guess, Sailor, Rutherford, & Baer, 1968; Sandberg & Sundberg, 1990; Bandini, Sella, Postalli, Bandini, & Silva, 2012). This result has been replicated recently considering exclusively participants with hearing impairment (Ferrari, Giacheti, & de Rose, 2009) and whose aural rehabilitation was through cochlear implant (Almeida-Verdu, Matos, Bataglini, Bevilacqua, & de Souza, 2012; Bataglini, Almeida-Verdu, & Bevilacqua, 2013), replicating the results obtained by Almeida-Verdu et al.

(2008). As a result, a research problem was posed: Under which conditions does oral production of stimuli occur with greater intelligibility (accuracy with which a normal hearing listener can recover the speaker's speech) when a participant is trained to be a listener? And would this allow for greater comprehension of relations established between hearing and speaking?

Therefore, this chapter will present a synthesis of research that followed the first publications that extended the stimulus equivalence paradigm to the symbolic functioning of cochlear implants users (da Silva et al. 2006; Almeida-Verdu et al. 2008).

Conditions for interdependency between verbal operants

The studies that that demonstrated how the model of equivalence relations was applicable to studying symbolic functioning of children with cochlear implants were conducted by the National Institute of Science and Technology on Behavior, Cognition and Teaching (INCT-ECCE)[3]. One of the objectives was to expand the sample of children with prelingual hearing loss and recent cochlear implants by systematically replicating previous studies on stimulus equivalence and oral naming.

We intend to demonstrate some of the conditions in which more intelligible speech can occur in children with hearing impairment and cochlear implants considering specific characteristics of listener training. To do so, we conducted an analysis of the adopted training procedures, including the amount of programmed training trials for the acquisition of auditory-visual relations, the emergence of stimulus equivalence class and, mainly, performance in oral production tasks.

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3. The creation of this institute counted on a partnership with Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes/MEC) and the Research Foundations from the states of Amazonas (Fapeam), Pará (Fapespa), São Paulo (Fapesp), Minas Gerais (Fapemig), Rio de Janeiro (Faperj), and Santa Catarina (Fapesc), the Brazilian Ministry of Health and the Brazilian Development Bank (Banco Nacional de Desenvolvimento Econômico e Social - BNDES).

Table 1 shows selected studies and their main analyzed variables. We located six published and two submitted[4] papers, one thesis, and one dissertation, displayed in Column 1.

Even though these studies have differences regarding the structure adopted for teaching conditional discriminations and test stimulus equivalence (sample as nodule, linear), as training auditory-visual conditional relations (exclusion, blocked, trial-and-error), adopted stimulus topographies (conventional and non-conventional, figures, dictated and written words and syllables), number of trials programed for training conditional discrimination, and design (experimental and quasi-experimental), important considerations can be extracted from their main characteristics.

Generally, all of the selected research involved training at least three conditional discriminations between auditory and visual stimuli with 46 children with prelingually hearing impairment and cochlear implant users; all the children presented oral production (of figures and/or written words) before and after training of auditory-visual conditional discriminations and equivalence tests.

Procedures that taught auditory-visual conditional discriminations and tested the emergence of equivalence relations as evidence of symbolic functioning were carried out with a total of 46 prelingually deaf participants. Thirty-four of these participants were submitted to studies that used dictated words, printed words, and pictures as stimuli, and the other 12 to studies that used dictated and printed sentences, and action pictures/videos. The age range of the studied population was 03 to 15 years. They had little (between one and two years) or significant experience (over three years) with a cochlear implant.

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4. Submitted papers are two studies from the Research Report “Relations between expressive and receptive repertoires in participants with auditory impairment and cochlear implants”, granted by Fapesp # 2009/51798-7.

Table 1:

Main characteristics of the studies selected for this paper regarding training structure, number of participants and age, stimuli used, experimental procedures and number of trials programmed for teaching the first three auditory-visual conditional discriminations.

Studies	Training structures	Participants	Stimuli	Procedures	Trials
Almeida-Verdu, de Souza, Bevilacqua & Souza (2009)	Echoic training (AD) combined with conditional discrimination between dictated words and figures (AB), between dictated words and non-conventional figures (AC) and equivalence class formation tests (BC/CB).	04 (07 to 08 years old)	Conventional dictated words Conventional figures Non-conventional figures	Exclusion	64
Golfeto (2010) Golfeto & de Souza (2015)	Study 2 – Curriculum with conditional discriminations between dictated words and figures (AB), between dictated words and printed words (AC), and testing equivalence classes (BC/CB), echoic behavior (AD), and naming and reading (BD/CD) tasks. Study 3 – Conditional discriminations between dictated sentences and videos (AB) with overlapping elements. Recombinative generalization and video naming tests (AD).	06 (03 to 13 years old) 04 (07 to 15 years old)	Conventional dictated words Conventional dictated letters Conventional figures Conventional printed words Conventional letters Dictated sentences (subject-verb-object) Actions (video)	Blocked trial procedure Blocked trial procedure	42 72
Battaglini, Almeida-Verdu, & Bevilacqua (2013)	Conditional discriminations between dictated words and figures (AB) and between figures and printed words (BC), emergent relations (AC and CB), and naming (BD) tests.	06 (05 to 09 years old)	Conventional dictated words Conventional figures Non-conventional figures Conventional printed words Non-conventional printed words	Exclusion	30
Anastacio Pessan, Almeida-Verdu, de Souza, & Bevilacqua (2015)	Conditional discriminations between dictated words and figures (AB), dictated words and printed words (AC), and dictated syllables and printed syllables (AC_S), equivalence tests with successive naming and reading tests (BD and CD).	06 (11 to 14 years old)	Conventional dictated words Non-conventional dictated words Conventional figures Non-conventional figures Conventional printed words Non-conventional printed words	Exclusion	30

Table 1 (cont)

Studies	Training structures	Participants	Stimuli	Procedures	Trials
Almeida-Verdu, Terra, de Souza, & Bevilacqua (submitted)	Conditional discriminations between dictated words and figures (AB), and between dictated words and printed words (AC), equivalence (BC/CB) and dictated syllables and printed syllables (AC_S) tests, and successive naming and reading tests (BD and CD).	03 (04 to 07 years old)	Conventional dictated words Non-conventional dictated words Conventional figures Non-conventional figures Conventional printed words Non-conventional printed words	Exclusion	30
Gomes & Almeida-Verdu (submitted)	Conditional discriminations between dictated words and figures (AB), and between dictated words and printed words (AC), equivalence (BC/CB) and dictated syllables and printed syllables (AC_S) tests, and successive naming and reading tests (BD and CD).	02 (06 to 07 years old)	Conventional dictated words Non-conventional dictated words Conventional figures Non-conventional figures Conventional printed words Non-conventional printed words	Exclusion	30
Lucchesi, Almeida-Verdu, Buffa, Bevilacqua (2013)	Conditional discriminations between dictated words and printed words (AC) with multiple exemplar-training, spelling (AE) and copying words (word-construction task), including contextualization trials (AB) Equivalence (BC/CB), reading (CD), dictation (AE) and figure naming (BD) tests preceded and followed each unit.	02 (07 to 08 years old)	Conventional dictated words Conventional figures Conventional printed words Dictated syllables Printed syllables	Exclusion	30
Neves (2014)	Study 3 – Conditional discriminations between dictated sentences and figures of actions (AB) and between dictated sentences and composition (AE), equivalence (BE/CB), reading (CD) and naming (BD) tests. Recombinative generalizations test.	08 (08 to 12 years old)	Conventional dictated sentences Conventional figures of actions Conventional printed sentences	Trial-and-error	9
Passareli, Oliveira, Golfeto, Cardinali, Rezende, & Fenner (2013)	Curriculum with conditional discriminations between dictated words and figures (AB) and between dictated words and printed words (AC), equivalence (BC/CB), echoic behavior (AD), and naming and reading (BC/CD) tests.	5 (04 to 07 years old)	Conventional dictated words Non-conventional dictated words Conventional figures Non-conventional figures Conventional printed words Non-conventional printed words	Blocked	84

Research conducted until now has made important methodological advances regarding the deficits of symbolic communication in children with prelingually deafness. It has helped identify the necessary and sufficient conditions for the development of symbolic functioning and, above all, in relations established between a listener's and a speaker's repertoire.

