Experimental evidence of the emergence of aesthetic rules in pure coordination games

Federica Alberti[1]
University of East Anglia

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Abstract

When people coordinate in one-shot, pure coordination games they rely on existing notions of salience. In an experiment with pure coordination games, concepts of salience emerged when players were given a set of different but related coordination problems with randomly generated labels. The same players were also given a set of different but related coordination problems with culture-laden labels and "common features" between labels across problems. The players could develop concepts of salience in the first set of games and appeared to use "common features" as rules for coordination in the second set. The paper also finds evidence of pair-specific learning and coordination on favourite labels.

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1. Introduction

There is now a lot of evidence that people are able to coordinate their actions in one-shot, coordination problems. For example, in a series of experiments involving players choosing between objects, like numbers, letters, or pictures, investigators find that the rate of successful coordination is significantly larger than one would expect from randomising choices (see e.g. Mehta *et al*., 1994, Bacharach and Bernasconi, 1997). Schelling (1960) observes this kind of behaviour in his earlier investigation. He argues that while "most situations [...] provide some clue for coordinating behaviour, some focal point for each person's expectation of what the other expects him to be expected to do" (p. 57) people "*can* often concert their […] expectations with others if each knows that the other is trying to do the same" (p. 57). This paper investigates how people coordinate their (expectations and) actions in such coordination problems.

One explanation in the literature makes this capacity a theoretical property of some expanded notion of rational action. For example, Bacharach (1993) assumes two stages in the decision process of one agent: "conceptualisation" and "choice". Coordination is achieved because agents choose the options that ensure that Pareto-dominant equilibria are selected, and rely on similar descriptions of the game.[2] The difficulty with this approach as a general explanation is twofold. First, there is no explanation of why players have similar descriptions of the game. Secondly, there remains a question regarding why particular solutions are salient. The evidence seems to suggest that the apparently salient solutions to some coordination problems are culturally or historically specific.

An alternative way of explaining coordination, which might also explain how salience can be culturally specific, turns on people learning to coordinate their actions. It is well

[2] Other similar theories are proposed by Gauthier (1975), Janssen (1997), and Casajus (2000). A slightly different approach is followed by Sugden (1995). All these theories are based on Schelling (1960)'s earlier investigation, showing that people have an innate capacity of coordinating on focal points.

known, for example, in evolutionary game theory people can achieve coordination when a game is repeated by learning to condition their behaviour on some piece of shared extraneous information (see Weibull, 1995, and Friedman, 1996); and there is some experimental evidence that this happens (see Van Huyck *et al*., 1997, and Hargreaves Heap and Varoufakis, 2002). However, this type of learning will not explain how coordination is achieved in the real, novel settings described above. If people learn how to coordinate in these games, as opposed to having some innate capacity to do so, they must be acquiring rules that apply to settings which while different are also in some sense similar, so that the same rule can be used. Little is known about this type of learning. Is there, for instance, a unique rule for a particular class of problems that everyone might discover? Or do different rules emerge for particular pairs or groups of people who try to coordinate in the same class of problems? What do such rules consist of? Do some people learn more quickly than others? Does a quick learner help others to learn? Does learning in a class of problems help with coordination in a different class? In other words, does the experience of one type of problems proves helpful with another. This paper is concerned with these general questions about how people come to be able to coordinate in these novel settings.

Investigating this type of learning experimentally is difficult because most coordination problems are suffused with cultural referents. Thus, if there are rules for solving coordination games, they are likely to be applied to these experimental games. In other words, there will be little scope for learning new general rules to take place in the experiment. What is required instead is a set of different but related games that are virtually culture-free, so that no pre-existing rule can be applied and there is scope for learning a new general rule to take place in the experiment. Of course, it would be impossible to devise games that are completely culture-free. But we use a set of aesthetic games which are plausibly culture-lite. They consist of chequered arrays of colours, and the combinations of colours change from one game to another, and we investigate whether there is evidence of learning in these games, in particular whether rules emerge in the experiment, and whether these rules are specific to pairs of individuals playing a series of these games.

For this purpose, it is important to have a control with respect to what play in such games would look like if the games had cultural referents which could be used to form rules. Thus, we introduce a set of aesthetic games which have more familiar aesthetic objects. Some of the games have images of fabric patterns from the same set of four styles while others have images of paintings from the same set of four artists, and the images share "common styles" across games with images of fabric patterns, and "common artists" across games with images of paintings.

