



Effects of Support Consequences and Cultural Consequences on the Selection of Interlocking Behavioral Contingencies

Efectos de las Consecuencias de Soporte y Consecuencias Culturales en la Selección de Contingencias Conductuales Entrelazadas

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Liany Tavares Tadaiesky,
Emmanuel Zagury Tourinho

Universidade Federal do Pará, Brasil.

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Universidade Federal do Pará, Centro de Filosofia e Ciências Humanas, Departamento de Psicologia Experimental, Rua Augusto Corrêa, 1, Guamá, 66075-110 - Belem, PA – Brasil. E-mails: liatadaiesky@gmail.com (LT) and eztourinho@gmail.com (EZT).

Resumen

El estudio tuvo como objetivo evaluar el efecto de las consecuencias de soporte (CS) y de las consecuencias culturales (CC) en la selección de entrelazamientos (por CS) o contingencias conductuales entrelazadas (CCEs – por CC). El trabajo se constituye de cuatro grupos experimentales. Los grupos 1 y 2 han integrado el Experimento 1, y los grupos 3 y 4, el Experimento 2. Cada grupo estuvo expuesto a un juego de apuestas. Los grupos 1 y 2 fueron expuestos a la condición A (contingencias de soporte) y/o a la condición B (metacontingencias). El diseño experimental del Grupo 1 fue B/A/A+B/B; el Grupo 2 fue expuesto a una única fase en la condición B. En todos los grupos se observó la selección de entrelazamientos o CCEs, no habiendo sido verificadas diferencias significativas de desempeño. Los resultados para los grupos 1 y 2 demuestran que entrelazamientos o CCEs pueden ser seleccionados y mantenidos por consecuencias de soporte o consecuencias culturales, que pueden también ser mantenidas al mismo tiempo por consecuencias de soporte y consecuencias culturales, y que entrelazamientos seleccionados por

Abstract

In this study the effects of support consequences (SC) and cultural consequences (CC) on the selection of interlocks (by SC) and interlocking behavioral contingencies (IBCs – by CC) was evaluated. The study comprised the analysis of four experimental groups. Groups 1 and 2 which participated in Experiment 1 and groups 3 and 4 in Experiment 2. Each group was exposed to a gambling game. Groups 1 and 2 were exposed to conditions A (support contingencies) and/or B (metacontingencies). Group 1 was exposed to four phases (B/A/A+B/B), while group 2 was exposed to a single phase (B). The interlocks or IBCs of both groups were selected and no differences in the performance of the groups were identified. Data for groups 1 and 2 show that interlocks or IBCs can be selected and maintained by support consequences or cultural consequences, that an interlock can be maintained simultaneously by support consequences and cultural consequences, and that the interlocks selected by support consequences may subsequently be maintained solely by cultural consequences contingent on the IBCs. In Experiment 2, the groups were exposed to conditions A'

consecuencias de soporte pueden ser subsecuentemente mantenidos sólo por consecuencias culturales, sin la presencia de las consecuencias de soporte. En el experimento 2, los grupos estuvieron expuestos a las condiciones A' y B', que eran idénticas a las condiciones del experimento 1, excepto por la complejidad del entrelazamiento o CCEs. El Grupo 3 fue expuesto a las condiciones B'/A'. El Grupo 4 fue expuesto sólo a la condición B'. En los dos grupos se observó la selección del entrelazamiento o CCEs. Los resultados indican que no hubo diferencia significativa entre el desempeño de los grupos bajo condiciones de metacontingencias y condiciones de contingencias de soporte. Futuros estudios podrían usar este diseño experimental, manipulando la complejidad del CCEs, para evaluar si consecuencias de soporte y consecuencias culturales pueden ejercer diversos papeles en la selección de CCEs.

Palabras clave: Contingencias de Soporte, Metacontingencias, Contingencias conductuales entrelazadas.

Despite its focus on second-level selection, cultural practices can be considered as legitimate subject matter for studies in Behavior Analysis. Behavior analysts have recently begun to approach social phenomena in a more consistent and systematic fashion, and have identified the need for the definition of the analysis unit adopted in such studies (cf. Andery, Micheletto & Sério, 2005; Glenn, 1991, 2004).

Cultural studies not only concentrate on the relationship between a response and their consequences for the organism, but also on the inter-relations among the different reinforcement contingencies, which describe the behavior of the members of a group, and may be referred to as interlocking behavioral contingencies, or IBCs. These IBCs are contingencies that involve the behavior of more than one organism, with the behavior of an individual forming the role of environment for the behavior of other individuals. In Glenn's (1991) view, the concept of an IBC emphasizes the "dual roles that each person's behavior plays in social processes – the role of action and the role of behavioral environment for the action of others" (p. 56).

Glenn (1988, 1991) considers certain cultural practices to be more than simply IBCs, but rather a more complex form

and B', which were identical to A and B, except for requiring more complex interlocks or IBCs. Group 3 was exposed to condition B'/A', while group 4 was exposed only to condition B'. The interlocks or IBCs were not selected in either group. Results indicate no remarkable differences in the groups' performance exposed to metacontingencies and support contingencies. Future studies should replicate the presented experimental design, but control the complexity of IBCs more precisely with the evaluating aim to check whether support consequences and cultural consequences play different roles in the selection of IBCs.

Key-words: Support Contingencies, Metacontingencies, Interlocking Behavioral Contingencies.

of organization, which can only be understood by using a different unit of analysis. Glenn (1988, 2004) proposed a unit of analysis – metacontingencies – appropriate for the study of cultural practices using concepts derived from Behavior Analysis. In her 2004 paper, Glenn determined that metacontingencies describe the functional relations in which the aggregate product of a given cultural practice acts as a feedback mechanism by selecting the IBCs that participate in the practice. This aggregate product is defined as an event produced by the responses of more than one individual, all participants of the IBCs. Glenn and Malott (2004) subsequently refined the concept of metacontingency by introducing a reference to the receiving (social) system, which receives the aggregate product and delivers a cultural consequence which functions as an environment change that selects the IBCs and their aggregate product. In this way, metacontingencies can be characterized as the selection of the relation between IBCs plus their aggregate product by a cultural consequence delivered by a receiving system. In this case, the cultural consequences selective of the IBCs (and their aggregate products) are distinct from the aggregate product itself. As identified by Glenn and Malott (2004) and discussed by Tourinho and Vichi (2012), this occurs when cultural phenomena reach a higher degree of complexity. Hereafter,

this study will refer to metacontingencies as the functional relationship between (a) IBCs plus, an aggregate product and (b) a cultural (selective) consequence.