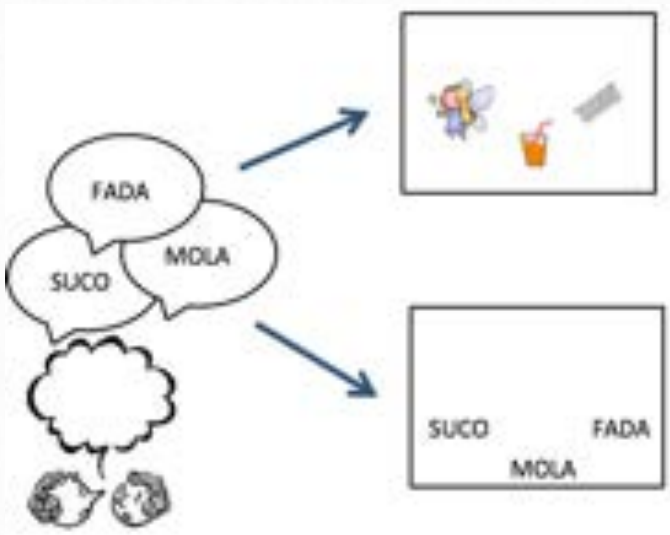
Acquisition of auditory-visual conditional relations

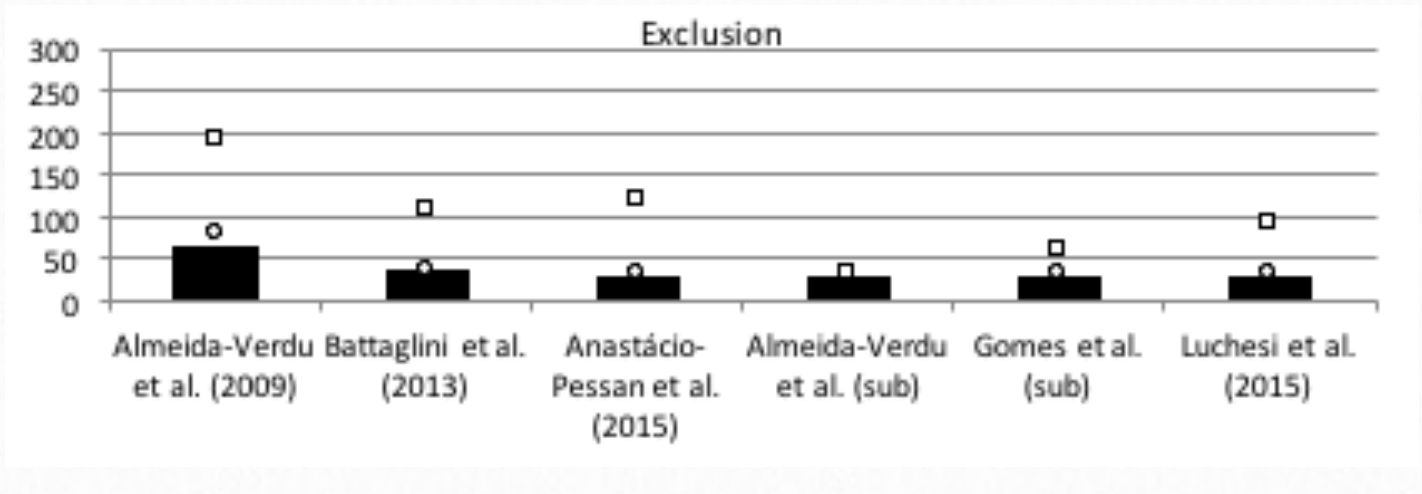
As previously exposed, the analyzed researches had different objectives, structures, and teaching procedures, as well as several stimuli types. However, they all taught conditional relations involving auditory-visual stimuli. Regarding teaching procedures, six studies adopted the "learning by exclusion" procedure. Three studies adopted blocked-trial and one the trial-and-error procedure. Although the programmed number of trials for teaching the first three auditory-visual conditional discriminations was distinct in each study, as demonstrated in Table 1, all participants learned the conditional relations, as shown in the results in Figure 1. The top of the figure illustrates two auditory-visual conditional discriminations, with a common element, in a teaching structure with the sample stimuli as the nodal.

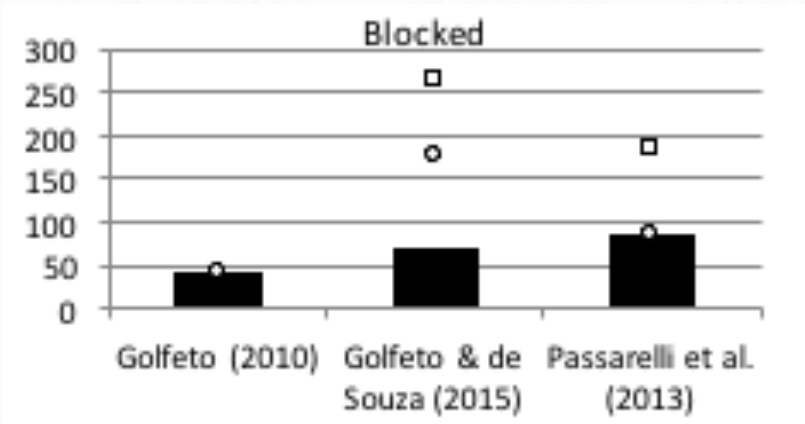
Teaching by exclusion consists of establishing an auditory-visual baseline and presenting undefined sample and comparison stimuli with a defined comparison stimulus. Exclusion consists of rejecting the defined comparison stimulus and selecting the undefined, thus establishing a conditional relation between the new sample and comparison stimuli (Dixon, 1977). It is a robust phenomenon in different populations (Costa, McIlvane, Wilkinson, & de Souza, 2001; Domeniconi, Costa, de Souza, & de Rose, 2007). This procedure is of particular interest for teaching auditory-visual conditional discriminations to children with cochlear implants.

According to results shown in Figure 1, although there is inter-participant variation in the minimum number of trials necessary to learn the first three relations between auditory and visual stimuli, a smaller number of training trials has been planned according to the established learning criteria (observe the black bar for all the studies). Furthermore, most participants reached the learning criterion within the minimum number of tasks (circles in Figure 1). Almeida-Verdu et al. (2009), for example, programmed 64 trials to teach three conditional discriminations. Subsequent studies such as Anastácio-Pessan, Almeida-Verdu, de Souza, & Bevilacqua (2015); Almeida-Verdu, Terra, de Souza, & Bevilacqua (submitted); and Almeida-Verdu and Gomes (submitted), programmed only 30 trials. In these studies, participants reached the learning criterion in only one exposure to the total number of trials, which were programmed for quick and errorless learning. These results are consistent with those in the literature on learning by exclusion demonstrated in diverse population (Domeniconi, Costa, de Souza, & de Rose, 2007).

Illustration of two auditory-visual conditional relations with one element in common[1]







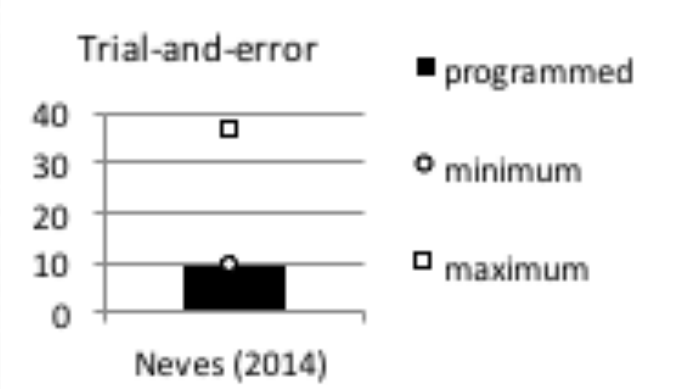


Figure 1 – Number of trials programmed to teach the first three auditory-visual conditional discriminations (bar) and the minimum (circle) and maximum (square) established number of trials for participants to reach the learning criterion.

Note: 1. In the figure: *fada* = fairy, *suco* = juice, *mola* = spring.

Three of the analyzed studies adopted a blocked-trial procedure that consists of exposing participants to consecutive blocks of trials of each conditional relation separately. For example, eight trials of relation A1B1, followed by eight trials of A2B2, followed by eight trials of A3B3. During the training phase, the first blocks are repeated until a participant produces correct responses on all trials. In subsequent blocks the number of trials per block is reduced (for example, four A1B1, four A2B2, and four A3B3). When a participant reachs 100% correct responses, the number of trials is further reduced (for example, two A1B1, two A2B2, and two A3B3) until the trial of the blocks is randomized considering the three conditional relations (Saunders & Spradlin, 1989). These studies taught conditional auditory-visual discriminations, based on blocked-trial procedure, by programming trials that varied between 42 and 84 depending on the study. The results showed that, some participants learned the auditory-visual conditional relations with a minimum of number of trials programmed, while others required more trials blocks before reaching the established learning criterion. However, all participants learned the auditory-visual conditional relations with the blocked-trial procedure.

