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From controlled experiments to formative interventions in studies of agency: methodological considerations

De experimentos controlados a intervenções formativas em estudos de agência: considerações metodológicas

De experimentos controlados a intervenciones formativas en estudios de agencia: consideraciones metodológicas

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Abstract

The article explores the possibility of developing a methodology for studying the emergence of agentive action experimentally. It discusses the limitations of classic experimental research and seeks a different perspective on the issue of control. The argument starts by reviewing how the concept of an experiment has been expanded throughout the years in social scientific research. Then new openings are considered toward experiments beyond the control paradigm and a methodology of formative interventions, particularly suitable to the study of the emergence of agentive actions. Three central qualities of experiments beyond the control paradigm within the cultural-historical approach are suggested, namely (1) building on participants' conflicts of motives, (2) focusing on the formation of participants' agentive actions of making sense of and transforming the experimental situation, and (3) following temporal and spatial expansions beyond the initial frame of the experiment. The article concludes with a discussion of the broader methodological implications of these new openings.

Keywords: Waiting experiment. Double stimulation. Agentive action. Control. Formative interventions.

Resumo

O artigo explora a possibilidade de desenvolver uma metodologia para estudar o surgimento da ação agentiva experimentalmente. Ele discute as limitações da pesquisa experimental clássica e busca uma perspectiva diferente sobre a questão do controle. O argumento começa por analisar como o conceito de uma experiência tem se expandido ao longo dos anos na pesquisa científica social. Em seguida, novas aberturas são consideradas para experiências além do paradigma de controle e uma metodologia de intervenções formativas, particularmente adequadas ao estudo do surgimento de ações agentivas. São sugeridas três qualidades centrais de experimentos além do paradigma de controle dentro da abordagem histórico-cultural, a saber: (1) construir sobre os conflitos de motivação dos participantes; (2) focalizar a formação de ações agentivas dos participantes de dar sentido e transformar a situação experimental (3) seguindo com expansões temporais e espaciais para além do quadro inicial da experiência. O artigo conclui com uma discussão das implicações metodológicas mais amplas dessas novas aberturas.

Palavras-chave: Experimento da espera. Estimulação dupla. Ação agentiva. Controle. Intervenções formativas.

Resumen

El artículo explora la posibilidad de desarrollar una metodología para estudiar el surgimiento de la acción de agentes experimentales. El mismo, discute las limitaciones de la investigación experimental clásica y busca una perspectiva diferente sobre la cuestión de control. El argumento comienza por analizar como el concepto de una experiencia se ha expandido, a lo largo de los años, en la investigación científica social. Seguidamente, nuevas aperturas son consideradas como experiencias, además del paradigma de control y una metodología de intervenciones formativas, adecuadas al estudio del surgimiento de acciones agentes. Son sugeridas tres cualidades centrales de experimentos además del paradigma de control adentro del abordaje histórico cultural, siendo estos; (1) Construir sobre los conflictos de motivación de los participantes;(2) focalizar en la formación de acciones agentes de los participantes, en dar sentido y transformar la situación experimental; (3) Continuando con expansiones temporales y espaciales para más allá del cuadro inicial de la experiencia. El artículo concluye con una discusión de las implicaciones metodológicas más amplias de dichas aperturas.

Palabras clave: Experimento da espera. Doble Estimulación. Acción agentive. Control. Intervenciones de formación.

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1 Introduction

An experiment is traditionally regarded as the main type of research to yield scientifically valid knowledge that allows to establish causal relations (CAMPBELL; STANLEY, 1966, ARONSON; CARLSMITH, 1969, McGRATH, 1995). The experimental method relies on statistical construction of causal relations between variables (McGRATH, 1995). It does not take into account alternatives to this source of causal explanations. This statistical notion of causality has been found problematic for instance in educational studies of human agency (MAXWELL, 2004b).