In the case of IBCs, the behavior of each participant of the cultural practice is maintained by its intrinsic consequences. Given this, the aggregate product or cultural consequences may or may not affect individual behavior, but it determines how the behavioral contingencies of the participants interlock (Glenn, 2004). For example, when a group of people play a game of volleyball, the behavior of each individual functions as an environment for the behavior of the others, so that the behavioral contingencies of the players interlock, which is necessary for the production of a consequence which will not select the individual behaviors, however the interlocking of contingencies which results in the cultural consequence, that is, the point scored by the team. Each player's shot was only effective because the other members of the team reacted in specific ways to the group members behavior. Ultimately, it is the probability of recurrence of this overall interaction that increases.

According to Glenn (2004), IBCs "function as an integrated unit and result in an outcome that affects the probability of future recurrences of the IBCs" (p. 144). Thus, the concept of IBCs implies a selective event that alters the probability of recurrence of the IBC as an integrated unity. The concept of IBCs, then, is connected to the concept of metacontingencies, this is different from talking about IBCs as interlocking (or, simply, social) contingencies in which what it is evolved is the operant behavior of each individual, under the control of social stimuli. But this distinction is not so clear in the recent literature on cultural selection.

Andery et al., (2005) propose that cultural practices are characterized by different degrees of complexity and thus, configurations of different types. According to Glenn (1988, 2003), the first cultural practices integrated individual behavior because each unique event had two distinct functions: the reinforcement of individual behavior and the selection of IBCs. As culture has evolved and cultural practices have become increasingly complex, the consequences which maintain operant behaviors (operant reinforcers) would have become increasingly distinct from those that maintain cultural lineages by selecting IBCs and the aggregate products. Furthermore, Andery et al. (2005) conclude that:

"we might imagine cultural practices occurring at different levels of complexity, ranging from those that involve simple imitation... to those that involve, for example, the organization of labor (and which can only be described completely if their aggregate products can be identified)... This suggests that the description of social phenomena may involve different units of analysis" (p. 132)

In accordance with Glenn (2004), and following Skinner (1953/1965), Andery et al., (2005) assert that interlocking contingencies themselves comprise a unit of analysis, other than the metacontingency. The main element distinguishing these units of analysis is the existence (in metacontingencies), or not (in interlocking contingencies), of a cultural consequence. Thus, while some social phenomena, such as imitation and reciprocal exchange, involve interlocking contingencies, they are not metacontingencies, due to the lack of a cultural consequence that selects the IBCs. In these cases, the appropriate unit of analysis would be that of interlocking (individual) contingencies.

In addition, Andery et al., (2005) identify an especially relevant type of interlocking contingency, which they refer to as a contingency of support. In this context, the interlocking contingencies are maintained because the other contingencies involved in the phenomenon support their intertwining through the maintenance of the behavior of at least some of the participants, as illustrated in Figure 1. The support contingencies may be supplied by another individual, a group, or a controlling agent.

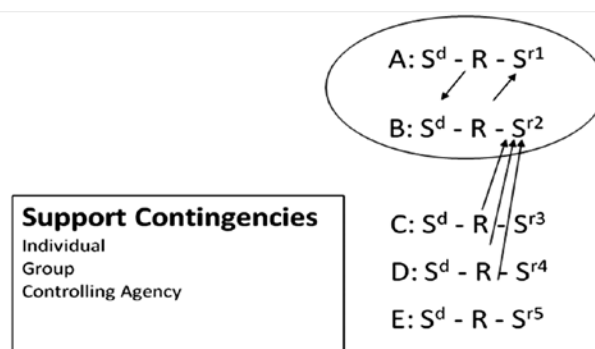


Figure 1 – Diagram representing support contingencies.

In this type of interlocking, other reinforcement contingencies are involved directly in the selection of cultural practices, so it is important to understand the role

of these contingencies in the maintenance of the behavior of the individuals which participate in the interlock. When, for example, a teacher designates a pupil as a class monitor, this pupil is responsible for maintaining the interlocking behavioral contingencies within the class, while the monitor's behavior may be maintained by consequences that are external to the individuals participating in the specific interlock, in this case, by accruing bonus points for the course. In this situation, the IBCs are present, but there is no need for the presence of a cultural consequence that selects the interlock, although support contingencies provided by an individual who is not a member of the group may be essential for the maintenance of the IBCs.

Perhaps it is possible to say that in the absence of an aggregate product and/or a cultural consequence, we are faced with no more than social behavior, which might be explained in terms of operant contingencies. However, the reference to support contingencies maintaining IBCs is an attempt to draw on the possible processes which are found in the transition from merely social behavior to metacontingencies, when individual consequences are typically different from (and, sometimes concurrent to) cultural consequences. Conceptual and empirical work is still needed in order to assess that, but we here start with the analysis of Andery et al., (2005), according to which

"The description of this inter-relationship, then, already takes us beyond that of interlocking contingencies themselves, which suggests that, if we are not already talking about a metacontingency (which would require the identification of an aggregate product [or a cultural consequence]), then we are surely referring to a scenario of transition to a different level of analysis" (p. 153, brackets added).