The trial-and-error teaching procedure was adopted by only one study. This procedure consists of the simultaneous presentation of the three comparison stimuli, and of successive and randomized presentation of the three sample stimuli in the same block of trials (Ferrari, de Rose, & McIlvane, 2008). Nine trials were programmed for teaching three conditional discriminations in this study. Participants required one to four exposures to blocks of trials to demonstrate precision in establishing the three auditory-visual conditional relations.

Analyses of these studies have demonstrated that people with prelingually hearing impairment, who were able to detect sound with cochlear implants, can learn conditional discriminations between auditory and visual stimuli - a type of

listener response -, based on stimulus selection (Michael, 1985; Suandberg & Sudnberg, 1990; Greer & Ross, 2008) using exclusion, trial-and-error, and blocked-trial teaching procedures. Two studies stand out (Golfeto & de Souza, 2015; Neves, 2014) due to their use of dictated sentences as auditory stimuli, and printed sentences and pictures of actions (Neves, 2014) or video scenes (Golfeto & de Souza, 2015) as visual stimuli. Regardless of the complexity of the adopted stimuli, their results replicate previous studies on teaching auditory-visual conditional discriminations with different populations, including people with minimal verbal repertoire (Carr, Wilkinson, Blackman, & McIlvane, 2000). For the most part, participants with hearing impairment with cochlear implants did not demonstrate difficulties in pre-requisite skills such as differential responding to auditory stimuli as samples presented during successive trials (McIlvane, Dube, Kledaras, Iennaco, & Stoddard, 1990; Saunders & Spradlin, 1989).

Formation of stimulus equivalence classes

The formation of stimulus equivalence classes is an operational measure of symbolic functioning that is observed when participants relate stimuli that were paired with a common stimulus, as shown in Figure 2. In the analyzed studies all participants, except for one, formed equivalence stimuli classes. In most studies, the auditory stimulus was the nodal element, consisting of the common element for teaching conditional discriminations (Almeida-Verdu, et al., 2009; Anastácio-Pessan, et al., 2015; Golfeto, 2010; Lucchesi, Almeida-Verdu, Buffa, & Bevilacqua, 2015; Neves, 2014; Passarelli, Oliveira, Golfeto, Cardinalli, Rezende, & Fenner, 2013; Almeida-Verdu, et al., submitted; Almeida-Verdu & Gomes, submitted). However, one of the studies adopted a linear teaching structure, where the nodal element sometimes functioned as sample, and sometimes as comparison (Bataglini, Almeida-Verdu, & Bevilacqua, 2013).

So far, the selected studies demonstrate that new repertoires, such as relations between stimuli that were not taught directly, may be obtained with learning contingencies that teach conditional discriminations with one common element. On one hand, if teaching auditory visual conditional discriminations allowed listening behavior based on selection; on the other, testing for the formation of equivalence stimuli classes verified the emergence of a more complex behavior, the relation between two stimuli paired to a common stimulus, known as symbolic behavior. These results replicate previous studies on stimulus equivalence (Melchiori, de Souza, & de Rose, 2000; Sidman, 2000) as well as the first studies with users of cochlear implants.

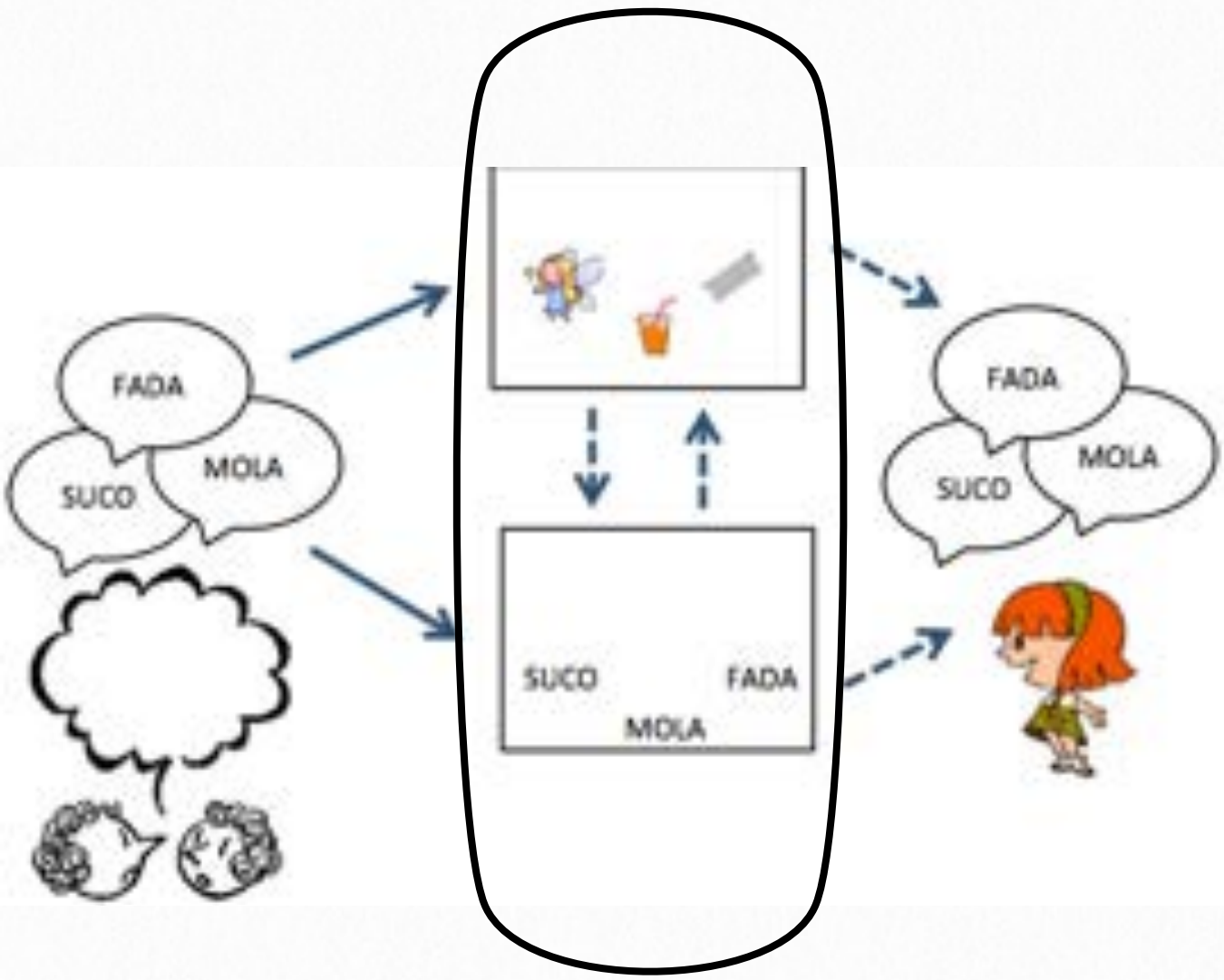


Figure 2 – Schematic representation of two auditory-visual conditional relations with one common element featuring relations that attest the formation of stimulus equivalence classes (restricted area).

Note: 1. In the figure: *fada* = fairy, *suco* = juice, *mola* = spring.

Oral production

Oral production comprises different types of responses to visual stimuli. Responses can be naming or tact (when the antecedent stimulus is the image of an object or action), or may be textual (when the antecedent stimulus is a printed word or sentence). In the analyzed studies, tact or naming of images of objects and actions were considered the main goal. Oral production may be

established directly with teaching contingencies that mold or serve as a model for a new repertoire, or obtained with auditory-visual conditional discrimination contingencies for competent speakers and listeners.

Particularly in cases of auditory impairment with rehabilitation using cochlear implants, results of initial studies demonstrated consistency in oral production emitted before pairing visual stimuli with a common stimulus. However, vocal topography did not directly match sample auditory. In other words, what participants said during the testing stages did not correspond to what they had heard during the teaching stages.

Recently Mark Sundberg (2015) reported an informal survey he conducted, where he questioned different behavior analysts regarding what was the most important verbal operant. To his surprise, many answered mand and some said intraverbal. The importance of mand and intraverbal behaviors are undisputed in different contexts such as domestic life, daily life, educational, and interpersonal relationships. However, Mark Sundberg stated that, according to Skinner (1957), tact is the most important verbal operant "*due to the exclusive control exercised by the antecedent stimulus*" (p.82), more specifically, by properties of the antecedent stimulus. Analogously, Greer and Ross (2008) described tact as the most complex verbal operant since it requires echoic and listener behaviors to establish.