Mainstream social psychological studies of agency build on Bandura's (1982) concept of self-efficacy. Recently other experimental approaches to agency have been proposed. Damen, van Baaren and Dijksterhuis (2014) present an experimental study in which the participant's sense of agency is measured with the help of subliminal and supraliminal primes (CUSTERS et al., 2009). Problems in pursuing empirical studies of agency partly originate in the perception that the concept of agency has been "surrounded by a mystique of undefinability" (ALKIRE, 2005). Issues related to self-control or willpower have traditionally been regarded as opaque traits of an individual which may not be operationalizable into statistical inquiry (MAHONEY; THORESEN, 1972). As such, they have been deemed unattainable through empirical study and for this reason many researchers still seem reluctant to take up a systematic study of agency (MURPHY; THROOP, 2010).

Empirical study of agency is further complicated by the fact that it is typically studied as a stable psychological trait or property. This means that the emergence and formation of agency remain hidden. One tempting option to remedy this shortcoming would be to turn to the experimental method: to conduct an experiment which would make it possible to observe agentive or volitional actions as they emerge and evolve. However, the experimental method requires that the experimenter sets an experimental task and is in full control of the variables that are turned into measurable form (McGRATH, 1995). This may contradict the very idea of agency, understood as the subject's ability to control his or her own actions.

The problem of studying agentive action experimentally culminates in the questions of control and linear causality. Following the traditional notion of experimental control, manipulations on the set variables are solely controlled by the experimenter and the experimental participant is expected to perform the task given by the experimenter without questions (e.g., FIELD; HOLE, 2003). However, literature taking a critical stance on control holds that people have a need for personal control, freedom, or autonomy. Perlmuter and Monty (1977) report several experimental designs in which the existence of control was examined. Imposing control over a person from the outside in an artificial situation such as an experiment can be stifling, a threat to personal autonomy. It changes the way people behave and may lead to a dip in performance (PERLMUTER; MONTY, 1977). On the other hand, prolonged failure to control one's circumstances may lead to senseless acts as ways to exert autonomy (PERLMUTER; MONTY, 1977).

In controlled experiments the experimenter is in control over the situation much like in natural sciences (ORNE, 1961). Potential actions within an experiment may be suppressed. Orne (1961) reports findings of the "good participant" who assumes the role of an experimental subject and acts upon that role, even if reluctantly. This imposition makes the participant "a *passive responder* to stimuli" (ORNE, 1961, p. 776).

From the point of view of cultural-historical activity theory, agentive action may be understood as "breaking away from the given frame of action and taking the initiative to transform it" (VIRKKUNEN, 2006, p. 49). Agency understood this way is transformative (SANNINO, 2015a). Such agency seems incompatible with the requirement of control and the related linear view on causality. Treating experimental participants as active subjects requires recognizing that a "meaningful body of knowledge about how man thinks, acts, and experiences can only be created by developing techniques which permit systematic observations, despite the fact that our subjects are, in varying degrees, inevitably active participants in the enterprise of being studied" (ORNE, 1962, p. 56).

This article explores the possibility of developing a methodology for studying the emergence of agentive action experimentally. We will discuss the limitations of classic experimental research and seek a different perspective on the issue of control. To accomplish this, we first explore how the concept of an experiment has been expanded throughout the years in social scientific research. We then explore new openings toward forms of experimentation beyond the control paradigm and a methodology of formative interventions, particularly suitable to the study of the emergence of agentive actions. We conclude with a discussion of the broader methodological implications of these new openings.

2 Critiques of controlled laboratory experiments and attempts to expand the concept of "experiment"

A "true experiment" (CAMPBELL; STANLEY, 1966, p. 34) is one in which causal variables are isolated to

ensure that all other explanations for a phenomenon than the manipulations made by the experimenter are excluded. Typically these requirements are met by conducting a controlled experiment in a laboratory in which other possible stimuli than the ones given and controlled by the experimenter are abolished. By this, the experimenter aims at isolating the effects of manipulations on the variable specified by the experimental design.