The distinction between social phenomena which involve support contingencies and those that involve metacontingencies is still somewhat unclear. The content of the present paper can, nevertheless be broken down into these main points: (a) both support contingencies and metacontingencies are social phenomena, given that two or more people are interacting; (b) both phenomena include interlocking contingencies, in which the elements of an individual's behavior function as the environment for the behavior of another individual; (c) in phenomena related to metacontingencies, it is possible to identify a cultural consequence that selects and maintains the interlock of

behavioral contingencies; (d) in the phenomena related to the contingencies of support, it is the individual behavior that is selected, by individual consequences that are external to the interlock, and provided by an individual, group or controlling agent; (e) when the individual behavior which takes part in an interlocking contingency is maintained by support contingencies, an adaptive change will depend on the rearrangement of the consequences contingent on the behavior of each member of the group; (f) when an interlock is maintained by a cultural consequence, the manipulation of this consequence is sufficient to alter the probability of a given pattern of interaction among the members of the group.

As stated before, in metacontingencies what it is evolved refers to an integrated unity comprising IBCs and their aggregate product and cultural consequences. In support contingencies, what evolves are the individual "interlocked behaviors" of the group members. The latter, however, would be poorly described as merely "social behavior", because that would conceal the fact that the individual consequences are transitional, in a process that may lead to the IBCs control by an event which is a function of the IBCs as a whole. For example, we have an "interlock" or a social behavior when an individual brings a glass of water under the control of someone else's demand, who also displays a social reinforcer. As a matter of fact, we have an interlock or a social behavior when a worker under initial training to exert a specific function in the production of computers hears that the piece he holds has been settled in the correct place. But in the latter case, the "support consequence" may be transitional (and additional to the operant consequence – e.g., his salary), and the worker behavior, as well as those of the other group members under the control of each other's (i.e., the IBCs), so its aggregate product may constitute a unity which is evolved as a function of a cultural consequence. Because of such differences, it may be useful to investigate support contingencies conceptually and empirically. As the study does so, it will refer to "interlocks" in support contingencies, and to IBCs in metacontingencies, but we acknowledge that this should be the object of a conceptual refinement.

Even though support contingencies have been considered to be a transitional stage in the development of more complex cultural practices (Andery et al., 2005), such as the phenomena described as metacontingencies, it remains unclear whether and to what extent this transition

may occur. As mentioned above, further theoretical and empirical studies will be necessary for a more conclusive discussion of this phenomenon.

Vichi, Andery and Glenn (2009) reported on the first experimental study in Behavior Analysis that focused on the selection of cultural practices using the concepts proposed by Glenn (1986, 1988, 1991). The objective of that study was to determine whether the behavior of a group could be modified by manipulating the cultural consequence derived from the IBCs of the participants and their aggregate product, without manipulating the consequences contingent on individual behavior. The eight participants of the experiment were divided into two groups to participate in a betting game based on a grid of eight columns and eight rows. A plus or minus sign was attached to each intersection, and each participant had to place an individual bet, while the group would subsequently have to choose a row for everyone. The researcher would then identify the column selected. If the intersection of this column with the row chosen by the group coincided with a plus sign, the players would win the bet and receive double the number of tokens betted. However, if there was a minus sign at the intersection, the players would lose, and would receive only half of the token betted. Without the knowledge of the participants, the researcher's choice of column was determined by the manner in which the tokens won during the previous cycle were distributed among the members of the group. In condition A, the egalitarian distribution of tokens among group members was reinforced, whereas in condition B, reinforcement was contingent on an unequal division. Both groups met the criteria of stability for the two different conditions. The results indicated that the procedure was effective for the modification of the form in which the group members distributed the resources obtained during the game (Vichi, 2004), even though the consequences were contingent on the behavior of the group as a whole, rather than that of each participant.

A study by Oda (2009) investigated the role of verbal interactions in metacontingencies. The study group participated in a game in which a given interlock and its aggregate product could be selected by a cultural consequence. The results indicated the selection of IBCs and their aggregate product. All the verbal communication of the subjects was recorded, transcribed, and subsequently analyzed. The results showed that the subjects interacted

on the experimental contingencies which, according to the author, suggest that the verbal interlock is part of the overall interlock necessary for the construction of the aggregate product. The results also indicated that, while the subjects were not always able to describe the experimental contingencies fully or accurately, they were effective for the construction of the aggregate product and, thus, the production of the cultural consequence. The author concluded that the verbal behavior was an important component of the selection of metacontingencies, with the verbal transmission of practices from one participant to another.

Glenn (1986) analyzed the relevance of verbal behavior for the selection and evolution of cultural practices, and discussed the notion that these practices are mediated by contingencies of reinforcement arranged socially. She provides an example of behaviors involved in the delayed consequence "reduction of air pollution", for which engineers must engage in a variety of activities related to the development of catalytic converters, workers must learn how to build the converters and mount them in cars, and consumers must buy and use these cars, and so on. She concludes that the probability with which all these activities would occur without the presence of socially-mediated contingencies would be very low.

Given this, verbal behavior would provide the link between contingencies and metacontingencies in at least two forms – as a rule, and as social reinforcement (Glenn, 1986). Initially, verbal behavior is essential to fill the gap between the behavior and its long-term consequence, in other words, a rule is established, which functions as a discriminative stimulus for a behavior which, in the absence of this stimulus, would be less likely to occur. The second role of the verbal behavior would be to maintain the behavior under the control of the rule until its long-term consequences are able to take over this control. Without this verbal behavior, the transmission of cultural practices between individuals and across generations would be practically impossible (Glenn, 2004).

The experimental models adopted for the present experimental study of cultural practices in small groups appear to provide important perspectives for the establishment of experimental research in this area. However, it will still be necessary to develop methods that permit the experimental analysis of the social phenomena

described as support contingencies. After all, what is the role of support contingencies in the overall interlock of contingencies? Do any interlocks exist that are maintained solely by support contingencies? Is it possible for IBCs maintained by support contingencies to be converted into those maintained by a cultural consequence? Is it possible for support contingencies to favor the control of the interlock by metacontingencies, especially in situations in which metacontingencies alone would not be sufficient to select IBCs and their aggregate product or would demand high levels of exposure for control to occur?