Tact, after listening with comprehension, is the most evaluated verbal operant in the highlighted studies with users of cochlear implants. Our most recent research has strived to obtain more intelligible oral production (regarding tact/naming, echoic, and textual) in contrast to data obtained in the study conducted by Almeida-Verdu et al. (2008). General results for naming figures in the studies considered in these analyses are illustrated in synthesized form in Figure 3. Figure naming tests yielded positive results for most participants, that is, 42 of the 45 participants formed equivalence classes. Among these participants, seven obtained 100% correct responses in naming post-tests. If

we take into account the number of participants with over 90% of correct responses, the number of participants increases to 47. The remaining participants exhibited some variation in the percentage of correct responses in post-tests when compared to pre-tests.

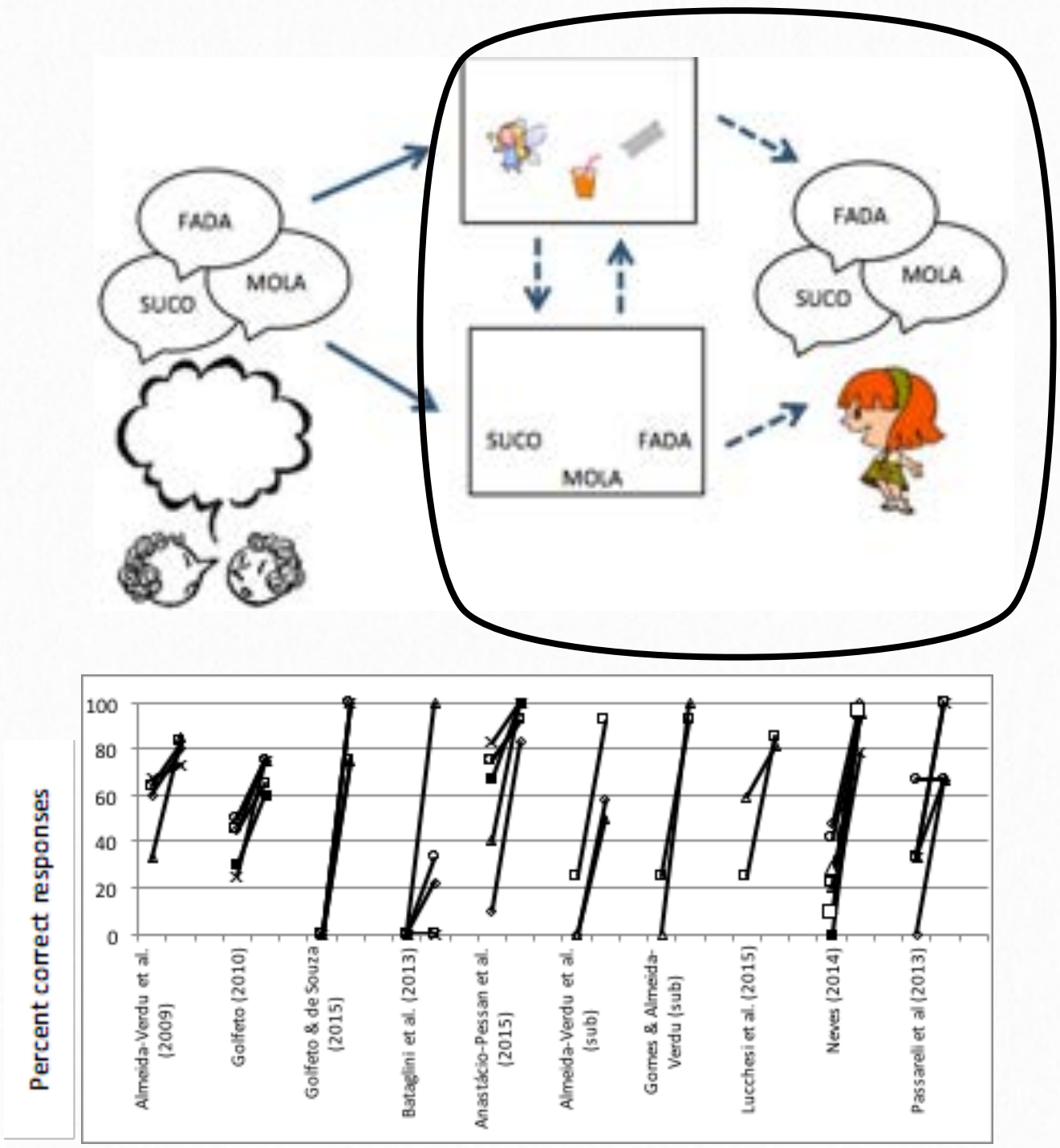


Figure 3 –Diagram of naming and reading tasks (top panel). Percent correct answers in naming figures (bottom panel) before (starting point of each curve) and after (end point) teaching conditional discriminations and testing for equivalence classes in the studies. Each marker on the graph represents the performance of each participant in each study.

Note: 1. In the figure: *fada* = fairy, *suco* = juice, *mola* = spring..

We may conclude from these results that participants altered their vocal topography. They become more precise when comparing pre and post-test results. Changes in topography responses was gradual in some cases - verified by multiple probing as experimental variables were introduced (Golfeto, 2010; Anastácio-Pessan, et al., 2015; Lucchesi, et al., 2015; Almeida-Verdu, et al., sub; Gomes & Almeida-Verdu, sub) -, or categorical - evaluated only by a final post-test (Almeida-Verdu, Souza, Bevilacqua, & de Souza, 2009; Bataglini, Almeida-Verdu, & Bevilacqua, 2013; Passareli et al. 2013; Neves, 2014). However, in all the studies, practically all participants became more precise in their vocal topography when naming figures (with greater direct correspondence to conventions of the verbal community) after the chosen procedures. Analysis of the hypotheses concerning why these changes occurred will be presented below.

Conditions under which listening may be linked to speaking

By analyzing the effects of teaching procedures on oral production (especially on naming figures) we may observe two prominent conditions that have contributed to the emergence of naming more accuracy: (1) teaching echoic responses (turnover or not) combined with listening behavior; and (2) establishing or strengthening reading relations (control by textual stimulus) and transferring stimulus control to tact relations (controlled by figures).

Considering the echoic teaching, naming more accurately has been observed after these teaching, because promotes modeling of vocal topography (Almeida-Verdu, Souza, Bevilacqua, & de Souza, 2009; Souza, Almeida-Verdu, Bevilacqua, & de Souza, 2013; Golfeto & de Souza, 2015). Teaching echoic behavior was interposed with trials that prioritized other response categories, such as listening based on stimulus selection, which is typical of matching-to-sample trials. Hearing a word, repeating it, selecting the

experimentally related stimulus and hearing the word again in a new trial may promote a rotation of operants (Greer & Ross, 2008). This favors the interdependence between operants and, consequently, promotes positive results in naming tests. For example, Almeida-Verdu et al. (2009) investigated whether teaching echoic behavior would be a relevant condition for the emission of oral productions with greater correspondence point-to-point, in figure-naming tasks. Two groups went through echoic training in different conditions. For the first group, echoic responses were taught before conditional auditory-visual discriminations. For the second group, teaching echoic behavior was chained with teaching auditory-visual discrimination. Taking each participant's baseline into account, participants from both groups improved performance regarding formal correspondence with dictated words. Similar results were obtained by Golfeto and de Souza (2015); they adopted echoic training after auditory-visual to increase oral accuracy in naming videos. This extended their findings to oral production of sentences.

In summary, teaching echoic, due to shaping of the required vocal topography as well as prompt transference of stimulus control, may have been a determinant condition in studies conducted by Almeida-Verdu, et al. (2009) and Souza, et al. (2013) with words stimuli, as well as by Golfeto & de Souza (2015) with sentences. Teaching echoic behavior, when chained with trials that prioritize other response categories, such as listening based on stimulus selection (typical of the matching-to-sample procedure), may promote the interdependence between operants and favor positive results in naming tests. The literature has positive results on transference of control from imitation of a dictated word to tact of objects with participants with intellectual disabilities and listeners (Ezell & Goldatein, 1989; Gree & Ross, 2008; Greer & Spackman, 2009; Petursdottir & Carr, 2011; Löhr & Gil, 2015). Regarding participants with cochlear implant, positive results with the transference of stimulus control procedure were extended to sentences (Golfeto & de Souza, 2015). Although

positive effects of requiring echoic behavior during listener training are reported in the literature, there is evidence that this is not a sufficient condition for the emergence of tact (Petursdottir, Lepper, & Petterson, 2014). Therefore, this proposal must continue to be systematically investigated with participants with hearing disabilities and cochlear implants.