The two variables at play are the independent variable, which is manipulated by the experimenter, and the dependent variable, which is the outcome (FIELD; HOLE, 2003). Stemming from a Humean (1965) or Millsian (1865) philosophical tradition, the notion of ruling out all other possible factors that could explain the phenomenon states that the causal factors should be isolated in such a way that there is one experiment in which the cause is present and then another experiment in which the cause is not present. This can be achieved by manipulating the independent variable, and by minimizing random factors by controlling them and keeping all experimental conditions constant. The aim is to create "identical" circumstances, keep the procedure "constant," take into account "all aspects" to produce "the same" effect (FIELD; HOLE, 2003, p. 21). This approach, known as the regularity approach, treats causality as a matter or "regularities in the data" and presumes a statistical view on the subject of investigation (MAXWELL, 2004a).

Randomization, or random assignment of cases to conditions (McGRATH, 1995) is applied to avoid systematic bias (FIELD; HOLE, 2003). Randomization allows the effects of the experimenter's manipulations of the independent variable to be isolated and statistical probabilities to be established (GREENBERG; FOLGER, 1988). Traditionally, this is done by operationalizing the results into a measurable form (MAXWELL, 2004a). In other words, what is known as variance theory in experimental research often culminates in using quantitative measurement and statistics to analyze the findings. The controlled laboratory experiment is concerned with establishing causal relations between variables in order to give unambiguous answers as to what leads to what by following a linear notion of causality in which phenomena have causes that can be unearthed and presented through statistical means. The experimenter's control over the manipulated variable together with randomization are meant to prevent the appearance of a third, confounding variable, that would disrupt the validity of the results (ARONSON; CARLSMITH, 1968).

In a typical controlled experiment, a stimulus offered by an experimenter causes a response in the experimental participant, and with a carefully laid out experimental design and subsequent analysis the relationships between these can be established. Even though many experimentalists acknowledge the insufficiency of the stimulus-response or S-R principle in the explanation of human behavior, the controlled laboratory experiment draws to a significant degree on this principle (BERGER; LAMBERT, 1968). The experimenter's role resembles that of a distant puppet master who manipulates and controls the artificial situation. This means that unless events taking place in the experimental room are controlled and manipulations administered by the experimenter, the experiment is biased and unsuccessful (FIELD; HOLE, 2003).

Traditional laboratory experiments have been criticized for decades. From its early years, social psychological laboratory experimentation bulged into large-scale research designs including hundreds of participants and resorted to using deceptive methods that led to serious ethical concerns (PARKER, 1989, KELMAN, 1967). This was followed by what is known in the literature as the paradigmatic crisis, beginning in the 1960s (PARKER, 1989, GREENBERG; FOLGER, 1988). Up until then, social psychological research had been synonymous to the experimental method (GREENBERG; FOLGER, 1988), but since its supremacy as the only way to study issues of interest to social psychology was questioned, other methods emerged. The experiment part of the laboratory experiment equation has remained viable while much effort has been made to discredit the laboratory side (GREENBERG; FOLGER 1988). The laboratory experiment may have lost its dominance as a research method, but handbooks of social psychology today still teach that an experiment yields what is considered true, scientific data (e.g., HEWSTONE et al, 2008).

The concern of the critics of the laboratory is focused on how well the findings of an experiment conducted in a laboratory can be applied to anything in the real life (HARRÉ; SECORD, 1972). The supremacy of the use of quantitative data has been called into question since the 1970s (HARRÉ; SECORD, 1972). Also the relevance of laboratory experiments in yielding data of trans-situational generality across cultures has been questioned (SCRIBNER, 1997). The balance between what is understood as mundane and experimental realism (BERKOWITZ; DONNERSTEIN, 1982) or external and internal validity (CAMPBELL; STANLEY, 1966) has persistently tipped in favor of the latter: the causal relations as a result of an experiment have been valued higher than the pertinence of the results in the lives of people. The personal qualities, histories and cultures of the participants are allegedly omitted in order to obtain pure data undisturbed by "noise" that could confound the causal relations being established between the variables to be manipulated (FIELD; HOLE, 2003).

