

An Experimental Study about the Cultural Transmission Process

DJALMA FRANCISCO COSTA LISBOA DE FREITAS
Institute of Psychology-University of São Paulo-USP, Brazil.

DANILO SILVA GUIMARÃES
Institute of Psychology-University of São Paulo-USP, Brazil.

Cultural transmission is a construct used to understand the process in which cultural aspects are apprehended by people that interact with different cultures or between different generations within a culture. This process implies cultural-individual transformations instead of mere copy or replication of culture. Along these lines, an experimental study on cultural transmission will be described and discussed: participants were asked to draw a 'boat' in three different moments. At phases A and C, they were allowed to use the materials available on the table; at phase B, the activities were carried out in pairs, having one participant of the couple replaced every round. The researcher interviewed participants at the end of each phase, aiming to identify individual perceptions/interpretations on variations and similarities of the drawings throughout 10 generations of participants. The analysis of the data focused on how the reproduction of cultural aspects and the emergence of novelties unfold in the process of cultural transmission. The way the experiment is structured and the asymmetric position of the researcher in relation to the participants assumed an important role in their productions and the meanings attributed to their actions. It was observed that the contact with tradition by artifacts; co-participation and the observation of someone acting are important mechanisms for cultural transmission.

Hagia Sophia is an imposing building located in Istanbul, Turkey (formerly Constantinople), which was constructed between 532 and 537 by the Byzantine Empire. In the periods from 537 to 1204 and from 1261 to 1453 it was an Orthodox Church temple; between the years of 1204 and 1261, it served as a Roman Catholic Church temple. In the year 1453 the building became an Islamic mosque that was closed in 1931. However, in 1935 the building saw its reopening as a secular museum, and, as such, can be visited nowadays. Much of its architectural structure and many functions it had were maintained, but much was transformed through the centuries and generations in a cultural process. Hagia Sophia is, therefore, a good example of the cultural dynamic in which ruptures and continuities unfold continuously through time.

Through cultural transmission people actively maintain and transform the environment. The religious changes that left their marks in Hagia Sophia architecture along the centuries express human's ability to construct and reconstruct the environment, allowing future generations to be in contact with history. Cultural transmission is, then, a notion used to identify and study the process in which cultural aspects from a previous generation are apprehended by new generations, with consequent modifications during the process.

Whereas Hagia Sophia brings to light a broad cultural process which crossed over 14 centuries, the present paper focuses on an experimental project that aimed to apprehend how transformations and maintenance of cultural aspects can be investigated in a short time in controlled experimental setting. The experiment conducted was based on Caldwell and Millen's (2008) design on cumulative cultural evolution. These researchers created a condition in which participants had to solve a task after observing the actions of previous generations of participants. The participants were successively replaced, one by one, to make it possible for the new observers to apprehend a solution to the task from a participant that had observed it previously. Newer generations of participants had at their disposal the products of the activities in which the previous generations took part.

Caldwell and Millen used two different tasks in their study: 1) to make a paper airplane, aiming to build one that would fly as far as possible, and; 2) to make a tower out of spaghetti and modeling clay, aiming to build the highest tower. According to Caldwell and Millen, "Each generation builds on the knowledge, inventions and achievements of the previous one. Our present-day technologies exist only as a result of our ability to understand and make use of the imparted knowledge and artifacts of others" (2008, p. 3530).

Caldwell and Millen were strongly interested in the regularities that occurred in their experiment from one generation to another in a process labeled cumulative cultural evolution. For them, cultural evolution is articulated with the practices of accumulations of functionally identical cultural elements. Considering the importance and relevance of their work, we adapted some procedures in order to account for the emergence of novelties and not only regularities in the cultural productions of the participants, specially looking into the process of cultural making and the meanings given by each participants to their own productions. Methodological changes were made to take into account the bidirectional understanding of the cultural transmission processes, which guided to our experimental project. The notion of bidirectional transfer (Valsiner, 2007) stresses that novel stable structures emerge in cultural dynamics, producing, among other things, cultural variability out of social relationships.

Valsiner (2007) points out that each cultural generation subsidizes, assists, and supports new cultural generation's development. Indeed, people can constrain the novelties emerged in social relations, and guide the reproduction of previous social patterns through different semiotic devices, for instance, verbal orientation, co-regulation through cooperation and/or observing and imitating a model. Moreover, imitation can be oriented to the result of the action and/or to the action itself (Guimarães and Cravo, in press).

Recently, Wagoner (2013) recovered Bartlett's insights on cultural reconstruction focusing on five key-points: the personal selectivity to the experienced world, the influence of past experiences in the present, the interdependence between changes and stabilities, atomic and holistic transformations of the culture and the possible stability of cultural aspects in different situations. These key-points converge with the notion of culture as an irreducible structure-and-process that takes place in personal-social relations, whereas personal and social elaborations can restrain and/or allow the field of personal symbolic actions:

[...] an action will always be performed by an 'encultured' individual who profits from cultural opportunities or facilities and is limited by their constraints; at the same time, the actor will

select and adapt cultural contents and thereby create the idiosyncratic meaning of the action [...] (Boesch, 2001, pp. 480-481).

The notion of culture as embracing dynamic processes and relatively stable structures guided our research concerning some of the mechanisms involved in the promotion of cultural stabilities, constraining and channeling interpersonal actions (Valsiner, 1998). Thus, reproduction, transmission, and propagation of cultural traditions among the members of a certain culture acquire an extremely important role in cultural continuity, demanding new adaptations in the face of every new-and-old life circumstance.

METHOD

Participants:

10 psychology undergraduate students of the University of São Paulo – USP aged from 17 to 37 years old took part in the study. The participants that would undergo the experiment were students from a discipline in which the researcher was working as a teacher's auxiliary. The group included 2 male and 8 female. All of them freely consented to participate as volunteers in the experiment.