The hypothesis that naming more accurately is supported by the reading strengthening relations is derived from results obtained by Golfeto (2010), allied to the recommendation that naming behavior should be occur as a component of listener behavior (Greer & Ross, 2008). Golfeto (2010) planned teaching conditional discrimination between dictated words and figures and dictated words and printed words (receptive repertoire), and analyzed the emergence of new repertoires such as formation of stimulus equivalence (between dictated and printed words and figures). Furthermore, the author investigated figure naming and reading before and after teaching a set of three words. A multiple baseline experimental design between word sets[5] was employed to assess the effects of the procedure. There were marked improvements in performance in naming and reading tests compared to the baseline. In addition, oral production exhibited greater distortions in the presence of pictures than in the presence of printed words, for which emissions occurred with greater point-to-point correspondence.

These aspects culminated in an investigation proposal: if speaking in the presence printed words (reading) is more accurately than naming figure (tact) then, control by a textual stimulus on reading, if network relations are strengthened, could contribute to improved performance in naming figures by transference of stimulus control. Transference of stimulus control in this case

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5. In this experimental design, more than one behavior is measured; however, teaching occurs in such a way that it is possible to observe the acquisition of a new behavior immediately after (and because) the use of a teaching procedure with this objective (Cozby, 2003).

could occur because the textual stimulus offers a visual cue or because the stimuli share equivalence relations. Thus, a second line of research was constituted so that teaching auditory-visual discriminations (for example, between dictated words and figures, between dictated words and printed words, between dictated syllables and printed syllables, between dictated sentences and action figures) could contribute to establishing control by units smaller than words (via teaching syllable selection by the composition of words such as in *constructed response matching-to-sample* - CRMTS). These control by units smaller could be transferred to other pictorial stimuli, through equivalence (Anastácio-Pessan, et al, 2015; Golfeto, 2010; Lucchesi, et al., 2015; Neves, 2014).

Anastácio-Pessan, et al. (2015) taught two sets of words to participants with pre-lingual auditory impairment. The experimental design was a multiple baseline between two word sets. Teaching and testing consisted of four different phases: (1) strengthening auditory recognition (auditory-visual conditional discriminations between dictated words and pictures); (2) strengthening discriminations between the same dictated words and printed words; (3) verifying equivalence class formation by testing the relations between pictures and printed words, and its symmetrical; and (4) teaching to select syllables that compose taught words through CRTMS; each phase was followed by figure naming and reading post-tests, conducted with both sets of words selected from the general pre-tests. In this study, all participants demonstrate taught relations and still formation of equivalence classes. Gradually, throughout successive naming and reading post-tests, better performance was observed regarding speaking intelligibility (point-to-point correspondence according to conventions of the verbal community). As in Golfeto (2010), performance that is more accurate was observed in reading of words than in naming figures. However, after equivalence tests a significant improvement was observed in participants' figure naming performance.

Another study that obtained tact more accurately from teaching reading was, Lucchesi, et al. (2015); they adopted a teaching curriculum of auditory-visual conditional discriminations based on selection and word composition (CRMTS). Their objective was to teach children with cochlear implants to read and write 60 simple Portuguese words using multiples exemplar (selection tasks, word composition tasks, and successive naming opportunities). Participants were exposed to five teaching units disposed in a multiple baseline experimental design. Exposure to the words in each unit occurred in a controlled manner, one at a time, with all words from all units systematically evaluated at the end of each unit. At the beginning of the study, participants were not proficient at reading. The procedure not only taught participants to read and write simple words, but also increased speaking precision throughout successive figure naming and word reading tasks.

Considering transference of control from a textual stimulus to a figure in oral productions tasks, the study conducted by Neves (2014) had similar objectives to Anastácio-Pessan, et al. (2015). However, instead of adopting words as stimuli, they used sentences with three syntactic units (subject, verb, and object). The teaching procedure involved multiple tasks (for example sentence selection and sentence composition using words – CRMTS); the results demonstrated extended control from printed sentences to action figures in vocalization tasks; also demonstrated new pictures naming through recombinative generalization of the elements from the training sentences. In this study in the pre test, all participants were literate, but the speech had a lot of errors; after strengthening the relations between dictated words and printed words, and dictated syllables and printed syllables, the whole network of equivalence relations that controls oral performance was strengthened. Thus, improved performances in naming action figures may have occurred due to transference of control from stimuli that control reading (printed sentences) to stimuli that control naming (figures). This can occur since they belong to the

same class composed of stimuli and responses (Sidman & Taiby, 1982; Sidman, 2000).

Analyzing this hypothesis is fundamental to identify and describe that, when someone reads words or sentences, vocal responses are controlled by smaller units (molecular) of printed stimuli (graphemes) that provide visual cues for oral production of consecutive sounds (phonemes), which are integrated into larger units (molar), that is, the actual word (de Rose, 2005). This process offers the conditions for oral production in reading to be more precise than in naming figures. If a printed stimulus favors more intelligible speaking for this population and, through teaching, this stimulus shares relations of equivalence with other stimuli (such as figures, objects, and dictated words), oral production will also occur with other equivalent stimuli (Catania, 1999). In other words, if the object cup and the printed word “CUP” are equivalent, and a child says “cup” when presented with the written word, one expects that he or she will also say it when the object is present, for example. When a network of equivalence relations connects reading and naming skills, the functions exercised by a printed stimulus in oral production (reading) may be extended to figures (naming) through equivalence, as discussed by Anastácio-Pessan et al. (2015).

Other hypotheses and additional discussions should be mentioned regarding greater precision in figure naming considering, above all, the experimental designs adopted by Anastácio-Pessan et al. (2015) and Lucchesi et al. (2015). By analyzing their obtained results, we should consider the effect of repeated probes or rotation of operants applied in teaching. In this case, repeated figure-naming probes that were planned to closely track possible changes in naming responses throughout the intervention, may have contributed to increasing precision of oral production in naming. This has been shown in previous studies that reported that probes used during teaching procedures, which aimed to transfer control from the original stimuli to new stimuli, greatly influence learning (Fields, 1981, 1985), in contrast with pre and

posttest experimental designs. Regarding the rotation of operants, repeated probes interposed with listener training and construction of responses in dictation tasks may have offered conditions for the transference of stimulus control.

Final considerations

These results demonstrate that reading may be a route to improve speaking intelligibility for children with cochlear implant (CIs). If we consider typical speakers and listeners, this route would be inverted. An individual is apt to behave as a listener from intrauterine life. Since the sixth month of pregnancy, there are alterations in heart frequency, muscular tonus and suction, as well as reactions to different sound stimuli, especially the sound of the mother's voice. Posteriorly, one of the key markers in language development occurs between 12 and 24 months, when children (with typical development) are able to recognize and comprehend auditory relations established between sounds and objects, and begin to speak their first words (such as "daddy", "mommy", and "ball") (Papalia, Olds, & Feldman, 2001). The simultaneous exposure to auditory and visual stimuli establishes the conditions for learning listener behaviors (Stemmer, 1996; Souza, Souza, & Gil, 2013); combined with successive opportunities to speak, establishes the conditions for speaker behaviors (Costa, Grisante, Domeniconi, de Rose, & de Souza, 2013; Neves, Antonelli, Silva, & Almeida-Verdu, 2014).

Speaker and listener repertoires are established as teaching objectives in different programs and curricular parameters for early childhood education. During Elementary School, reading and writing are established as academic objectives with the appropriate transference of stimuli control (for example, from hearing a word and pointing to a figure, to hearing a word and pointing to the printed word; from seeing a figure and speaking its name, to seeing the written

word and speaking its name) and the interdependence of verbal operants (for example, from hearing a word and pointing to the written word, to hearing the word and writing it). The studies reported here demonstrate that there isn't one single route to establish verbal behavior (Pettursdottir & Carr, 2011) because pre-requisites may be completely different depending on a student's starting repertoire and auditory capacity. Literature on stimulus control has demonstrated transference of control from figures to textual stimuli in systemic teaching programs of generalized reading (de Souza, Hanna, de Rose, Fonseca, Pereira, & Sallorenzo, 1997). Application of the model of equivalence relations and translational research provide further strong evidence that the teaching route may be inverted in order to establish verbal repertoires, transference of stimulus control, and interdependence between stimuli and responses because it demonstrates the transference of control from textual stimuli to figures in intelligible speaking.

The fact is that teaching verbal operants, especially to populations with deficits in sensorial functions, will depend on the accurate analysis of verbal operants and on the arrangement of teaching contingencies that establish coherent stimulus control.

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8 Chaining and ordinal classes: conceptual, methodological, and intervention aspects

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Chaining

Many behaviors may be considered complex because its occurrence is required to happen in a prescribed sequence or behavior chain. Behavior chains may be difficult to be installed for the fact that each step or component of a chain gathers its own conditioned reinforcers and discriminative stimulus (Kelleher, 1966; Skinner, 1991); in other words, the consequence after the conclusion of each component in the functions played in the chain, is both, a conditioned reinforcer for the previous behavior and a discriminative stimulus for the next response. Teaching behavior chain starts with a task analysis, followed by backward chaining, forward chaining, or presentation of the general format of the task.