While controlled experiments have been purported as "true" scientific experiments thanks to the reliability gained by strict experimental controls, there are situations – such as the study of the emergence of agentive action – in which imposing "full control over the scheduling of experimental stimuli" is impossible (CAMPBELL; STANLEY, 1966), or the answers that are sought are not meaningful in terms of whether "x causes y?" (McGRATH, 1995). In a quest for higher generalizability of findings, and criticizing the controlled laboratory experiment for artificiality of the setting, what is known as a field experiment is purported to allow the world to be studied as it is (GREENBERG; FOLGER, 1988). Classic field experiments for example by Darley and Latane (1968) brought experiments into the participants' mundane lives. Field experiments customarily aim at manipulating variables similarly to the controlled laboratory experiments, only within a different setting and with more sensitivity to the context (GREENBERG; FOLGER, 1988).

Already in the 1960s, Campbell and Stanley (1966) in their seminal work outlined the requirements for rigorous quasi experimental research. Also, contemporary handbooks of social psychology for example by Field and Hole (2003) and Hewstone et al (2008) acknowledge quasi experiments as a viable research option if it is not possible to conduct a true experiment. Quasi experiments follow the same rules as controlled experiments to the extent that it is possible, meaning that the aim is control over the variables (FIELD; HOLE 2003).

In the field of organization studies, attempts at combining scientific rigor with ecological validity through experimentation include what Greenberg and Tomlinson (2004) call situated experiments. In these experiments, the researcher is concerned with unearthing and understanding psychological processes that are beneath organizational phenomena. Situated experiments seek to establish rigor through similar features as controlled experiments, such as aiming at unbiased randomization and setting up causal effects through manipulation of variables.

Expanding the conception of what an experiment could be, Garfinkel (1963, 1967) conducted a series of what became known as breaching experiments. In these non-laboratory experiments, the experimenter broke the rules of a game or a social norm. In a "conversation clarification experiment," the student-experimenters were to initiate an everyday conversation in their lives so that as a response to the interlocutor's mundane comment e.g. "I'm tired," the student-experimenter was to ask the interlocutor to specify the type of tiredness (GARFINKEL, 1963, p. 38). In this experiment, the assumption of reciprocity according to which interlocutors draw on "what everybody knows" (HERITAGE, 1992, p. 81) was breached by the student-experimenter. The set of experiments showed that maintaining the reciprocity of perspectives requires, besides cognitive effort, trust in "that the other will accomplish as a matter of moral necessity" (HERITAGE, 1992, p. 82).

In another set of breaching experiments, participants were instructed to discuss a personal problem with a "therapist" who was in fact an experimenter answering the participants' questions arbitrarily with pre-set answers motivated by the questions. The participants regarded these answers as answers-to-questions and reported having understood what the therapist meant, attempting to work out the hidden meanings (GARFINKEL, 1967). This experiment brings forth the sense-making involved in an experimental situation and highlights the problem of reducing experimentation to rigid rules, confined within the walls of a laboratory. Regardless of the arbitrary or illogical nature of the given answers, these experiments prompted the participants to engage in a search for meaning, bringing into their answers their own reasoning and relevance to the original problem. These experiments, besides opening up the rigid conception of experimental settings, suggest that the participants unavoidably bring in the experimental situation their personal issues.

In the field of education, so called design experiments may be seen as an attempt to go beyond the limitations of standard experimentation (BROWN, 1992). Cobb et al (2003) characterize design experiments as creating "a learning ecology" (p. 9) in which the complexity of the educational world is taken into account, aiming at a dynamic and interactive stance. This means that the conditions and supports of learning are improved in successive iterations of the experiment. Thus, the requirement of control is necessarily loosened and the establishment of causal connections becomes more tentative. Perhaps for this reason researchers have mostly given up the notion of "design experiments" and characterize their approach more flexibly as "design-based research" instead (BARAB; SQUIRE, 2004). Still, design-based research in education tends to be quite linear, aiming at an optimally refined learning arrangement that accomplishes predefined learning goals and can be standardized and replicated in other settings (ENGESTRÖM, 2011).