Materials:

Materials used in this study included: *1 table, 6 chairs, 1 pack of 6 colored pens, 3 graphite pencils, 1 box with 6 colored pencils, 3 ballpoint pens, 1 highlighter, 1 eraser, sulfite sheets, 2 Camcorders, Tapes, Identification labels and Consent Terms sheet.* The materials in italics were available on the table during all activities.

Procedure:

Participants were asked to draw a 'boat' in three different situations:

Phases A and C: All participants had to draw a boat, individually, using the materials that were available on the table. In both phases instructions were delivered on a short paper sheet, as follows:

“Observing the marked spot on your paper sheets, you’re supposed to draw a boat using the material available on the table. Whenever you’re done, please inform the experimenter and wait. Thank you.”

Phase B: Participants underwent a dynamic experimental treatment in which they first had to observe two previous generations developing the activity; then, they had to develop the activity with a participant from the previous generation; and lastly they had to do it, with a new participant. At all times, they had at their disposal all the drawings produced by the previous generations. When participants were in the position of the observer and during the intervals between activities, they were not allowed to communicate with each other. A

research assistant remained outside the experimental room watching the participants in order to keep them silence. Therefore, after starting the activity, participants could only talk to the participant cooperating with them. They were not allowed to communicate with the observers or with the researcher.

Before starting the activities, participants were identified with numbers 1 to 10. The sequence of participants during Phase B was predetermined as shown in Table 1:

Experimental Generation	Disposition of participants throughout Phase B										
0	P1	P2	P3						...	Producer	
1	P1	P2	P3	P4						...	Observer
2		P2	P3	P4	P5						
3			P3	P4	P5	P6					
4				P4	P5	P6	P7				
5					P5	P6	P7	P8			
6						P6	P7	P8	P9		
7							P7	P8	P9	P10	
8								P8	P9	P10	
9									P9	P10	
10										P10	

Table 1. Disposition of participants along Phase B

Experimental generations were analyzed from P1/P2 to P10 excluding, therefore, the activity made by P1 alone. Thus, each participant, except P1 and P2, observed two previous generations developing the activity. Likewise, each participant developed the activity twice, in pairs, first with a member from a previous generation (except P1) and after with a new member (except P10).

A paper containing instructions was delivered only to P1, as follows:

"Please read it silently. You must draw a boat occupying almost the entire space marked on the sheet on table. You must use the materials that are also on the table.
The boat must contain: 5 windows, 3 open sails, 1 cabin and 1 rudder.
You must follow the following sequence to draw the boat: 1st the part that sits on the water, 2nd windows; 3rd sails, 4th rudder and 5th cabins.
You must draw the part that sits on the water with colored pencils, the windows with colored pens, sails with blue ballpoint pen, cabin with pencil graphite and rudder with highlighter.
 You will develop the activity two times in a row and then, you will be replaced by the participant that has been beside you. At the end, you must return to the waiting room. Please don't share with the outside participants any information on the activities that were carried out. After the signal given by the experimenter, you'll have 3 minutes to complete the task. When time is up, the activity will be interrupted, and a new one will start. These instructions are exclusively for you, so, only you will be able to access

them. If you have any questions, they should be asked now, observing that the researcher may refuse to answer them.

Finally, if perhaps you have already participated in any similar activity, notify the experimenter. If there are no doubts, you may begin. "

These instructions aimed to specify the compositional elements the boat should have, the sequence that should be followed, as well as the materials that should be used in each boat part during its production. Only P1 had access to these instructions, but P2 and P3 observed that the paper sheet was delivered to P1. P2, P3 and P4 could see P1 observing the instructions. At the end of P1 participation the paper sheet with the instructions returned to the researcher. When the participants played the role of observer, the following statement was delivered in a short paper sheet:

"Please, carefully observe the activity being developed, because within a few moments you will be asked to carry out a similar task. Thank you. "

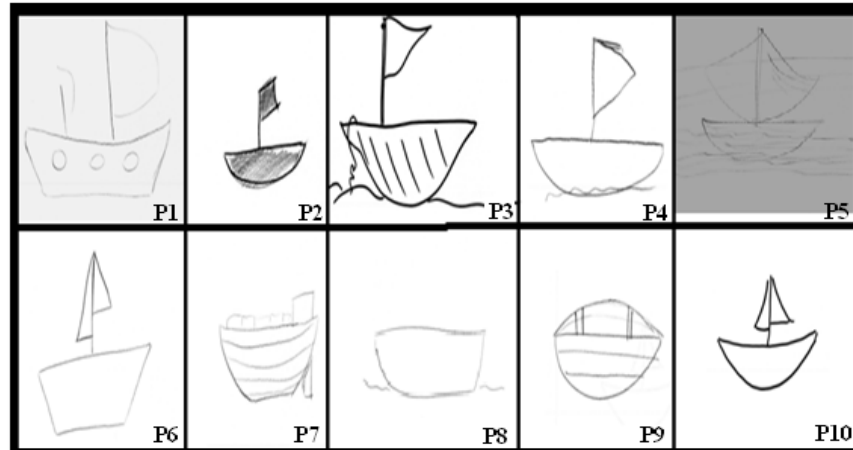
Interviews: After completing their tasks, at the end of each phase, participants were asked to wait outside the experiment's room. After all participants had undergone the experimental treatment they were invited, one by one, to come back, then, semi-structured interviews (on average composed of 5 questions) were carried out individually. Participants were questioned about their interpretation of their way of drawing and of what they noticed as constraining the tasks. After all interviews of phase C, participants were dismissed.