Comparison between different chaining procedures have demonstrated different results; some experimental studies used forward chaining (Assis, 1987; Ash & Holding, 1990; Borges & Todorov, 1985; Watters, 1990, 1992), backward chaining (Wightman & Sistrunk, 1987), or whole-task presentation (Spooner, Weber, & Spooner, 1983). At least one study didn't show difference in preference between teaching procedures through chaining (Hur & Osborne, 1993). Some authors have suggested (Spooner & Spooner, 1984) that such results may be different due to the dependent variable used to measure its

efficacy (for example, the response duration criterion, numeric responses for the error rate criterion), though there might be differences in chaining for specific populations, there are advantages and disadvantages of each teaching format through chaining.

Behavior chain is a series of discrete responses that happen in a sequence and produce a consistent final result when correctly arranged. The analytical behavioral literature about stablishing behavior chains is fairly well developed and it is thoroughly discussed ahead.

Response chaining is an instruction procedure used to teach complex skills or tasks that have several discrete components, which must happen in a specific sequence to be considered correct. Several behavior sequences that we perform on a daily basis are behavior chains. Playing a certain song in a musical instrument, brushing the teeth, tying the shoes, and making a sandwich are examples of behavioral chains. However, not all behavior sequences are behavior chains. For example, studying for a test; taking the test; and going to the next class to know the grade, correspond to a general sequence of behaviors to which people from all the courses are subjected. Nonetheless, that general sequence consists in a variety of behaviors (read, write, calculate, remember), with several action brakes (studying, sleeping, going to the class by car, opening the car door, walking, talking to friends, etc.). The sequence is composed of a consistent series of stimulus (S), and responses (R), each stimulus (except the last) is a conditioned reinforcer (S^r) for the previous response and an S^d (discriminative stimulus) for the next following response. In this context, by acquiring the discriminative function for the following response, the same stimulus acquires the conditioned reinforcer function for the operant that produced it (Skinner, 1991). That facilitates behavior chains to be established, in other words, that several triple contingencies happen successively. Preparing a bath, for example, is a task that requires the emission of several responses in a specific order to be correctly performed. For the

identification of each response that composes a chain, a task analysis must be done, in which the task is analyzed in a detailed list of its components. In preparing a bath the task analysis must be certain of: opening the faucet, testing the water temperature, adjusting the water temperature, and entering the bathtub. When correctly performed, there is no brake between the end of a response from the chain and the beginning of the next one; so the final reinforcer (SR) of a hot bath is available only after the completion of a whole chain. Cooking a meal, getting dressed, are examples of behavior chains. Psychology handbooks, in general, have examples of motor chains with rats that are trained to respond in different topographies, for example, pulling a chain, jumping through a ring, pressing a lever, etc.

In order to stablish a new behavior through chaining, several variables have influence on the probability for a procedure to be well performed: First it is imperative that an accurate task analysis is well performed before the instructions are presented. Each response of the chain must not only be identified, but the correct order or each response must be detailed. Observing the demonstration of a skill by a person that was taught to present it helps ensuring the accuracy of the task analysis. Second, only complex responses skills that include responses already present in the individual's repertoire must be taught; that is much easier than trying to establish a complex skill that includes responses that are difficult for the individual to perform. Third, along the instructions, it might be necessary to provide hints so the individual responds correctly. Those hints may be planned ahead, verbal, gestures, or physical ones, and will facilitate the acquisition, granting the success of the individual and its permanence in the study. Hints are especially beneficial to assist in the transition between each response of the chain. Nevertheless, as the main goal of the chaining is for the individual to perform the task independently, it is important that the amount of assistance offered to the individual is gradually removed or reduced along the teaching process. Fourth,

reinforcing or providing a verbal feedback for the correct emission of each response in the chain will also facilitate the acquisition. However, away from the instruction context, reinforcement is not available until the whole chain is complete, demanding reduction or fading of the feedback provided during the construction of the chain.

The operant literature would conventionally suggest a procedure that would begin by the closest response to the primary reinforcer – SR (*backward procedure*), until it would be under discriminative control of a given stimulus (S^d1). Posterior to that training it would be introduced a new response (R2) in the sequence that would be under control of a second discriminative stimulus (S^d2) and would produce S^d1, that, on its turn, would be the occasion for R1, and successively. Another procedure (forward procedure) presented by the literature suggested that in different moments, each response from the chain is directly followed by basic reinforcer (SR). The training begins with the response that at the end will be the furthest from the primary reinforcer, and the chain is gradually expanded until it reaches its final form, including responses between the last one included and the basic reinforcer. Empirical studies (including the ones demonstrated in Psychology handbooks) used mainly rats and pigeons and primary reinforcers. The controversy began in 1980s (end of the 70s) with social demands for solving human problems (chiefly in people with cognitive development delay). In Brazil, a study published by Borges and Todorov (1985) suggested a forward teaching procedure to be the most efficient.

This theme is yet very current and relevant; it has been exhaustively described in handbooks of operant literature in the form of book chapter (Catania, 1999; Cooper, Heron, & Heward, 2007; Fisher, Piazza, & Roane, 2011; Martin & Pear, 2009; Matos & Tomanari, 2002; Moreira & Medeiros, 2007; Hübner & Moreira, 2012; Rehfeldt, 2002; Spradlin, 1999; Sulzer-Azaroff & Mayer, 1991). Moreover, the recent bibliographic production has explored other relevant variables to this theme (see, for example, Slocum, & Tiger, 2011;

Bancroft, Weiss, Libby, & Ahearn, 2011; Batra, & Batra, 2006; Valentino, Conine, Delfs, & Furlow, 2015; Albert, Carbone, Murray, Hagerty, & Sweeney-Kerwin, 2012).

The systematic replication of Assis (1987) conducted a procedure used by Borges and Todorov (1985) corroborated that the forward procedure was the most efficient. In the natural environment, for example, opening the faucet introduces a new stimulus in the environment, the view of running water. This stimulus may therefore occasion the next response in the chain, the response to test the water temperature. This response also introduces a new stimulus in the environment, the sensation of the water at a certain temperature on the finger. Then, this stimulus may lead to the next chain response, the response to adjust the water temperature, and so on. Therefore, the response that produces a stimulus may be established as an S^d for the following responses in the sequence that constitute a chain. Additionally, since these stimuli are temporarily pared to a delayed reinforcer, which is available at the end of the chain, they may be stablished as conditioned reinforcers, what maintains the responses they produced. For example, the view of the running water, the sensation of water on the finger, may reinforce the response of touching the running water to check its temperature. It is likely, then, that the chain needs to be seen not only as complex tasks produced by a series of individual responses, but as a sequence of responses that produce discriminative stimulus and conditioned reinforcers. Long chains may, therefore, easily be performed and maintained by stimuli that are produced while the chain is completed, despite the fact that the final reinforcer is delayed. In other words, in the forward procedure the response previously emitted and reinforced is the next “correct” response to be emitted. In the second time the chain is performed, the participant has a high probability of emitting the same response, once it was previously reinforced. In the backward procedure, another response (different from the previous ones) necessarily has to be emitted, and the

emission of the one previously emitted is punished. That means, under the same S^d a response was first reinforced and then punished. That leads to a predicament in the acquisition of discriminative properties of the stimulus: sometimes it signs a correct response, sometimes an incorrect one.

In the study this author conducted with thirty-two college students (Assis, 1987), dispersed into four experimental groups, the task was to put in order six card over a table (a set with gray tones, white, and black; another one with arrows in different space orientation; another with black capital letters, and yet one set with cardinal numbers). All the participants were exposed to both procedures (forward and backward) with full instructions. Correct sequences produced a social reinforcement contingent to the produced sequence. In the second experiment, other sixteen college students were subjected to two teaching procedures in four sequences of responses with heterogeneous topography, with complete instruction and demonstration by the experimenter. The task of the participants was to whistle, nod, blink, touch the table, clap the hands, and snap the fingers. Therefore, it seems that the discriminative stimuli used were named by the participants (letters, numbers, and colors) and the names (verbal labels) of the motor responses with different topographies were randomly described and maintained by the verbal community. Additionally, in the response chaining, for the construction of a behavior chain, the acquisition of reinforcing properties of the stimuli depend on the strengthening of its discriminative function.