The experiment is designed to answer the following specific questions:

i) whether people coordinate more than randomly in these aesthetic problems;

ii) whether they learn to coordinate more with experience of related problems;

iii) whether experience of one class helps with coordination in another class;

iv) whether some pairs learn to coordinate better than others;

v) whether all pairs learn the same rule;

vi) whether the rules which are developed turn on personal favourites.

The questions i)-iii) investigate the capacity of people of developing rules of salience in real coordination problems, as opposed to their ability to coordinate by using existing notions of salience. The question vi) examines the influence of individual preferences, like "personal favourites", on the rules learned. Such preferences may in fact provide the basis for a rule to become established (see Lewis, 1969, and Sugden, 1998). The more important question is whether all pairs learn the same rule. If different groups or pairs of individuals develop different rules, then these rules will incorporate characteristics of the games that are known to be psychologically salient to the members of a population. The group or pair-specificity of a rule provides the basis for its salience to be “culture”.

The organisation of the paper is as follows. Section 2 introduces the theoretical framework. Section 3 describes the experimental games and the procedures. Section 4 gives the results, and Section 5 concludes.

2. Theoretical framework

In order to focus on the analysis, consider the example of a two player pure coordination game in Table 1. The game has four strict Nash equilibria, (a, a), (b, b), (c, c), and (d, d), and the mixed strategies Nash equilibrium p_i=1/4 (for both players, p_i is the probability of choosing the strategy *i*). When a game has multiple equilibria, equilibrium analysis cannot predict (whether any equilibria can be selected at all) which equilibrium will be selected.

Table 1: Payoff matrix of a pure coordination game

	Opponent			
Player	a	b	c	d
a	1, 1	0, 0	0, 0	0, 0
b	0, 0	1, 1	0, 0	0, 0
c	0, 0	0, 0	1,1	0, 0
d	0, 0	0, 0	0, 0	1,1

Note: Example of a two player pure coordination game with four strategies: a, b, c, and d.

However, in situations involving multiple equilibria, people may be able to use *rules* in order to identify specific solutions of a coordination problem. Rules of this type are based on common thinking about the characteristics of the game (see Bacharach, 1993, and Sugden, 1995). If some rule can be used to solve a coordination problem, then this must incorporate characteristics of the game that are commonly known to be salient.[3] Also, in situations where more than one rule can be applied, players must be able to use the same rule in order to achieve coordination. Different rules can be equally effective ways of coordinating actions, but a salient rule will enable players to select an equilibrium based on "conspicuous uniqueness" (see Lewis, 1969). Both theoretical and experimental literatures show that it is rational for a player to choose a salient outcome.

In the absence of a rule of this type, repeated interaction of members of a population may allow them to establish one that solves the coordination problems. In the literature, a regularity in the behaviour of members of a population, which is customary, expected, and mutually consistent, is a "convention" (see Lewis, 1969, p. 42).

In both theoretical and experimental literatures, subjects confront the same game repeatedly, either with the same opponent or with opponents drawn from a population. The games played in the sequences of coordination tasks are identical. Such an extraordinary degree of similarity is not observed in real-world interactions. Real-world interactions differ in details, which can make the process of learning rules considerably complex.[4] Lewis argues that people in real-world situations rely on "precedence" based on experience with "familiar" coordination problems (1969, p. 36). The information content of an individual's experience depends on the characteristics of games from a particular class.

That people are capable of coordinating their behaviour in one-off, coordination problems may reflect their ability to learn rules that enable them to identify particular

[3] Notice that, in pure a coordination game, there is complete symmetry between players, and payoffs. Thus, rules of salience must be based on features of the labels associated with the strategies of the game.
[4] See on this Goyal and Janssen (1996), Sugden (1998), Schlicht (2000), Cubitt and Sugden (2003).

solutions. These are rules learned by repeated interaction over a class of problems, which while different are also in some sense similar. In such environment, rules based on non-strategic features of the coordination problems must be general enough to apply to different situations. If a rule has to emerge, which selects an equilibrium in a game like that in Table 1, this must be based on the principles of coordination that was proved to be successful in previous games from the same class. These are rules that may influence the outcome in the current game, and provide the basis of successful coordination in future games.