RESULTS

Focusing on the experimental activities, in which the emergence of novelties and the reproduction of the previous took place, the experimental setting offered an opportunity for apprehending forms and mechanisms concerning cultural innovations and continuities out of personal symbolic actions. The presentation of the results was divided according to each experimental Phase.

Phase A

Picture 1 shows the 10 boats produced throughout Phase A. Drawings are identified by the number of the author-participant:



Picture 1. Boats produced individually in Phase A

First, it is possible to observe that the numbers of sails of all boats varied in the participants' productions. Only three (P7, P8 and P9) do not have sails or any similar components. Four boats drawn have two or three sails, while only one sail can be seen in the rest of them. Of the three boats that have no sail, one of them has a drawing of an object that looks like an engine attached to its hull, while the others only show their hulls. The presence of windows was evident only in the boat produced by P1. The presence of water line in the production could be identified in P3, P4, P5 and P8 boats.

Concerning the questions on the possible influences of the way each participant decided to draw the boat, 6 from 10 participants referred to the boats' shapes as coming from their previous histories of drawing this sort of picture (P2, P3, P4, P6, P9 and P10). P5 reported that he imagined a boat within a context, then, decided to draw it including in the drawing traces representing water and wind. P7, mentioned his own feelings as the main guidance to the production. The data relating to the interview P1 in Phase A were lost. Finally, P8 mentioned that the main influence in the drawing of the boat was the instruction given by the researcher.

Phase B

The results from Phase B will be presented in five topics: a) Boats' composition; b) Participants' conversations; c) Sequence of production; d) Materials used in production and; e) Meaning construction.

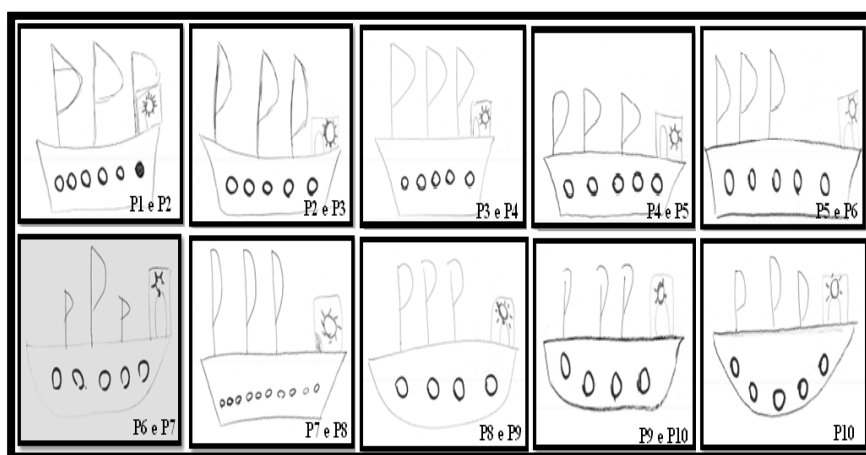
a) Boats' Compositions: All pairs of participants had at their disposal the boat just produced by previous generations in Phase B. In general, participants only looked at the drawings made by immediate previous generations, that is, the last generation. Only P2, P3, P5 and P6 clearly consulted the previously produced boats.

Participants	Boat Components
P1/P2	5 windows, 3 sails, 1 cabin with a door, 1 rudder and the hull with an inverted trapezium form
P2/P3	5 windows, 3 sails, 1 cabin with a door, 1 rudder and the hull with an inverted trapezium form
P3/P4	5 windows, 3 sails, 1 cabin with a door, 1 rudder and the hull with an inverted trapezium form
P4/P5	5 windows, 3 sails, 1 cabin with a door, 1 rudder and the hull with an inverted trapezium form
P5/P6	5 windows, 3 sails, 1 cabin with a door, 1 rudder and the hull with an inverted trapezium form
P6/P7	5 windows, 3 sails, 1 cabin with a door, 1 rudder and the hull with an inverted trapezium form
P7/P8	10 windows, 3 sails, 1 cabin with a painted door and 1 rudder.
P8/P9	4 windows, 3 sails, 1 cabin with a door that was not painted, 1 rudder and the inverted trapezium-shaped hull, however, with a more rounded shape.
P9/P10	4 windows, 3 sails, 1 cabin with a door that was not painted, 1 rudder and the inverted trapezium-shaped hull.
P10	5 windows, 3 sails, 1 cabin with an unpainted door, 1 rudder and 1 'half-moon' shaped' hull

Table 2. Components and number of components of boats produced in Phase B

Although only P1 had access to the researcher's instruction, the drawings of P1/P2, P2/P3, P3/P4, P4/P5, P5/P6 and P6/P7 generations remained very much oriented by it. Data shown in Table 2 presented that participants used same components, however, the form and the components' quantity shows few but interesting variations.

All the boat shapes produced at this Experimental Phase (except the one done individually by P1) are presented in Picture 2. The *gestalt* of the boats in Picture 2 is considerably different from *gestalt* of the boats drawn in phase A. Differently from Picture 01, at this phase, similarities in the shapes were more evident and we noticed that few variations are evident along 10 generations.



Picture 2. Boats produced throughout 10 experimental generations.

Other important variation in the pictures could be observed, for example, in P5/P6 boat, with the sails placed clearly on the left side of the boat. In P6/P7 case, the sail in the middle seems larger than the others. P10's sail seems discreetly larger than the others, and the windows alignment with the rounded hull is notable.

b) Participants' conversation: A conversation was observed only in P1/P2 generation, in two different moments of their task solving. The whole session lasted 1 minute and 50 seconds, the conversation started 45 seconds after the session had begun:

0'45": P2: Is this one meant to be blue?

1'00": P1: This one is... no... this one. Lend it to me (P1 corrected what had been done by P2). That's how it's done.

1'30": P2: What is this?

1'33": P1: It is the rudder, the part which gives direction.

1'40": P2: Oh! And that part?