The principal aim of the present study was to evaluate the effects of support consequences and cultural consequences on the installation and maintenance of interlocking behavior contingencies (IBCs) and their aggregate product. The specific objectives were to:

1. Evaluate the effects of support consequences on the production and maintenance of IBCs and their aggregate product in the presence/absence of metacontingencies.
2. Evaluate the effects of cultural consequences on the maintenance of IBCs and their aggregate product following the removal of the support contingencies.

The study, thus, manipulated support contingencies and metacontingencies. The task performed by participants was similar to that reported by Vichi et al., (2009): basically, the participants would make a bet with colorful tokens and choose a row from an 8x8 matrix. In order to produce an analog of support contingencies and metacontingencies, the IBCs required in the programmed conditions were related to a coordination of the colors of the tokens chosen to make the bet. It is conceived that an experimental analog of support contingencies might be a condition in which support consequences would be delivered individually when a participant's response occurred under the control of another participant's response. Moreover an experimental analog of metacontingencies might be a condition in which cultural consequences were delivered to the group when the IBCs (individual responses emitted under the control of one another) and their aggregate product (a sequence of colors chosen) recurred consistently with the programmed requirement.

Method

Participants

Twelve university students – eight females and four males with ages of between 18 and 23 years – participated in the present study. The students were selected from a number of different courses except Psychology. The 12 participants were divided into four groups, each with three subjects, identified only as P1, P2, and P3, in each group.

Materials

- A 42" LCD television.
- A personal computer with a Dual Core processor, 2 GB of RAM memory, hard drive of 160 GB and Windows XP™ or Vista™ operational system.
- A digital video camera.
- A table and four chairs.
- Record sheets.
- Sheets of instructions for the participants.
- 400 plastic tokens colored orange, lilac, yellow, brown, and pink.

Setting

The study was carried out in the Social Behavior and Cultural Selection Laboratory, located in the Experimental Psychology Laboratory of the Graduate Program in Behavioral Theory and Research at the Federal University of Pará. The laboratory was equipped with four chairs, the television, and the video camera, used to record the sessions. The participants, researcher and research assistant (responsible for conducting the experiment and recording the sessions) were present in this room.

Procedure

Experimental sessions were conducted independently for the each group. Groups 1 and 2 participated in Experiment 1, and groups 3 and 4 in Experiment 2. The general characteristics of the study, which were common to all groups and experiments, are described below.

Each group participated in a game involving small bets and winnings. The three participants of each group were

present during each session, which lasted approximately one hour. Each session was made up of 30 cycles, each cycle consisting of three plays, one for each participant. Each play consisted of:

- (a) a player's bet, in which a token of any color is selected from those available in the collective pot located in the center of the table, and given to the researcher.
- (b) the player chooses a row from a matrix on a television screen, which is composed of eight rows and eight columns.

Each of the tokens was worth 10 cents (approximately equal to six cents of an American dollar). Depending on the experimental condition in question, the plays would be followed by either a support consequence (an event delivered individually after each play, but contingent on responding under the control of another player's performance - IBCs) or a cultural consequence (an event delivered to the group, after all participants had chosen a row, and contingent on the IBC and its aggregate product). The organization of the cycles is explained in detail below, in the description of the experimental conditions.

Experiment 1.

This experiment was composed of two treatments or experimental conditions: condition A (support contingencies) and condition B (metacontingencies).

Condition A. In this experimental condition, following each subject's play, the following individual consequence was presented: the researcher chose a column of the matrix presented on the television screen. If the square at the intersection of this column with the row chosen by the player contained a plus sign (+), the token betted by the player was returned by the researcher and deposited in that player's pot, referred to as the Individual Bank. If the square contained a minus sign (-), the researcher kept the token betted by the player, who won nothing in this play. The columns were chosen by the researcher according to predetermined reinforcement criteria.

Once the first participant's bet was concluded, the second and third participants also placed their bets, separately,

following the steps described for this experimental condition. The cycle terminated when all the participants had placed their bets. Each cycle was started by a different player, following a continuous rotating schedule.

The tokens in each participant's individual bank were exchanged for the corresponding monetary value at the end of the session. For this condition, tokens of only three colors – orange, brown, and yellow – were used, and were made available in the collective pot at the center of the table.

Condition B. In this experimental condition, no individual consequence was presented at the end of each player's bet, that is, the researcher did not choose a column and did not reward the individual bets of the players with different consequences. The only consequence presented was a collective payout of four tokens following the bets of all three players. This group bonus was only provided if the interlock had been maintained. When the interlock was not maintained, the group was informed that no bonus had been won in that cycle.

The group bonus was deposited in a pot referred to as the Collective Bank. At the end of the study, the tokens in this pot were exchanged for the corresponding monetary value and divided equally among the players.

Each cycle was started by a different player, following a continuous rotating schedule. As for condition A, tokens of only three colors – orange, brown, and yellow – were available in the collective pot at the center of the table.

In Experiment 1, the delivery of a support consequence to each participant (in condition A), or cultural consequences (in condition B), to the group was dependent on:

1. The selection of a token of a color that was different from that chosen by the same player during the preceding cycle.
2. The first participant of each cycle should choose a token of the same color as that chosen by the last participant in the previous cycle.

Experimental Design.

The schedule for group 1 involved the following four phases: B/A/A+B/B. The criterion for closing a phase was 30 cycles, or a total of 24 cycles with positive consequences during a session. Group 2 went through only one phase under condition B, with this criterion of 24 positive cycles. The participants received general instructions on the matrix game, the players' bets, the payout of tokens to the individual or collective banks, depending on the condition, and the monetary value of the tokens.

In phase A, only support consequences were delivered. In phases B, only cultural consequences were delivered. And during the phase A+B, both support consequences and cultural consequences were delivered by the experimenter.

Results and Discussion

In this experiment, for both groups IBCs were selected and maintained.