The different attempts described contribute to the expansion of the notion of experiment by questioning and diversifying the contexts in which experiments can be conducted, what issues can be controlled, and also what is the role of the experimental participant. Yet the types of experiments depicted above involve persistent vestiges of the control paradigm prevalent in controlled experiments. In the next section we look at two experiments that go beyond this notion of control.

3 Two controversial experiments

In psychology and anthropology, experiments conducted in other ways than following the requirements of a controlled experiment have been done with rigor. For example Scribner and Cole (1981) used experimental methods in combination with ethnographic methods, including observation, in a series of studies of literacy in West Africa. Here we discuss the studies of Istomina (1948) and Karmiloff-Smith and Inhelder (1974-1975) as examples of experimentation that does not follow the requirements of classic controlled experiments but yields important insights.

Istomina (1948) conducted a series of experiments with children of different ages in two parallel settings: one setting was a laboratory, the other one a playroom. In both settings, the children had to memorize a shopping list and one child at a time was sent off to do the shopping. In the laboratory, there were no contextual elements present other than the experiment, whereas in the playroom the child left the group to go to the "shop" to buy the items for the children. Istomina's (1948) findings were that the children's memory functioned better in the playroom, i.e., the situation in which there was a meaningful context for the child to remember the shopping list.

Istomina's (1948) study has been contested by Wessberg and Paris (1986), Schneider and Brun (1987) and Schneider and Hasselhorn (1994) in their replication attempts. According to these critics, there were methodological "flaws" in the original study, mainly related to contextual elements in the playroom setting. These "flaws" were corrected by wiping away the community of the children in the kindergarten and imposing control on how the task was presented to the children in both the laboratory and the playroom. However, in the original Istomina (1948) study, going shopping was not about a mechanical task of memorizing a certain list. The task itself was actually embedded in the activity shared by the children in the playroom context.

Interestingly, correcting these methodological flaws resulted in a failure to replicate the experiment (SCHNEIDER; HASSELHORN, 1994). Here, replication refers to an attempt to replicate outcomes of the experiment to confirm Istomina's (1948) results. By correcting what were considered methodological flaws in order to meet the criteria of controlled experiments, the experimenters "sterilized it [the experiment] to the point that it possibly lost its meaning" (FOLDS-BENNETT, 1994, p. 230). Also the replication by Ivanova and Nevoennaia (1998) presented a shift in results: all the results were higher in all age groups. However, Ivanova and Nevoennaia (1998) reject the criticism of methodological flaws in the Istomina (1948) experiment, pointing out that the original study was conducted half a century before theirs and explaining the difference by historical factors in the development of memory.

The level of experimental control was limited in the Istomina (1948) experiment: the children in the playroom were allowed to return to the experimenter to ask for an oral repetition of the items to buy. Occurrences of returning to ask for help may be seen as agentive actions taken by the participants in the situation, ones that would not occur in the controlled laboratory environment because the experimental design would not allow this. Istomina's experimental design allowed a search for meaning. Mistry et al (2001) report on their replication in which the list of items to remember was connected to the meaningful goal of shopping for items to make lunch with, instead of representing just a list to repeat to someone. The children performed better when the context was meaningful (MISTRY et al, 2001).

The study of Karmiloff-Smith and Inhelder (1974-1975) presents an experiment in which 67 children were given the task of balancing blocks of different sizes and materials. In the first phase, the children were allowed to freely choose in which order they completed the task; the researchers merely observed what the children did. In the second phase, the children were asked to do the task again; this time the researchers focused on how the children attempted to grasp the properties of the blocks, how they grouped them and how they behaved once they managed or failed to balance blocks (KARMILOFF-SMITH; INHELDER, 1974-1975).