1'43": P1: It is ...from the cabin."

c) Sequence of Production: The instructions given to P1 included a sequence to be used in the boat production. P1 drew the hull first, then, the windows, next, the sails (using material that was not requested in the instructions for this part), after that, the sails (then, he adjusted the pencil used previously), after that he drew the rudder and, finally, the cabin, thus, inverting the last instructed sequence.

Table 3 shows the sequences used by all generations of participants along the experiment. The top line indicates the generation of participants. The first column indicates the order of the activity. The subsequent columns correspond to the sequences of components drawn. Between parentheses is the indication of which participant from the pair drew/produced each element.

Order of activity	P1	P1/ P2	P2/ P3	P3/ P4	P4/ P5	P5/ P6
1	Hull	Hull (P1)	Hull (P2)	Hull (P3)	Hull (P4)	Hull (P5)
2	Windows	Windows (P2)	Windows (P3)	Windows (P4)	Windows (P5)	Cabin (P6)
3	Sails	Scratching a window (P1)	Sails (P2)	Sails (P3)	Sails (P4)	Sails (P5)
4	Sails	Sails (P2)	Cabin (P3)	Cabin (P4)	Cabin (P5)	Rudder (P6)
5	Cabin	Cabin (P1)	Rudder (P3)	Rudder (P4)	Rudder (P5)	Windows (P6)
6	Rudder	Rudder (P1)	-	-	-	-

Order of activity	P6/ P7	P7/ P8	P8/ P9	P9/ P10	P10
1	Hull (P6)	Hull (P7)	Hull (P8)	Hull (P9)	Hull
2	Sails (P6)	Sails (P7)	Sails (P8)	Sails (P9)	Sails
3	Windows (P7)	Cabin (P8)	Windows (P9)	Windows (P10)	Windows
4	Cabin (P7)	Rudder (P8)	Cabin (P9)	Cabin (P10)	Cabin
5	Rudder (P7)	Windows (P8)	Rudder (P9)	Rudder (P10)	Rudder
6					

Table 3. Sequence of production, from P1 to P10

From table 3 it is possible to observe that the same sequence employed by P1 continued to be used until P4/P5 generation, without any change. P5/P6 presented a variation in the second activity, P6/P7 presented a new variation, observed in its second activity, which continued along the sequence of generations. P7/P8 maintained the two first orders of activity as P6/P7, but varied the 3rd activity. In P8/P9 generation a different sequence is shown from the 3rd activity in comparison to P7/P8. The sequence of activities followed by P8/P9 was the same employed by P9/P10 and P10 alone. The latest sequences are very similar to that employed by P1/P2, that is, the first generation, with only one change: an inversion in the order of drawing sails and windows.

All generations organized the activities of each participant in a similar way: First, the old member of the pair started drawing, and then the new member of the pair continued drawing, making other parts of the boats, and so on. The same sequence of drawings (first: old member; second: new member) continued throughout others generations.

In sum, the sequences of activities during boat productions in the first experimental generation remained similar, with few variations along the other experimental generations. The functions applied to each member of the pair (the old one and the new one) were the same from the P2/P3 generation to the P9/P10 generation.

d) Materials used in the production: The instruction given to P1 guided the use of specific materials (colored pen and pencils) for each boat component.

P1 used: Brown Pencil for the hull; blue Ball Pen for the sails, Red colored pen for the windows; graphite pencils for the cabin and pink highlighter for the rudder. The same materials used by P1 were used by all successive generations, in the same locations.

e) Meaning Construction: Participants' reports were categorized according to three main topics that emerged in the conversation: 1) Imitating a model, 2) Discriminating functions and 3) Naming boat components.

Imitating a model: All participants reported that they had to imitate the previous participant activity, that is, from P1 to P10, participants referred to the activity as 'imitating' or

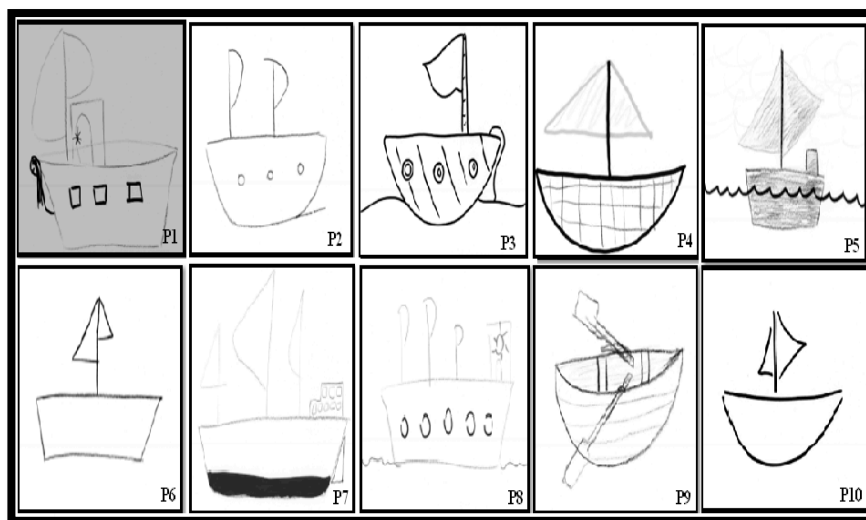
'replicating' or 'copying' what the others had previously done. In relation to the model at their disposal, some participants said that "[...] it seems logic to do something alike" and others expressed that reproducing the previous drawing was something "[...] that had to be done", although this idea was not explicitly presented in the instructions.

Discriminating functions: Some functions emerged during the execution of the activities and some meanings were mentioned in the interviews. P9 says: "First you would observe the others making it, there were four people around a table and in each round one of them would leave the room, so you observed during two rounds, in the third one you would draw as an assistant and at the fourth round you would, I don't know, provide the basis of the drawing, as the most experienced person".