Group 1

For this group, only one session was conducted in phase 1 (B - metacontingencies) (see Figure 2), and the group performed only 10 interlocks during the 30 cycles of the session. The next two sessions were in phase 2 (A - support contingencies). In the first session under this condition, again the group did not reach the stability criterion, with only six interlocks maintained. The criterion was achieved in the third session, however, when support consequences were produced by each one of the three participants in 25 cycles,

indicating unequivocally that the programmed interlocks were selected. In phase 3 (A - support contingencies plus B- metacontingencies), only one session was necessary to reach stability, with 29 interlocks being maintained during the 30 cycles, indicating, once again, the selection and maintenance of the IBCs. Phase 4 involved exclusive exposure to condition B - metacontingencies, as in phase 1. In this case, 28 interlocks were maintained in the session, satisfying the stability criterion.

The selection of the programmed IBCs was clear in this group. The first two sessions demonstrated that the interlock had not yet been established by the group, so that its subsequent maintenance was effectively selected for by the prevailing contingencies. The results for this group are very interesting, because they demonstrate that support contingencies are sufficient for the selection of IBCs. Session 3, when the IBCs were selected definitively, was based on condition A, which provides only support (individual) consequences contingent on the interlock. In this situation of a support contingency, there is no cultural consequence to maintain the interlock. This result represents the first empirical evidence that cultural practices may have different levels of complexity and configurations, as proposed theoretically by Andery et al. (2005). Their hypothesis that some types of interlock may be maintained, independently of the presence of a cultural consequence, as proposed by the concept of the support contingency, was supported empirically by the results for group 1.

A more detailed analysis of the players' choices of colors and rows, as well as their verbal interactions during each

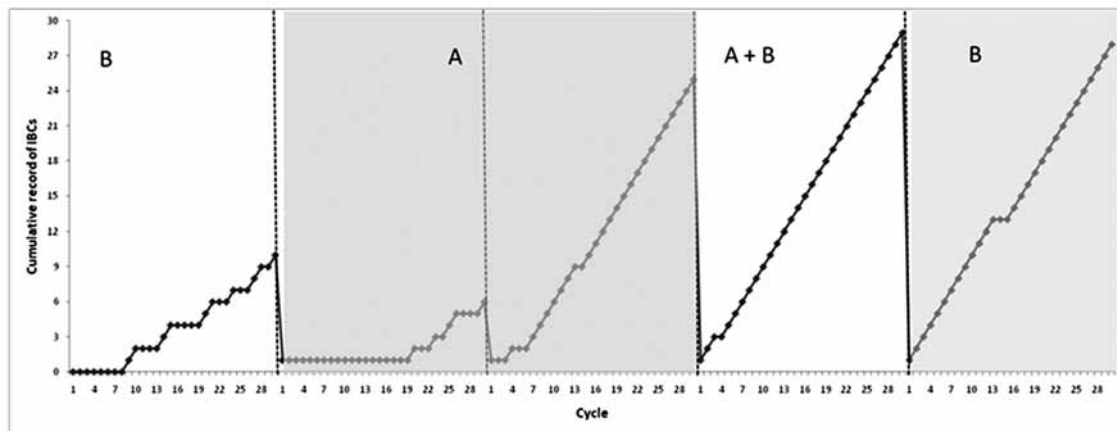


Figure 2 – Cumulative Record of interlocking behavioral contingencies per session in experimental group 1.

session, may contribute to a better understanding of the data. In the last cycle of each session, group 1 performed the programmed interlock, with the choice of tokens in the following order – yellow, orange, and brown. In the first cycle of session 3, the group decided to repeat the colors in the same order, given the positive consequences resulting from this choice in the last cycle of the previous session. This decision was based on the positive consequences of the preceding combination. However, as one of the criteria for reinforcement is that the first player of each cycle should choose a token of the same color as that of the last player of the preceding cycle, the repetition of the sequence of tokens did not reach the requirements for the production of a support consequence.

From the eighth cycle of this session onwards, the group selected tokens in a specific pattern of colors – in one cycle, they chose yellow, orange, and brown, and in the following cycle, brown, orange, and yellow. This pattern satisfied all the criteria established for the interlock. Some of the participants' comments reveal how they chose the color pattern: P2 – “Let’s try from top to bottom now (the color sequence)”, P3 – “You must have noticed that we are just inverting the sequence... first we start with brown, and then with yellow”.

This description of the experimental contingencies by the group was effective for the production of the support consequences of the interlock, with this pattern of color choice being observed in practically all of group 1's subsequent cycles. In general, the results obtained for group 1 demonstrate that IBCs can be selected and

maintained by support contingencies, that an interlock can be maintained simultaneously by support contingencies and metacontingencies, and that the IBCs selected by support contingencies may subsequently be maintained solely by a cultural consequence, without the need for support contingencies.

These results also indicate that the verbal behavior of the participants may have played one of the two roles in the selection of cultural practices as defined by Glenn (1986). The participants' descriptions of the experimental contingencies may have worked as verbal stimuli for the group, supporting a more efficient interlocking pattern. It is also possible that some of the participants' verbal behaviors may have functioned as a differential consequence, thus maintaining the behavior of the members of the group under the control of specific rules, as suggested by some of the comments recorded during the fourth session: P3 – “Hey, did you start with a yellow token?”, P2 – “It wasn't yellow”.

Group 2

Group 2 was exposed to only one phase, under condition B. As shown in Figure 3, only three sessions were necessary for the group to reach the criterion of stability.