The first phase generated a hypothesis according to which the children would evaluate their success in the task in two radically different ways, using either an action-response or a theory-response. If a child evaluated her result in terms of whether or not she had managed to balance the blocks, an action-response was involved. In this case, the child would be happy if the blocks balanced and unhappy if they did not. Conversely, a theory-response was at play if a child evaluated the outcome in terms of confirming of refuting her own theory-in-action. Thus, the child would be happy even if the blocks did not balance – if this corresponded to her own theory and prediction. The second phase of the study focused on verifying the hypothesis and on exploring the interplay of action-response and theory-responses by systematic intervention. After having balanced all the blocks, the children were asked to balance one additional block similar in appearance but different in gravity.

The study of Karmiloff-Smith and Inhelder (1974-1975) was not a "true" experiment as the exact order of presentation of items and the types of problems set were not standardized in advance. There was little experimenter control over the children's possible

actions, and the foundational "variable" of the two types of response was only discovered in the process of conducting the experiment. The experiment involved interviews of the children within both phases of the experiment (KARMILOFF-SMITH; INHELDER, 1974-1975), observation was used, and the overall approach was qualitative. The careful observation of children's actions allowed the researchers to discover an important mechanism.

In the two experiments discussed above, the role of the participants differs from that of participants in controlled experiments. The designs of these two studies allowed a level of uncertainty on the part of the participant's actions. In other words, a significant degree of control was in the hands of the subjects, not in the hands of the experimenter. In the next section we explore this issue further by discussing an experiment used by Vygotsky as an example of a setup to study the emergence of agentive actions.

4 From experiments beyond the control paradigm to formative interventions

Vygotsky (1987, 1997, 1998) discusses an experiment, originally designed in Kurt Lewin's research group, as an instance to illustrate how agentive actions emerge and how their emergence can be studied. The experiment is used by Vygotsky to introduce his principle of double stimulation, according to which human beings in situations of uncertainty and cognitive incongruity can rely on artifacts serving the function of auxiliary motives that help them to undertake agentive actions. This experiment and the related principle of double stimulation have great heuristic potential for developing experimental designs in which control is conceived primarily to be in the hands of the participants themselves (VAN DER VEER; VALSINER, 1991). Vygotsky's (1997) description of the experiment reads as follows.

"That in Lewin's experiments we are actually speaking of such control of oneself through stimuli is easy to see from his example. The subject is asked to wait for a long time and to no purpose in an empty room. She vacillates – to leave or to continue waiting, a conflict of motives occurs. She looks at her watch; this only reinforces one of the motives, specifically, it is time to go, it is already late. Until now the subject was exclusively at the mercy of the motives, but now she begins to control her own behavior. The watch instantly constituted a stimulus that acquires the significance of an auxiliary motive. The subject decides 'When the hands of the watch reach a certain position, I will get up and leave.' Consequently, she closes a conditioned connection between the position of the hands and her leaving; she decides to leave through the hands of the watch and she acts in response to external stimuli, in other words, she introduces an auxiliary motive similar to the dice or the count 'one, two, three' for getting up." (VYGOTSKY, 1997, p. 212).

A person is invited to participate in an experiment but upon arriving in the experiment room, the experimenter leaves without giving instructions or an experimental task. The experimenter observes the participant's actions from a separate room while the participant attempts to deal with the situation. Triggered by the problematic situation (first stimulus), the participant experiences a conflict of motives, alternating between the urge of staying or leaving. The second stimulus is an artificial means (such as the watch in Vygotsky's account above) to which the participant turns to deal with the conflict. The participant's actions of forming and using the second stimulus are not controlled by the experimenter.

This experiment is a way to bring the study of agentive action to a concrete level and to eliminate the mysticism related to issues of self-control – a very much needed step forward already called for by Mahoney and Thoresen (1972). What happens in the experiment room in this case is not under the experimenter's control. What is the potential of this experiment then? How can this experiment be positioned in the field of experimentation, and what does it yield as its nature is peculiar and goes against practically every rule in the book?