Naming boat components: During the task P1 and P2 exchanged information. P1 emphasized the position of the rudder and cabin, naming those parts of the drawing as stipulated in the instructions. However, when he mentioned the rudder during the interview, P2 said that he did not know the name of that specific component of the boat. P3 referred to that component as something that "gives directions to the boat". P4 said that it was a "window". P5 said that it was either a "window" or a "little sun". The notion of "sun or a little sun" appeared in P6, P7 and P9's reports. P8 and P10 did not give a label to that component. All participants referred to other boat components using similar names.

Phase C

Picture 3 shows ten boats developed during Phase C, identifying in the each picture the number of the participant who drew it.



Picture 3. Boats produced during Phase C.

As it was the case in Phase A, the individual productions of Phase C presented a considerable variation perceived in the comparison of the *gestalt* shapes of each boat drawn. Table 4 discriminates components of each boat produced in Phase C.

Participants	Boat Components
P1	2 Sails, 1 Cabin, 3 Windows, Hull and 1 Frown
P2	2 Sails, 3 Windows and Hull
P3	1 Sails, 3 Windows, Hull, Water Line and Anchor
P4	2 Sails and Hull
P5	2 Sails, Cabin, Hull and Water Line
P6	2 Sails and Hull
P7	3 Sails, Cabin, 8 Windows, Hull and 1 Keel
P8	3 Sails, 5 Windows, Cabin, Rudder, Hull and Water Line
P9	2 Paddles and Hull
P10	2 Sails and Hull

Table 4. Components present in boats produced in Phase C

Boat's components produced by the participants during Phase C showed considerable variation, although some components appeared in more than one boat. The presence of sails was observed in nine out of ten boats produced (except P9 with no sails in the boat). The presence of cabins was observed in 4 out of 10 (P1, P5, P7 and P8). The presence of windows could be verified in 5 out of 10 boats (P1, P2, P3, P7 and P8) and, the presence of water line could be observed in three out of 10 drawings (P3, P5 and P8). Other components (keel, rowing and scowl) appeared in only one production.

Participants	Boat Components
P1	Cabin
P2	Windows
P3	Windows
P4	None
P5	Cabin
P6	None
P7	Sails, Cabin and Windows
P8	Sails, Windows, Cabin and Rudder
P9	None
P10	None

Table 5. Components present in Phases B and C but not in Phase A

Table 5 suggests the presence of lines of continuation from the part which was drawn in phase B to individual productions in phase C, that is, we can observe in Table 4 components present in Phases B and C, but not in Phase A. At the last phase, only P4, P6, P9 and P10 did not produce any component that arose in Phase B. P1, P2, P3, P5, P6 and P7 have reproduced at least one similar component observed in Phase B, but not in phase A.

Participants' reports, in the interview after Phase C were categorized into four topics: 1) Mentioning both boats (from phases A and B); 2) Mentioning only Phase A boat; 3) Mentioning only Phase B boat and, 4) Mentioning things external to the experiment. Based on this categorization we constructed Figure 1:

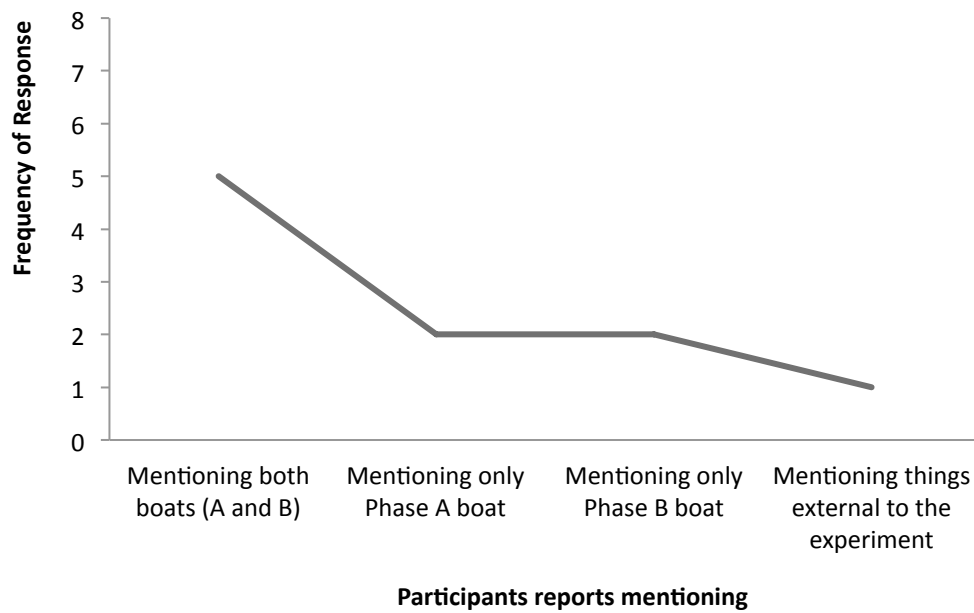


Figure 1. Frequency of topics mentioned by the participants during phase C interviews.

Five responses mentioned the influence of the boats produced in phases A and B on the production in Phase C (participants involved: P1, P2, P3, P4 and P7). Two participants declared themselves influenced by Phase A (P6 and P9) when producing pictures in Phase C, the same value was found considering the influence by the experimental treatment undergone in Phase B (P5 and P8). Finally, one participant (P10) mentioned things external to the experiment element as the main influence on his production (something about his previous history).