During session 1, group 2 performed only six interlocks, and did show the selection of the programmed IBCs. The group's performance was equally inconsistent in session 2, during which only 13 interlocks were performed over the 30 cycles of the session. However, it is important to

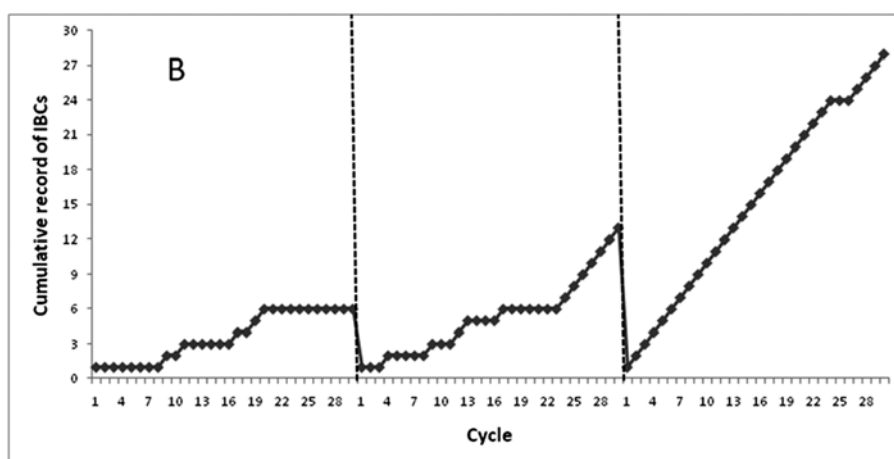


Figure 3 – Cumulative Record of interlocking behavioral contingencies per session in experimental group 2.

note that the programmed interlocking of the behavioral contingencies was performed from the 24th cycle until the end of the second session. In the final session, the IBCs were selected continuously, with 28 interlocks being performed during the session's 30 cycles. These results allow us to conclude that the programmed cultural consequence was effective in selecting the IBCs (a specific pattern of coordination of the behaviors of the members of the group).

These results were clarified by the researchers' records of the sessions and some of the participants' comments. During the 24th cycle of session 2, P2 made the following observation: "Colleagues, what do you think of the idea of repeating the sequence that we got right?" In this cycle of the session the cultural consequence was produced by the group. At the beginning of the 25th cycle, the following verbal interaction was recorded: P1 – "Choose a sequence that we got right!" P2 – "There was one that you started – it was orange-3, brown-2, and yellow-6", P1 – "Okay then, let's do it again". In this cycle the participants also produced the cultural consequence. In response, P2 commented "Look, when P1 started one of the cycles, the sequence was orange-3, brown-2, and yellow-6, and it was right. One of the sequences started by P3 was brown-1, yellow-6, and orange-5, and that was right too. I'm going to start now, and I'll try and choose a correct sequence that I started". In this 26th cycle the group also produced the cultural consequence, resulting in the following dialogue: P1 – "Now we know that the sequences are correct", P2 – "So, let's just keep repeating the same sequences when each one of us starts". From this moment onwards until the end of the experiment, the participants repeated the sequence defined by P2 repeatedly, producing cultural consequences at the end of each cycle.

Once again, the descriptions of the experimental contingencies provided by the participants did not correspond exactly to the prevailing contingencies, although they were effective in leading the group to produce cultural consequences. The results also suggest that the verbal interactions among the participants may have been important for the establishment of contact with the contingencies, and probably also functioned as stimuli for the development of an effective interlocking pattern.

The results for group 2 demonstrated the selection of the IBCs by the cultural consequence, indicating that

metacontingencies were in effect. Similar results have been obtained using different experimental procedures (e.g. Caldas, 2009; Leite, 2009; Pereira, 2008; Vichi, 2004), all of which support the proposal of Glenn (1988, 2004).

One of the objectives of this study was the collection of empirical evidence of an interlock maintained by support consequences contingent on that interlock, independently of the cultural consequence and, the results did in fact demonstrate that the support consequences were sufficient to establish and maintain an interlock. Furthermore, they demonstrated that the interlock can be maintained by cultural consequences following the withdrawal of the support consequences. The results also indicate the possible coexistence of support contingencies and metacontingencies in the maintenance of an interlock. These data also suggest that the study of cultural practices encompasses, but may not be restricted to the study of metacontingencies and macrocontingencies.

In general, it was possible to confirm that interlocks can be established and maintained under the control of both support consequences contingent on each interlock (a selection in the individual/behavioral level, but possibly a transition to the cultural level) and cultural consequences contingent on IBCs (a selection in the third, cultural, level). However, given the similarity of the performance of the two groups in terms of the speed and efficiency with which the programmed interlocks were established, it is not possible to discern whether the prior exposure to support consequences favors the control of the interlock by cultural consequences. This is probably related to the reduced complexity of the programmed interlock, as suggested by the performance and comments of the two groups. In order to test this hypothesis, a second experiment was conducted. This experiment was similar to the first, but with a much more complex programmed interlock.

Experiment 2.

Experiment 2 consisted of two experimental conditions: condition A' (support contingencies) and condition B' (metacontingencies).

Conditions A' and B'. These conditions were identical to those of the same denomination used in Experiment 1, the only differences being the use of tokens of a larger number of colors and a more complex criterion for the

production of either support or cultural consequences. In both conditions, tokens of the colors orange, brown, yellow, lilac, and pink were available in the collective pot at the center of the table.

The delivery of a support consequence to each participant (in condition A), or cultural consequences (in condition B), to the group was dependent on:

- The first player in each cycle should choose a token of the same color as that chosen by the second player in the previous cycle.
- The second and third players in each cycle should choose tokens of colors that were different from those chosen by the three participants in the previous cycle.

Experimental Design.

Group 3 was exposed to four phases: B'/A'/A'+B'/B' (analogous to Experiment 2, differing only in complexity). Group 4 went through only one phase, under condition B. The instructions provided to the members of the two groups were the same as those given to groups 1 and 2.

The phase conclusion criterion was also the same as that for Experiment 1.

Results and Discussion

In Experiment 2, selection of interlocks or IBCs was not observed in either group.

Group 3

On phase 1, which consisted of a single session under metacontingencies, only one interlock was performed (see Figure 4). Subsequently, the group was exposed to phase 2, but did not reach the criterion of stability after eight sessions. The largest number of interlocks performed in a given session was only three, in sessions 2, 3, and 7. In all other sessions, no more than two interlocks were performed, well below the criterion for stability, and demonstrating a clear lack of selection of the interlocks.