Finally, the discussion in this area followed two directions: in the first, several authors justified that the subject's history, the nature of the task, and the fact that in the forward procedure all the responses have, at some point, direct contact to the final reinforcer. This author's proposal pointed that, in addition, the problem was at the criterion used for "real error" in the articles published in this field. In other words, "errors" made after a correct response was introduced in the behavior chain. It was understood as more efficient the procedure that

created the lower number of “errors” for the learning of the complete chain. However, the researcher must be under the control of the correct performance of the organism (that is, those responses that are under control of relevant environmental events), programing appropriate contingencies through visual/auditory prompts, hints, fading and gradual changes of stimuli to strengthen a greater stimuli control, adopting useful correcting procedures, as “errors” lead to control by irrelevant stimuli or undesirable ones, in addition to producing collateral effects (cf. Sidman, 1989).

Ordinal classes

Behavior analysis has presented *stimulus control* as an important area for it involves the study of how variables present in the environment affect behavior. Therefore, stimulus control may be defined in terms of change in the probability of a form or a rate of a behavior that happens as a result of the presentation of the stimuli. Thus defined, stimulus control could include reinforcing, eliciting, and discriminative functions (Skinner, 1991). Subtle characteristics of *stimulus control* may be relevant, also researches on *stimulus control* have revealed promising results regarding the possibilities of actions behavior analysts may have, for example on alphabetization. Several procedures variables of discriminative teaching have been investigated for researchers in this area: fading; stimulus shaping; delayed hints; verbal prompts; conditional control; stimulus overlap; spatial arrangement of stimuli; stimuli order. The investigation of the relations between stimuli also increased exponentially in the latest decades, as documented by the main scientific journals in the area.

In Brazil, at the end of the 1980s the success in applying the paradigm of stimulus equivalence to the network of stimuli relations between teaching reading and writing, lead to a change in researches conducted by behavior analysts in the country. The paradigm proposed and formalized by Sidman and

Tailby (1982) allows documenting and creating conditions to describe the formation of symbolic repertoire, besides providing operational criteria to identify symbolic functions in behavioral relations, enabling the simulation in laboratories of symbolic relations that happen naturally.

Therefore, the study of production and novelty in the repertoire of human beings has received important recognition in researches performed by behavior analysts. Production and novelty, in this point of view, refer to the appearance of new complex performances, without direct exposure to reinforcing contingencies, what has been named cognition, abstraction, concept formation, and ability to select and classify, with or without the use of verbal operants. These repertoires, in a behavioral perspective, can be understood as symbolic behaviors.

To that matter, the equivalence phenomenon is considered a basic behavioral process (Sidman, 1994), derived from the reinforcing contingencies and requires relational properties between stimuli: *reflexivity, symmetry*, *and transitivity*, widely documented by the literature in behavior analysis. It is worth mentioning that the concept of stimulus equivalence is fairly old (Hull, 1939; Peters, 1935), however it had lost its importance after a study performed by Jenkins (1963) that did not show the expected results. The data from Sidman (1971) led to a reactivation of the concept and the related empirical research.

In this context, the formation of ordinal classes constitutes an expansion of the paradigm of equivalence of sequential stimuli. A very common procedure has been the stimulus overlapping. Two stimuli are presented simultaneously (for example A1 → A2). The symbol "→" represents a relation of order. The student must respond to the first stimulus and then to the second to produce the reinforcer. Next, a third stimulus is introduced and the first is removed from the sequence (for example A2 → A3) and so forth until the sequence is complete. That is, how can the organisms respond in sequence to new stimuli that were not previously related to them?

Theretofore, the literature had considered several behavioral processes involved in sequential responding: a) transitive inference; b) formation of sequential classes in the triple contingency; c) conditional control (S^C); and d) transference of the discriminative function with matching to sample for sequential classes or vice-versa. All studies presumed that the notion of *stimulus control* may be applied to new behaviors, derived from contingencies that established the production of sequences, in which the order has a crucial function and the studies had tried to comprehend how repertoires under the control of order are stablished and maintained.

Studies in this line of research made use of the equivalence paradigm for ordinal relations (Green, Stromer & Mackay, 1993), in other words, the relations between the components of the stimuli sequence may be considered ordinal relations if it is possible to identify among them each of the relational properties: *irreflexivity, asymmetry, transitivity, and connectivity*, through behavioral tests.

The observation of ordinal classes formation depends on tests that verify *substitutability* between the elements that occupy the same position in different sequences. The formation of ordinal classes seems to be an underlying phenomenon to syntax learning, therefore, to the production of new sentences beyond those the children are exposed to in their verbal community. The performances in substitutability tests demonstrate the productivity as a crucial property of syntax. The demonstration of productivity means that after the individual had learned a small amount of sentences in a given syntactic structure, a large number of sew sentences will emerge without direct teaching, and each new sentence will have a new group of words produced in an appropriate order, defined by the verbal community; such productivity points out that the individual acquired a relational syntax reflected by the production of new sentences grammatically correct (Mackay & Fields, 2009). For that, the order of stimulus presentation becomes the main variable of control over the class formation of firsts, seconds, thirds, and so on, through contingencies of

differential reinforcement that require responses to order them in an experimentally programmed sequence.

A relevant study of literature review was published by Assis, Baptista and Nunes, (2009). The authors reviewed experimental studies produced in this area, concluding that in sequential responding: *the variable order is defined by dimensions or characteristics of stimuli to which they are related, among them are the size and temporariness of the sequence, and it refers to the relation between antecedent and consequent events.* Therefore, to respond sequentially or ordinally in the presence of stimuli presented simultaneously imply *responding under control of the relational property "stimuli order"*.

In this sense, the concept of chaining as proposed by Skinner (1991) seems *insufficient* to explain the formation of ordinal classes. Two theoretical studies published in this line of research clearly describe these differences, presenting conceptual and methodological advances on the ordinal responding, also suggesting some variables yet to be studied: Miccione, Assis, and Costa (2010), and Miccione, Assis, Carmo and Lopes Jr. (2014).

The observation of experimental results admits the identification of successive and ordered sequences of events. For example, it is large the list of behaviors that happen ordinally. In music: the flutist presses the holes on the instrument according to a given order. In sports: the swimmer emits its movements orderly. At school: the child risks with pencil on the paper the letters of a word, then selects the syllables and later organizes the words. At work: the employee established electronic mail selecting the virtual commands orderly. In leisure: the driver engages in sequential actions to drive, first places the key to the ignition, then shifts the gear, and so forth, when traveling with the family; at home: the son brushes his teeth, first opening the toothpaste, then pressing it to get some of the content, and so on.

For example, establishing ordinal relations constitute an important behavioral skill demanded when learning math. A child that is learning how to

speak will have its vocalization reinforced differentially, and then shaped, due to the adjustments to the sequence of sounds defined by its verbal community. When learning how to count/subtract/multiply/divide it should respond to the sequence of numbers.

Some experimental studies are typical of this line of research: (Assis, Corrêa, Souza & Prado 2010; Assis, Magalhães, Monteiro & Carmo, 2011; Nunes & Assis, 2006; Magalhães, Assis, & Rossit, 2012; Magalhães, Rossit, & Assis, 2013; Ribeiro, Assis, & Enumo, 2007; Souza, & Assis, 2005; Souza, Assis, Magalhães, & Prado, 2008; Souza, Magalhães, Assis, & Goulart, 2010; Souza, Miccione, & Assis, 2012).

Syntatical Classes – production of sentences.

Another line of research, through the paradigm of sequential stimulus equivalence, described and documented by Green et al (1993), demanded probes that documented the relational properties: *irreflexiviy, asymmetry, transitivity, and connectivity*, essential to the emergence of ordinal/syntactic classes.

The studies used the teaching procedure by stimulus overlapping and teaching of conditional discrimination by constructed response matching to sample (CRMTS), recently becoming a line of experimental basis research highly documented. That reflects the history of the discriminative teaching of sentences by response chaining, since the classical study presented by Emilio Ribes named: "*Técnicas de modificación de conducta: su aplicación al retardo en el desarrollo*" (1972) and other handbooks (Ferster, Culbertson & Boren, 1979; Staats & Staats, 1973), until the formation of syntactic classes, through the expansion of the paradigm of stimulus equivalence for the production of sequences (Green et al., 1993).

The production of sentences permits new matching of units (for example, the words that constitute a sentence, Skinner, 1991) generating new sentences. Such recombinative generalization presented by different types of repertoire (Suchowierska, 2006) is defined as “differential responding to novel combinations of stimulus components that have been included previously in other stimulus contexts” (Goldstein, 1983, p. 281).

It is important to highlight that the discriminative teaching of words (for example, by response chaining) or the teaching of conditional discrimination of sentences is not enough for an individual to effectively comprehends written texts, it is important that the individual is subjected to test contingencies of words substitutability (generalized recombinative reading), an essential condition for reading comprehension. Therefore, control by minimal units (letters and syllables) is a fundamental and necessary prerequisite to competently master a fluent sentence reading (Skinner, 1992).