DISCUSSION

Some mechanisms of cultural transmission—i.e., *contact with tradition by artifacts; contact with tradition by co-participation and; contact with tradition by the observation of someone acting*—identified along 10 experimental generations affected the emergence of novelties and the reproduction of previous elements in the cultural transmission process. Participants' reports have evidenced that, in general, the observation of the other's actions was crucial for reproducing a model. The importance of observation and contact with artifacts produced (as mechanisms of cultural transmission) in the experimental treatment is evinced in the more significant similarities in the productions of Phase B (considering that few verbal interactions have occurred during co-participation and considering which participants looked at the drawings made by previous generations, especially, the drawings from the last or immediate previous generations). Thus, this data allowed us to infer that these mechanisms—observation of the action and contact with artifacts—mainly channeled the construction of similar actions and artifacts throughout the experiment.

On one hand, similarity of the boats produced at Phase A, probably, was due to the fact that drawing a boat is part of participants' culture and their life histories of belong to the same broad cultural field. That is, they have an experience of drawing boats and know typical drawings of boats. On the other hand, visible differences in the drawings could be observed in the three experimental phases. At Phase B of the experiment, however all participants altered their ways of drawing the boat. They produced a strong regularity in their drawings *gestalts* (i.e. Picture 2), including the sequence of production, used materials, functions attributed to parts of the boat and function of each participants when solving the task. At Phase C, again, was notable the variations among participants' productions. Nevertheless, 60% of them reproduced at least one boat component from Phase B, showing, thereby, expressive continuities in the productions at the individual level (i.e. Picture 3 and Table 4).

Thus, contact with tradition by artifacts, contact with tradition by co-participation and contact with tradition by the observation of someone acting, as mechanisms of cultural transmission, entailed the emergence of evident regularities and variations in the productions of all participants during the three experimental phases. The following discussion will bring participants' opinions concerning their drawings and the experimental situation in each experimental phase.

Phase A

Participants of the experiment associated their way of drawing a boat to their idiosyncratic stories, as noted in the following reports:

P2: "[...] it was the very first thing I learned how to draw."

P3: "I just remembered how I used to draw it when I was a child [...]"

P4: "I just thought about the way I used to draw it [...]"

P5: "I imagined it contextualized, and then I imagined a sailboat and put it in the water [...]"

P6: "...in the boats I have drawn throughout my life."

P7: "In what I feel."

P8: "In the instructions."

P9: "In the previous knowledge."

P10: "Based on a formed idea of boat."

Participants' reports stressed the strong effect of past models in contemporary productions showing individual selectivity of previous events. It is quite evident for cultural transmission processes happen everywhere in life, through contacts with older members of the culture by observation/imitation—observing teacher, friends or parents—and/or contact with artifacts produced by previous generations—looking at some drawings in a book, on TV or internet—and/or co-participation—learning how to draw with someone more experienced that instructs and mediates the production.

Phase B

At Phase B, regularities predominate over variations, in the contrast of individual productions between Phase A and B (i.e. Picture 1 and 2). The experimental boundaries and the cooperative work exerted a significant effect on the participants' responses and action. The

gestalt of each boat produced in Phase A differs significantly from the *gestalt* of the boats produced in Phase B. A comparison of the drawings components made at each Phase reveals how significant their differences are, that is, it reveals the impact of the experimental treatment:

Participants	Boat's components (Phase A)	Boat's components (Phase B)
P1	Sails, Windows and Hull.	Sail, Cabin, Rudder, Window and Hull
P2	Sail and Hull	Sail, Cabin, Rudder, Window and Hull
P3	Sail and Hull	Sail, Cabin, Rudder, Window and Hull
P4	Sail, Hull and Water line.	Sail, Cabin, Rudder, Window and Hull
P5	Sail, Hull, Water line and Win	Sail, Cabin, Rudder, Window and Hull
P6	Sail and Hull	Sail, Cabin, Rudder, Window and Hull
P7	Hull	Sail, Cabin, Rudder, Window and Hull
P8	Hull	Sail, Cabin, Rudder, Window and Hull
P9	Hull	Sail, Cabin, Rudder, Window and Hull
P10	Sail and Hull	Sail, Cabin, Rudder, Window and Hull

Table 6. Comparing boats' components of Phase A and Phase B

P1 guided P2 and P3 through two different mechanisms of cultural transmission: instructing his colleague when cooperating aiming at the production of a drawing of a boat and through the observation of P2 and P3 when P1 first received a paper sheet with the instructions. Finally, when completing the task, P1 checked the paper and made a signal that meant he had finished the activity. Then, while P2 carried out the task with P1 (P1 with the instructions by his side), thrice the latter verbally attempted to show P2 what should be done in the task (i.e. P1/P2 in dialogue in the pages 8-9). Apparently, participants actively tried to find a way of reproducing the activity specifications that was given only to P1.

The fact that P1 had received a paper sheet with instructions of the researcher apparently led P2, P3 and P4 to believe that there was a "correct" way of solving the task, and tried to reproduce what P1 had done. That is evident in participants' reports below:

P1: "[...] I reinforced the drawing to show the observer the color which should be used [...] there was one topic of the instructions that I did not follow [...] This is the one I did with" P2 ", she understood that the order mattered, but did not understand the shape of my flag and she put one more window that I crossed to signalize to the observers what was wrong. By then, we did not know we could talk, so, it was made practically without conversation. "

P2: "I had to watch a female colleague drawing according to instructions [...] I was supposed to draw with her the same drawing, using the same materials she had used for each part of the boat, it was basically that [...] there were specific quantities, there were exactly three sails on each drawing with a specific shape. So, I did it and my friend who had read the instructions adjusted the flag [...] I have made the drawing based on observation and memory [...] I understood that the proposition was to reproduce the drawing. "

P3: "[...] Each participant who came had to produce a drawing and the others were observing, after that, they exchanged places and without having read any instruction, the ones who had observed were supposed to reproduce the same activity than the previous participant [...] they had to do what the other had done [...] I did exactly what I noticed the woman in front of me had done [...] it was practically an imitation."