In experimental research conducted within the Russian cultural-historical tradition, the issue of control is put in a new perspective (ROSA; WERTSCH, 1993). The waiting experiment is a prototypical example of a methodology in the making which puts control primarily in the hands of the research participants (SANNINO, 2015b; SANNINO; ENGESTRÖM; LEMOS, 2016). Our aim here is not to criticize the laboratory experiment as such (GERGEN, 1978) or to claim that controlled experiments are bound to yield ecologically invalid results (HARRÉ; SECORD, 1972). Our aim is to expand the idea of experiment beyond the confines of the control paradigm. This expanded notion of experimentation may be seen as a foundational component of the emerging methodology of formative interventions (ENGESTRÖM; SANNINO; VIRKKUNEN, 2014).

The experiments conducted by Russian cultural-historical psychologists have been characterized as "transforming experiments" (BRONFENBRENNER, 1977) and as "teaching experiments" (VAN DER VEER, 2009). The notion of teaching experiments is, however, used quite widely in mathematics and science instruction and is not specific to the cultural-historical approach (STEFFE; THOMPSON, 2000). To indicate the crucial quality of experiments based on the cultural-historical

approach, we prefer to talk about experiments beyond the control paradigm.

What are the key qualities of experiments beyond the control paradigm within the cultural-historical approach? We suggest three central qualities, namely (1) building on participants' conflicts of motives, (2) focusing on the formation of participants' agentive actions of making sense of and transforming the experimental situation, and (3) following temporal and spatial expansions beyond the initial frame of the experiment. These three qualities make the cultural-historical perspective on experiments distinctive.

(1) *Conflicts of motives*. Following Vygotsky (1997) we see conflicts of motives as powerful driving forces of human learning and development. If an experiment does not trigger such a conflict, it is unlikely that the participants will be fully engaged and that their potentials will be revealed (SANNINO, 2015a). On the other hand, in many conventional experiments participants probably experience conflicts of motives but these are ignored or suppressed by the experimental design. The aim of the type of experiments we are proposing is to create a setting in which the participants face a conflictual situation and mobilize material and intellectual resources to change the given circumstances. The collision of contradictory motives sets forth a search for solutions and opens up the potential to act intentionally by using artifacts (ENGESTRÖM, 2007). In other words, when facing contradictory situations one must move forward taking actions based on one's own judgment, and these actions cannot be fully predicted.

(2) *Agentive actions of making sense of and transforming the experimental situation*. The concept of agency has given researchers grief over decades, being characterized as "elusive" (EMIRBAYER; MISCHE, 1998, p. 962) and "slippery" (HITLIN; ELDER, 2007, p. 170). This may be largely due to the fact that most researchers have focused on categorizing types of agency as if it existed in humans in a ready-made form. Very few researchers have tried to examine how agentive actions actually emerge.

It is not possible to create a totally meaningless experimental situation (ORNE; EVANS, 1965) because the experimental participants are people with their own experiences, lives and minds and bring into the situation all of what is theirs and through that create meanings. Van der Veer; Valsiner (1991) point out that the experimenter cannot control the "psychological instruments" (1991, p. 399) the participants bring into the situation. So control over an experiment can be shared between the experimenter and the experimental participant, or it is even taken over by the participant (SANNINO, 2015a). Control over the waiting experiment may have been initially in the hands of the experimenter, but the participant took use of the "limited freedom of re-defining the experimental situation" (VAN DER VEER; VALSINER, 1991, p. 399). This open-endedness of the experiment allows agentive actions of the participant to emerge and to be studied. The core of this type of an experiment is to observe how the participant takes over the situation.

(3) *Temporal and spatial expansions*. Controlled experimental settings are often depicted as a closed space, void of all extra distractions and the experiment has a clear starting and finishing points. A controlled experiment operates in an experimental reality (BERKOWITZ; DONNERSTEIN, 1982) which resembles a vacuum where what is meaningful for a human being is wiped away. When participants are allowed to redefine and transform the experimental situation, they typically begin to break away and expand it physically, mentally and discursively. Agentive actions may be taken successively, as if in longitudinal chains or strings. They may also be taken in the form of testing and extending the boundaries of the experimental situation, that is, by bringing in elements from the outside world or by moving between the experimental space and the world outside (SANNINO; LAITINEN, 2015, SANNINO, 2015b).