This is the concept of rule that will be used in the remains of the paper to identify specific ways of solving coordination problems. For example, take a sequence of different but related games of the structure of that represented in Table 1. Suppose that players in this game have to choose between objects, and these objects have observable features (e.g. shape, colour, size). A rule can be expressed as a principle that distinguishes between objects and selects objects with particular features (e.g. triangle shape). When all players use the same principle, a rule that picks up objects with particular features (e.g. triangle shape) will result. (In this case, a Nash equilibrium in the game in Table 1 is selected.)[5]

The learning of a rule of this type may involve the learning of generic coordination skills, such as the ability of players to choose objects with salient features. The salience of the features of an object is essentially an empirical question. But when a rule is not established, people need to learn what salience is about (and perhaps why it is rational to choose salient solutions). The experience with features of the objects of choice may influence the notion of salience which is being used in the population of players. This notion is a way of addressing to the relation between an individual choice and his perception of the characteristics of the objects to choose. The primary salience hypothesis is that a player is choosing the object with the features that strike him most. The secondary salience hypothesis is that a player is

[5] Rankin *et al*. (2000) investigate the emergence of conventions in repeated stag hunt games with randomly perturbed payoffs.

choosing the object with the features that he believes to strike the other player(s) most (see Mehta *et al*., 1994, p. 660). Rules based on primary salience and/or secondary salience might emerge in coordination games where strategies have aesthetic labels.

3. The experiment

3.1 Experimental games

We investigate whether some rule can emerge when players are given a set of different but related aesthetic games. In particular, pair of players were given a series of 20 coordination games, presented in four *blocks* of five games each. Each game consists of four images. The two players see the same images, and each chooses an image with the aim of coordinating with the co-player. The images are chequered arrays of coloured squares, and the combination of colours change from one game to another. Figure 1 in the Appendix shows the set of coordination games used in the experiment (a sample of these is offered in Figure 1). We shall refer to this *type* of game as *abstract*.

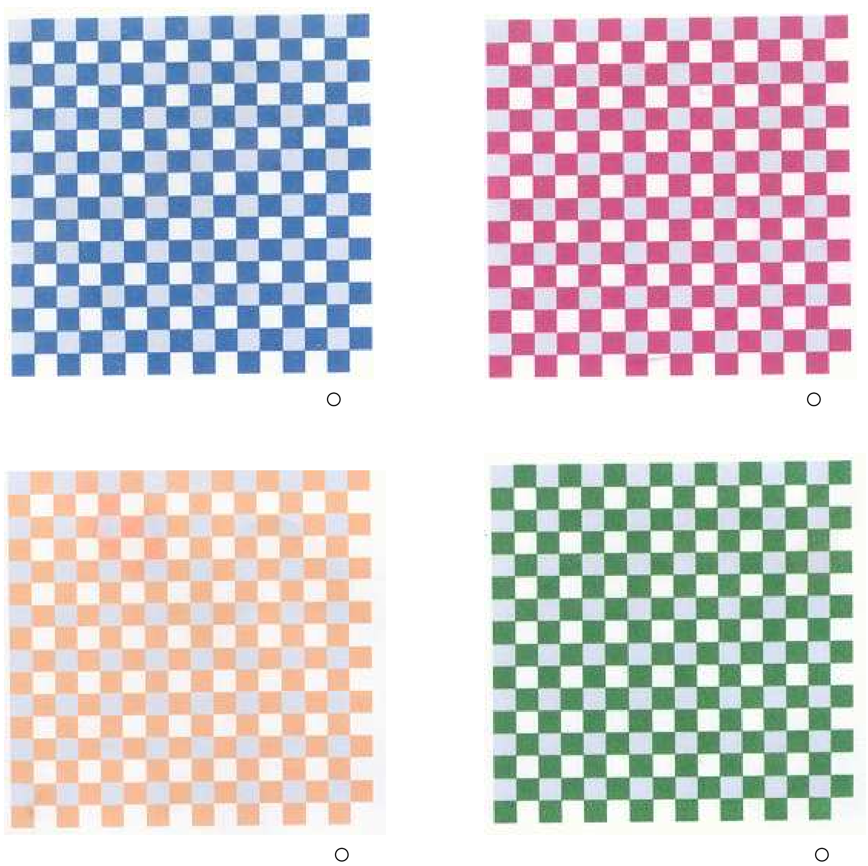
Abstract games were constructed by means of a computer programme prior to the experiment. Notice that, in each image, the 16×16 array of squares can be subdivided into 8×8 identical *cells*, where each cell consists of the same 2×2 array of four squares in three colours. The programme created the images within each game using an independent random procedure which a) selected three colours from a set of 48 colours; b) assigned each colour to one of three positions within a cell (note that each image in abstract games consists of 8×8 identical cells); c) pulled out one position in a cell, and replaced the existing colour with a new one. The purpose of this was to create four images within each game which are similar to one another, so that each game within the set of abstract games can be acknowledged its own "character".