P4: "At first I drew a boat and after that I had to draw a boat again, now with a friend [...] I noticed that the one that sat in the first chair had to draw a brown body and blue flags and the one that sat in the second, had drawn the little windows using a red pencil."

These reports express a visible valorization of the instruction delivered to P1. P1 clearly showed his intention to transmit what was requested in the instructions based on three cultural transmission mechanisms emphasized here. P1 expressed his preoccupation emphasizing to the participants who were observing the components and the order of production, thereby allowing the others to have access to the instructions through observation. P1 tried to prepare his drawing according to what was required in the instructions without deviations, intending to assist his colleagues (next generations), thus allowing contact with the tradition to be made through artifacts produced by it. P1 highlighted to P2 what should be done, using the co-participation as a way to transmit what he believed to be correct. Therefore, P1, as the one who had access to the instructions, assumed the role of transmitter, enabling the emergence of regularities over the subsequent generations.

Researcher-participant relationship, nevertheless, guides participants to provide the researcher with what they think he/she demands (Simão, 1992). Outside the experimental setting, the researcher was an auxiliary teacher in a discipline that participants were studying at the university. This situation may have contributed to participants' adherence in the activities, hence to the belief that the instruction contained a right way to be followed during the task solving. Hence, P1 became the holder of what was right, sharing the researcher's affective position in relation to the others. The double role of the researcher—auxiliary teacher and the one that gave instructions in the experimental setting—may have significantly affected the participants actions, creating a power hierarchy leading the participants to act according to what they believed was the aim of the researcher which was to follow the model as instructed in the paper sheet.

The remaining participants (P5, P6, P7, P8, P9 and P10), who did not observe the instructions given to P1, acted in a convergent way, as if they appropriated the instruction and P1's way of drawing. Aspects of the cultural transmission process emerge in the reports of the 9 participants who followed the production of P1:

P2: "[...] I understood that the proposition was to reproduce."

P3: "I did exactly what the other had done. It was practically an imitation. "

P4: "The instructions were to pay attention to the activity by your side and then I would have to do the same."

P5: "[...] I saw that everyone always took the same pen or pencil, a member of the pair would draw a part and the other would do another part."

P6: "[...] I analyzed what they were doing, and then tried to follow their every step on each phase, because I went through two phases."

P7: "It seemed to be a matter of sequence, people were doing similar drawings, it seemed logical to me doing a similar one."

P8: "I followed what they did before. Just watching."

P9: "[...] I think that one easily makes the connections: I will observe and then do the same."

P10: "I tried to follow the model [...] there seemed to be something already set, then I followed it."

Reproduction was considered to be the goal of the activity. Whereas only P2 and P3 have referred to the instructions received by P1, probably the 3 generations P1/P2, P2/P3 and P3/P4 contributed to the maintainability of practices created by P1 based on the instructions. Evidently, all participants used the observation of someone acting as a way of keeping the regularities that arose from previous generations.

The recorded images of the activities show that only 4 participants (P2, P3, P5 and P6) consulted the drawings produced by previous generations. Thus, we concluded that observation of someone acting was the main cultural transmission mechanism used by participants, instead of the contact with the tradition through the artifacts, that is, the previous produced drawing. Only 4 participants established contact with the previous drawings, nevertheless, this cultural transmission mechanism also exerted effects on the cultural productions of other participants, since each of these 4 participants participated of the activity twice, directly influencing the generations P1/P2, P2/P3, P3/P4, P4/P5, P5/P6 and P6/P7.

The cultural transmission mechanism named as co-participation also had an effect on how the task was performed. When co-participating, only P1 and P2 established some kind of dialogue (i.e. P1 and P2 dialogue in page 8). During this dialogue, P1 instructs P2, for three consecutive times, showing that there was a correct way to produce the activity. For this reason, P2, P3 and P4 suspected that instructions given by researcher to P1 contained what should be done in the task. So even without verbal communication between participants of the next generations, their behavior indicated that there was an implicit model to be followed, which gave priority to the sequence of production, components, materials and functions to be exercised in the activities.

Participants also established specific functions in the production of the boat—the oldest member had a specific function in the production while the youngest member exercised another—throughout the experimental generations. Therefore, we could conclude that the very methodological structure of experiments communicates to participants the sequences and functions that each must perform. That is, the experimental arrangement is based on cultural evolution, as it places the participants twice in the role of observers, after they are promoted to be the one that is able to make the activity, first as a beginner and then as the 'older' member, he is allowed to teach the activity to others. Such understanding of the sequences and functions as a kind of progress or hierarchical evolution can be clearly seen in P9's report presented in the results of this experiment. A conception of cultural evolution, therefore, is implicit in the very structure of the experiment, as it is, in fact, derived from an experiment elaborated by researchers who share such evolutionary conception of culture.

It was clear that the mechanisms of cultural transmission discussed here, as well as, the structure of the experimental arrangement guided the emergence of meaningful regularities throughout the 10 experimental generations. Nevertheless, some variations could be observed in components and forms used by the participants. Most of the participants who produced variations did not mention it in their reports. Out of those who were aware of their modifications, a few stressed that they were deliberate, and others said that it was without apparent intention:

P5: "[...] I realized I had done the hull too big. It was too late then [...] so that the colleague was forced distribute the little windows over it [...] I was so preoccupied with distributing, I had made it myself, I think that in an attempt to reduce the boat again, I ended up concentrating the sails on this side here, "right"? "

P6: "[...] you can see that there is a difference in the size of the one that came before me, I've made it smaller [...] I thought it was better."