In this context, the pioneer study conducted by Lazar (1977) is considered a milestone in the literature of Experimental Analysis of Behavior over the formation of synthetic classes. The author suggested that behavioral processes involved in equivalent stimuli classes formation must also be involved in the development of productive sequential responding. In this case, such processes could provide a basis for syntax development, particularly ordering words. For this author, for example, words occur in the same ordinal position in different sequences, becoming mutually interchangeable or equivalent, favoring the production of new words sequences.

Examples from the everyday life are important to demonstrate the control variables involved: for example, we could consider a child who was taught three different sentences: *“the big house”, “a blue ball”, “a dirty blouse”* could then produce new grammatically correct sequences, consisting in several generalized recombination of words to form new sentences (for example, “*a big ball*” or “*a dirty house*”, or yet, “*a blue blouse*”). Also, using sentences in

affirmative or negative, for example: THE RIVER DOLPHIN IS PINK (t*he river dolphin isn't pink*), THE BOWL IS BEIGE (*the bowl isn't beige*), THE CAPE IS BLUE (*the cape isn't blue*). In active and passive voices: THE DUCK ATE A JACK FRUIT (t*he jackfruit was eaten by the duck*), or THE COW BIT A JACK FRUIT (*the jackfruit was bitten by the cow*). Moreover, in a recent investigation (study in press), the author of this memorial used the discriminative teaching of sentences in Portuguese with different verb tenses: past, present, and future, as seen in these examples: "a boy sells two shirts"; "a boy sold two shirts", and "a boy will sell two shirts".

Now, think about these two sentences: *"during the filming, the actor said he doesn't like to talk"; "the actor said he doesn't like to talk during the filming"*. Yet, using negative adverbs: "*don't eat dark chocolate"* and *"don't, eat dark chocolate"*. Displacing some words in the sentence or the use of some notation, for example, a comma can modify the meaning/understanding of the sentence. In Skinner's taxonomy of verbal operant it is described as autoclitic (Skinner, 1992). To this author,

> *the ordering and grouping of responses also have several functions. In this first place, speech sounds are ordered in the patterning of responses. Apart from the spectra of single speech sounds, the only dimension of verbal behavior is temporal, and order is therefore an important property* (p.332).

To Skinner, the relational autoclitic enables the organized coexistence of other basic operants in a larger unit than the one observed separately in each operant. In other words, the elements of a sentence, its verbal units (example, prepositions, conjunctions, punctuation, grammatical agreement in tense, case, and number), and *the order in which these units are presented to modify the effect on the listener characterizes the relational autoclitic relation*. Skinner (1992) also considered ordering and grouping verbal answers as autoclitic

functions when stated “responses evoked by a situation are essentially nongrammatical until they have been delt with autocliticaly”. (p. 346).

The concept of relational autoclitic is the base of Skinner’s treatment for grammar/syntactical aspects of verbal behavior. According to this author, these grammatical and syntactical aspects of verbal behavior are derived from verbal regularities observed in a verbal community. These regularities (for example, relations of order, agreement, etc.) are functions of the reinforcement contingency established by the verbal communities in the interactions that characterize the autoclitic relations.

On the other hand, to elucidate how more extensive behaviors are acquired and maintained by the verbal community, Bandini and de Rose (2006) comment how the verbal environment reinforces longer and more complex behaviors, also suggest that “not habitually a more complex response is derived only from the recombination of smaller units. For example, the verbal response – *a glass of water, please* - may be a functional unit controlled as a whole by environmental stimuli” (p.78). The authors also conclude: “the formation of longer responses depend, on most cases, on the emission of autoclitic forms to create ordered and relational pools of responses” (p.78).

In this sense, as well pointed out by Catania (1999) in his classical handbook, words as *“above”, “before”, “late”, “close to”, “very”,* most of the time, occur for being temporarily related to words that take place before. In this case, the *relational property of order* is an important variable for a sentence to have effect on the listener.

Examples of this line of research are the studies conducted by several authors with students from elementary school; students with history of failure or not at school, or with cochlear implant (Assis, Élleres, & Sampaio, 2006; Assis, Motta, & Almeida-Verdu, 2014; Assis, Fonseca, & Bandeira, 2014; Corrêa, Assis, & Brino, 2012; Fonseca, Assis, & Souza, 2015; Golfeto & Souza, 2015; Soares, Assis, & Brino, 2013), using words overlapping procedure or by chaining verbal

responses (Haydu, Fernandes, Assis, & Kato, 2015; Sampaio, Assis, & Baptista, 2010).

In some of these studies on sentence production (Assis, Motta, & Almeida-Verdu, 2014; Assis, Fonseca, & Bandeira, 2014; Corrêa, Assis, & Brino, 2012; Fonseca, Assis, & Souza, 2015; Soares, Assis, & Brino, 2013), it is inferred that some relational properties happen implicitly. In these studies the authors used only tests of stimulus substitutability (generalized recombinative sentence reading), to document the production of new sentences, in agreement to the descriptions on the formation of autoclitic processes proposed by Skinner (1992).

Table 1 presents the results of a study published by Assis, Motta and Almeida-Verdu (2014) that corroborate this statement.

Table 1.

Number of correct answers by trial per participant in the phases of sentence construction test, sentence substitutability test, maintenance test, and percentage of correct answers in the reading comprehension test I and II.

Participants	Sentence Construction Test	**Sentence Substituibility Test**	Maintenance Test	Reading Comprehension Test I	Reading Comprehension Test II
P1	3/6	**7/8**	8/8	100%	30%
P2	5/6	**6/8**	8/8	100%	40%
P3	4/6	**7/8**	3/8	80%	0%
P4	4/6	**7/8**	6/8	100%	10%
P5	6/6	**6/8**	3/8	90%	30%
P6	4/6	**7/8**	2/8	80%	20%

Characteristics of the intervention

The analytical-behavioral approach that describes the emergence of new behaviors with no direct training (and technology of stimulus control derived from empirical studies), have demonstrated success in the applied research literature. The success of such teaching procedures derived from the applied behavior analysis for students with disability/handicap, seems to have, on its turn, occasioned the augmentation of this study, being consolidated by translational research.

It is crucial that behavior analysts engaged in establishing new behaviors maintain a long-term view. The purpose of teaching is providing support to clients and students to develop adaptive and flexible repertoire that maintains access to reinforcement, and that provides adaptive advantage and resistance to extinction. Developing such complex behaviors demands teaching procedure engineering and a constant analysis that augments by teaching discrete behaviors to support the development of strategic behaviors that were efficient with flexible behavior classes.

On the other hand, interruptions in the interior of behavioral classes cause emotional behaviors (Brady, Saunders, & Spradlin, 1994). In this context, for example, a child may cry, scream, kick, bite, or show anger; if an adult, it may blaspheme, or yet, if it doesn't have an appropriate history of life, may produce self-injury.

Delays in behavioral chains suppress the behaviors that cause them. If one pays attention to the behaviors that happen when an interruption or delay occurs (for example, in a daily routine), they seem to have aversive properties. If that is the case, interruptions or delays will nullify behaviors that result in interruptions or delays (Barton, Guess, Garcia, & Baer, 1970). That is accurate even if delays are relatively short. Therefore, any behavior that ends with delay or leads to a continuation of chain are strengthen. There are several studies that

demonstrate behaviors that decrease delays, as part of a chain, though short, may result in appropriate behaviors after being interrupted (Goetz, Gee, & Sailor, 1985; Halle, Baer, & Spradlin, 1981; Halle, Marshall, & Spradlin, 1979; Sigafoos, Reichle, Doss, Hall, & Pettitti, 1990).

A study published by Albert, Carbone, Murray, Hagerty & Sweeney-Kerwin (2012), was the first to document that children diagnosed with autism could acquire trained tact responses after training with mands through interrupted behavioral chain procedure. Other studies (for exemple, Tarbox, Madrid, Aguilar, Jacobo, & Schiff, 2009), have improved intervention procedures, chiefly for children that had the same diagnosis of autism. In the latter, the authors expanded some verbal operants (for example, echoic) through verbal response chaining, another research line relevant for the behavioral intervention nowadays.

On the other hand, conceptual review studies on the formation of syntactic/ordinal classes (see Mackay, 2013), have increasingly oriented authors to develop a stimulus control technique derived from basic research, whether in teaching generalized recombinative reading (an example is the computerized teaching program proposed by Souza, de Rose, & Domeniconi, 2009), or the result of studies as those published by Assis, Motta and Almeida-Verdu (2014), and Golfeto and Souza (2015), mainly for populations that demonstrate deficits in learning sentence reading. All these studies make use of the stimulus equivalence paradigm (or with sequential stimuli) applied to teaching reading.

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