Experiments that go beyond the paradigm of control aim at disclosing core mechanisms of human agency and potential for creative action. Such experiments generate vital insights for the development of a methodology of formative interventions. The methodology of formative interventions stems from two epistemological principles, namely the principle of double stimulation and the principle of ascending from the abstract to the concrete (SANNINO, 2011, ENGESTRÖM; SANNINO; VIRKKUNEN, 2014). Formative interventions are embedded in collective activities such as workplaces and organizations, educational institutions, communities or social movements. They build on historical and ethnographic data on the development of contradictions in the focal activities, and they involve groups of key participants or practitioners in longitudinal efforts to analyze and redesign their activities. The stepwise cyclic progression of a formative intervention, such as the Change Laboratory (VIRKKUNEN; NEWNHAM, 2013), builds on the theory of expansive learning (ENGESTRÖM, 2015).

Formative intervention differs from an experiment. An experiment – even one that goes beyond the paradigm of control – is typically focused on a reasonably well-bounded question that pertains to the foundational mechanisms of human conduct. The contextual complexity of an experiment is reduced to allow focusing on the essential. In other words, an experiment aims at identifying, elucidating and modeling something that

may have very broad explanatory potential beyond the initial experimental setup. We might say that experiments beyond the control paradigm aim at uncovering and modeling "germ cells" of human potential. Thus, the experiments recently conducted in Helsinki as replications and modifications of Vygotsky's description of the waiting experiment have generated a general model of the stepwise mechanism of double stimulation (SANNINO, 2015b; SANNINO; LAITINEN, 2015).

Germ cell models generated by means of experiments beyond the control paradigm are of great value for the elaboration of a methodology of formative interventions. Understanding the mechanism of double stimulation allows the interventionist to carefully introduce situations and artifacts that may facilitate the emergence of double stimulation and agentive action in the intervention process. And such models allow systematic analysis of the data accumulated in the course of the intervention.

5 Conclusion

The aim of classic controlled experiments to wipe clean the laboratory and use naïve participants who respond to only those stimuli that the experimenter has control over has been questioned for decades (ORNE, 1961, ORNE; EVANS, 1965). Yet the controlled experiment is still purported as the most valid research method to produce scientific data. We propose to expand the idea of experiment beyond the paradigm of control. This expanded understanding of an experiment is needed if we want to study the foundational mechanisms of human agency, that is, the emergence of agentive actions. The expanded view of experiments directs our efforts to the design and implementation of experiments that (1) build on participants' conflicts of motives, (2) focus on the formation of participants' agentive actions of making sense of and transforming the experimental situation, and (3) follow temporal and spatial expansions beyond the initial frame of the experiment. We believe that experiments that adhere to these three qualities will shed light on important aspects of human behavior not yet fully scrutinized (YANCHAR, 2011, YANCHAR; WILLIAMS, 2006).

The idea of conducting and refining experiments beyond the control paradigm derives from the century-long Russian cultural-historical tradition. In this tradition, the control imposed on the participant in an experiment was purposefully loosened (ROSA; WERTSCH, 1993). Viewing the participants as agents, allowing and studying their agentive initiatives in the experiment, is at the core of classic cultural-historical ideas on experimentation, vividly so in Vygotsky's account of the waiting experiment.

Experiments beyond the control paradigm serve as catalysts of the development of a methodology of formative interventions. While such a methodology relies on the same three qualities listed above, it also transcends the boundaries of an experiment, focusing on historical transformations in entire activity systems. Interplay between experiments beyond the control paradigm and formative interventions such as Change Laboratories is an important challenge and promising perspective for cultural-historical research aimed at fostering transformative human agency.

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