P7: "In the first one I started with a red crayon and I thought that 5 balls, which should be the windows, were too little, so I decide to draw more of them. When I drew the turret, I thought that it was supposed to have a door, a sort of sidelong, pointing forward and not directly to whoever was drawing [...] I've made the hull first, I decided to make it more rounded and put sails in different size because to my mind, when there are 3 sails, the one that is in the middle should be higher. "

P8: "Oh, because that was how they did before right? [...] I thought I was supposed to do this way. "

P9: "[...] I watched, I saw how people were behaving and behaved the same way."

P10: "[...] I've made it thinking about the first model I had seen, I watched and wanted to do it in the right way."

P5 was sensitive to drawing variations perceiving the implications of his/her drawing in the production of his/her colleague (P4). He/she was also aware of the influence from the previous productions (P5/P4) to his/her activity with P6. He/she, however, was unable to perceive that the sequence of components' production also varied. P6 did not reveal any concern on the variations he/she produced; on the other hand, P7 highlighted his/her intention of promoting some variations from the previous drawings. Finally, P8, P9 and P10 apparently did not notice any changes in the forms and sequences used in their productions.

Phase C

While idiosyncratic histories influenced participants' production at Phase A, during phase B, the researcher gave instructions to P1 and the participants were submitted to the presence of models, including the observation of a previous pair working. Elements emerged at Phase C, on the other hand, were partly similar to the productions of Phase A and to what was produced in Phase B. It shows that the experimental setting carried out the influence of past generations and left impacts to the next Phase.

Table 4 (cf. results) presented that as a result 6 out of 10 participants (P1, P2, P3, P5, P7 and P8) reproduced at phase C at least one component of the boat that had arisen exclusively from Phase B, that is, which were not present in phase A. These data show how the participants were affected by the experimental treatment. More can be noticed in the reports of P1, P2 and P3 below:

P1: Partly in what we had done in the other, but trying to bring something different [...] This was a concern I had, not to keep too fixed in the previous model.

P2: I based it a bit on what had appeared before and on the idea of boat that was in my head, I did not want to reproduce exactly what I had done in another experiment.

P3: It was more or less like the first one I did, which is the way I got used to draw a boat, very simple, and some details I noticed that I had not done in the first drawing, when I was alone, what other people did e.g. these little balls, which allow people to see the inside.

Participants were not only affected by the cultural transmission process experimentally created, but, sometimes were also able to realize how they had been affected.

ADDITIONAL COMMENTS

This paper started presenting the broad cultural process of transformations and maintenance occurred in Hagia Sophia, as an instance of how long practices can be maintained or neglected and that new practices can be implemented while others discarded over more than 14 centuries. The perpetuation and the propagation of new or old practices are, therefore, evinced in cultural products. The construction of material stabilities permeates the cultural field as sediments of the interpersonal negotiation (cf. Guimarães, 2010).

Experimental studies focusing on cultural phenomena have been done in different psychological frameworks in different decades, for example: Asch (1951); Jacobs and Campbell (1961); Henrich and Boyd (1998); Mesoudi and Whiten (2008); Caldwell and Millen (2008). Although the conception of culture in each study is relatively different from the others, the experimental accounts from these studies emphasize the relevance of cultural transmission processes to understand cultural phenomena.

The experiment presented here enabled the observation and description of distinct variations and regularities throughout the activities of the 10 experimental generations. The 'stereotyped or stabilized' responses of the participants to the task of drawing boats and their answers in reports have demonstrated a strong tendency for cultural continuity. Cultural transmission protects some stable elements of individual production channeling their continuities in participants' generations (Valsiner, 1998). Nevertheless, the forms of producing and understanding the task revealed not only an effort of reproduction, but also active transformations carried out by the participants. Sometimes trying to imitate the actions and the intentions of the predecessors had as a consequence the production of non-deliberate variations and the emergence of novelties: a "rudder" turned into a "sun" quickly probably because new meaning stabilizations usually emerge in ambiguous, unfamiliar situations (Werner & Kaplan, 1957).

On one hand, the experimental analysis does not allow one to explain conclusively why novelties emerge as such. Some behaviors that emerged in the last generation can be similar to the ones of the previous one, after not being evident in the generations in the middle. That is, similar results could be found in the action and pictures of participants that did not have any contact with those who created some of these elements. It opens the question of the possible reemergence of cultural process that seems lost in the present.

Many reports expressed that observation and imitation were the major cultural transmission mechanism, it was evident that the contact with the artifacts previously produced, the co-participation and the structure of experimental arrangement exercised a forceful effect on

participants' symbolic actions throughout the 10 experimental generations. Participants' reports, on the other hand, show that some variations can be perceived reflexively and appropriated by whoever produces it.

The issue of the continuity is emphasized in this analysis as something necessary for the construction of identifiable cultural structures. The ways of acting and understanding the activity in the Phases B and C address the idea that experimental continuities could probably be seen if the experiment had been followed by further generations. The continuation of small cultural aspects occurs if people are placed in similar situations, and if someone or something (i.e. an image, a speech or a sequence of actions) mediates the relations between the previous and the next generations—by observation/imitation of older members of the group/culture, contact with artifacts produced by previous generations and co-participation with the tradition. These mediations are important resources of the cultural transmission process.

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AUTHOR BIOGRAPHIES

Djalma Francisco Costa Lisboa de Freitas is currently a masters student at the Institute of Psychology (University of São Paulo, São Paulo, Brazil). His current research is about psychological points of cultural phenomena in experimental studies. Email: djalmaffreitas@usp.br or djalmaffreitas@hotmail.com

Danilo Silva Guimarães, PhD, is Professor at the Institute of Psychology (University of São Paulo, São Paulo, Brazil). He has been working with analysis of Self-otherness interactions from a dialogical semiotic-cultural perspective in psychology. His main focus of investigation is the process of symbolic elaborations out of tensional boundaries between cultural identities and alterities. Email dansgui@usp.br