The analysis of the data found no evidence of any type of recurring pattern in the choice of either token colors or matrix rows by the members of group 3. In general, the choice of colors and rows appeared to be based on a previous successful play of one of the participants.

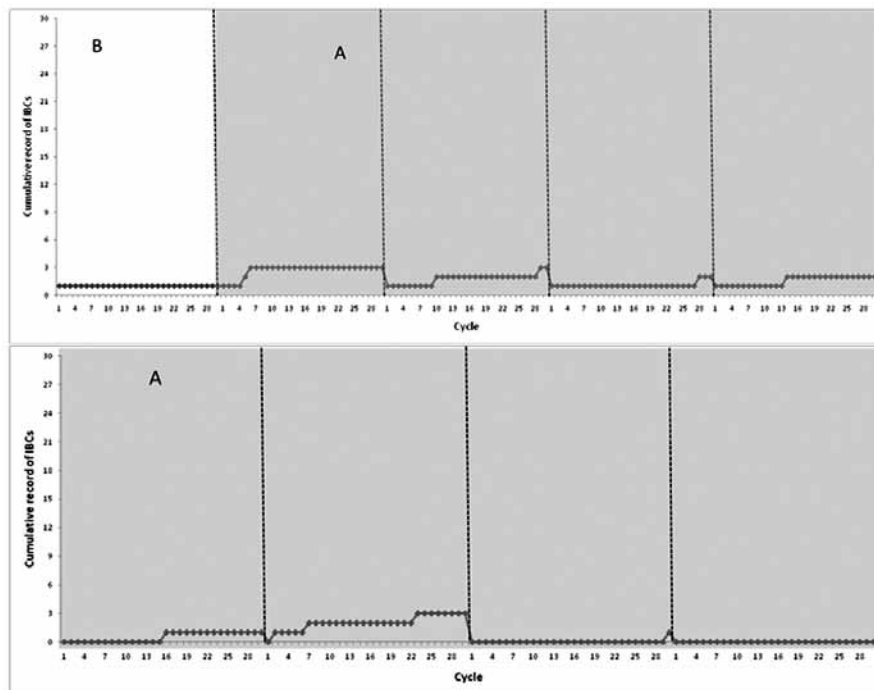


Figure 4 - Cumulative Record of interlocking behavioral contingencies per session in experimental group 3.

In comparison with the results obtained for groups 1, results from group 3 indicate that the metacontingencies and support contingencies were much more complex, hampering the selection of interlocks or IBCs. While group 1 was able to achieve stability in each phase (except phase 1), group 3 was unable to show the same performance in phase 2, and thus did not carry on to the subsequent phases. In addition to being unable to perform more than three interlocks in a session, the group members were also unable to provide a verbal description of the experimental contingencies.

The support consequences were not effective in selecting and maintaining the interlocks in this group. It is possible that the support consequences contingent on the interlock, which were available during the support contingencies phase, provoked either competitive or at least non-collaborative behavior among the participants. This is supported by some participants' verbal responses in some of the sessions. In one case, while confirming the number of tokens won by each player, P1 declared "I'm winning! Oh, no, everybody's tied". During another session, P2 took P1's notes to look at them, to which P1 responded by saying "Make your own notes".

In contrast with groups 1 and 2, group 3 engaged in relatively few verbal interactions related to the game. This, associated with the greater complexity of the contingencies, probably hampered the verbal description of the experimental contingencies by the members of the group.

Group 4

The performance of group 4 was even less effective than that of group 3 (see Figure 5). With the exception of session 4, when two interlocks were performed, the group was unable to establish more than one interlock in any of the experimental sessions. These results indicate the lack of selection of IBCs by the cultural consequences.

The similarity of the results obtained for groups 3 and 4 further emphasizes the complex nature of the interlocks or IBCs programmed for Experiment 2, especially considering the performance of the groups in the first experiment. It is interesting to note that, in Experiment 2, no more than three interlocks were performed in any one session, although the group exposed to support contingencies presented the more variable results, which may be related

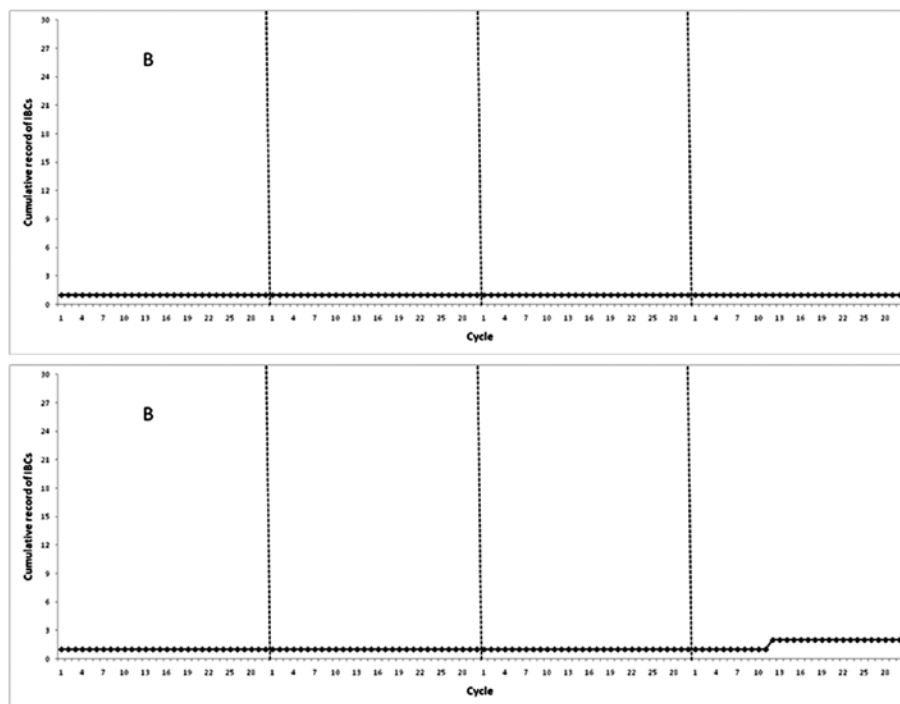


Figure 5 - Cumulative Record of interlocking behavioral contingencies per session in experimental group 4.

to the greater contact with “reinforcing” consequences, given the availability of support consequences contingent on the interlock in this condition.

The experimental design for group 4 was based on the presentation of cultural consequences alone. As this group was able to perform only one interlock in almost all sessions, there was practically no contact whatsoever with the cultural consequences, which almost certainly impeded the selection of interlocks. On the other hand, the greater contact of the members of group 3 with support consequences did not have any very marked effect in comparison with the performance of group 4. While the complexity of the programmed IBCs may account for the performance of groups 3 and 4, then, some other variable may have affected the results for group 3, as discussed above.

In contrast with group 3, the members of group 4 presented a much larger number of verbal interactions related to the game, and were also apparently more attentive to the responses of one another. This is demonstrated by comments such as the following: P3 – “Let’s discuss this...”, P1 – “Who played first in that cycle?”, P2 – “Come on, let’s try and repeat the play we got right... each of us should repeat the colors we chose that time”.

These comments indicate that the members of group 4 interacted verbally over their participation in the game, apparently establishing rules to control the behavior of all the players. In general, in fact, the group’s performance was decided on collectively, in contrast with the procedure in group 3, in which each player decided his/her play individually, and with little verbal interaction related to the game.

Overall, then the results of Experiment 2 show that it was impossible to select the interlocks or IBCs under the control of either support contingencies or metacontingencies. Given the contrasts with Experiment 1, it seems likely that the complexity of the IBCs is the primary factor determining the observed differences in the establishment and maintenance of interlocks. In other words, the data indicate that both support consequences and cultural consequences were ineffective for the selection of highly complex IBCs.

General Discussion

Overall, the results of the present study provide empirical evidence that support consequences may produce and maintain interlocks, as proposed by Andery et al. (2005), even though they evolve as individual behaviors, not as IBCs. As in previous studies (e.g. Caldas, 2009; Leite, 2009; Pereira, 2008; Vichi, 2004), the data collected here also provide empirical evidence of the effectiveness of cultural consequences to select and maintain IBCs, as proposed by Glenn (1988, 2004).

The results of Experiment 1 indicate that interlocks selected and maintained by support contingencies may be maintained subsequently (as a unity - IBCs) by a cultural consequence, and that an interlock may be maintained simultaneously by both support consequences and cultural consequences. However, the results analysis obtained for the groups involved in this experiment demonstrated that prior exposure to support consequences did not alter noticeably the control of the IBCs by the cultural consequences. This is probably related to the low degree of complexity of the interlock programmed for Experiment 1. In this case, support consequences would appear to have the same effect as cultural consequences in the production and/or maintenance of an interlock, when the complexity of the interlocks or IBCs is low.

Experiment 2 was designed in order to verify whether under increased complexity there would be a difference in the control of interlocks or IBCs by support consequences and cultural consequences. The lack of selection of interlocks in both the groups studied in this experiment may be accounted for, primarily, by the high complexity of the programmed interlocks/IBCs, although other variables may also be relevant, such as the lack of verbal interaction among the members of group 3, and the reduced contact of the members of group 4 with the consequences. Considering these results, a more conclusive analysis of the role of support consequences and cultural consequences in the control of interlocks would require further studies that replicate the experimental design reported here, but concentrate on refining the variation in the complexity of the programmed interlocks. The results of this study indicate that the experimental design is effective for the evaluation of the effects of support consequences on interlocks and IBCs, by providing a relatively precise

description of the interlocking behavioral contingencies, including the topography of the interlock.

The task performed by the participants in this study was very similar to that reported by Vichi, Andery and Glenn (2009), with the difference that the topography of the interlocks or IBCs could be specified in detail in the procedure adopted here (the coordination of token color and row choices). As in Vichi et. al., a problem remained, concerning the lack of identification of the individual/operant consequence. This showed to be especially problematic in this study, because support consequences were individual consequences, which perhaps had the function of the operant consequences. It should be noted, however, that the rate of (interlocking) individual behaviors selected under support consequences did not decrease as these consequences were removed and cultural consequences remained active. It is not, clear, then, that the support consequences played the role of operant consequences. This might be cleared up when it is possible to separate support consequences and (other) operant consequences (for example, when an operant consequence contingent on the choice of odd rows independently of any interlock is displayed).

The results of this study also provided evidence of the role of verbal behavior in the selection of cultural practices, as proposed by Glenn (1986). In groups 1 and 2, in particular, the experimental contingencies were described effectively through the dialogue of the group members. In some situations, the verbal behavior of the participants functioned clearly as a differential consequence, maintaining the responses of the group members under the control of the established rules. However, as the specific aims of this study did not include the analysis of the role of verbal behavior in the selection and evolution of cultural practices, further studies that focus specifically on the role of verbal behavior in the maintenance of interlocks by different types of consequences would provide more conclusive insights into this question.

The need to define the unit of analysis for the study of social phenomena, as discussed by Andery et al. (2005) appears to be even more urgent following this empirical demonstration of an additional type of arrangement for cultural practices – the support contingency. The concept of metacontingencies was proposed by Glenn (1988, 1991,

2004) as a potential unit of analysis for the description of cultural phenomena. Social and cultural phenomena not always coincide. “Support contingencies” is not a unit of analysis of cultural phenomena in the sense that there is no cultural – supraorganismic - unit recurring in this case. But, as suggested by Andery et al., (2005) it may be a relevant concept towards the understanding of the processes that lead to cultural units.

Consequently, what is clear is that further debate is required for the more systematic definition of the unit or units of analysis that should be adopted by behavior analysts in trying to understand social and cultural phenomena. This is especially important given the identification of social phenomena which involves interlocks, but not a cultural consequence.

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