Players also confronted 20 *culture-laden* games involving images of more familiar aesthetic objects. As in the abstract games, each game was a coordination problem requiring a choice from a set of four images. Again, games were presented in blocks of five. Two of these blocks involved images of fabric patterns, while two involved images of paintings (see Figure 2 in the Appendix). In each block of fabric games, all the images were in one of four styles. In each game in the block, there was one image in each style (e.g. see Figure 2).[6] In each block of painting games, all the images were the work of one of four artists. In each game in the block, there was one image by each artist. The purpose of having images with "common features" across culture-laden games was to provide players with cultural referents, which are absent in abstract games, which can be used to form rules.

For each culture-laden game, we chose images with similar subjects (e.g. "flowers" in Game 13 in Figure 2 in the Appendix) in order to avoid asymmetries which may take one's attention away from aesthetic judgements which may be necessary to learn aesthetic rules.

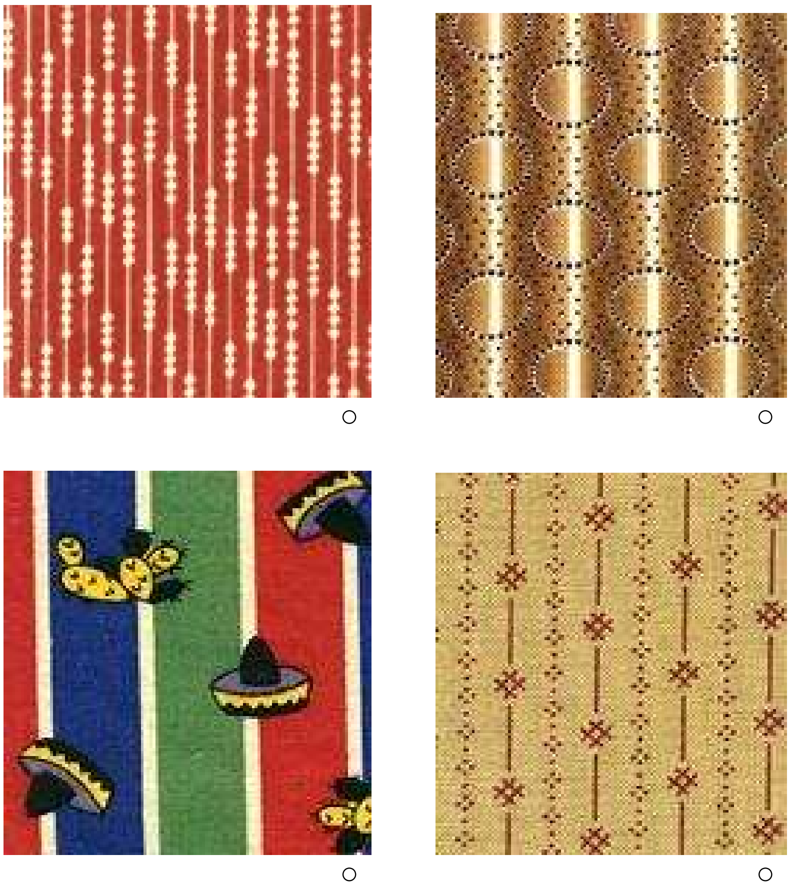
[6] Each style was defined as a set of fabric patterns which is representative of a specific period in the history of fashion in the Western society (e.g. late Victorian, retro). We followed the classification provided by the website: http://www.reproductionfabrics.com/.

Figure 1: Example of abstract game



Note: For the whole set of abstract games, see Figure 1 in the Appendix.

Figure 2: Example of culture-laden game (fabric patterns)



Note: For the whole set of culture-laden games, see Figure 2 in the Appendix.

Source: http://www.reproductionfabrics.com/

3.2 Structure of the experiment

Each subject played a series of 20 abstract games and a series of 20 culture-laden games with the same anonymous co-player. In 5 sessions, subjects played the series of abstract games before the culture-laden games. We shall refer to these sessions as the "abstract-first" *treatment*. In 4 sessions, the subjects played the series of culture-laden games before the abstract games. We shall call these sessions the "culture-first" treatment. In both treatments, the order of play was randomised. We allowed three levels of randomisation: of

i) blocks, within each type;

ii) games in the three central rounds of each block;

iii) games in the first and fifth round of each block.

These features were designed to mitigate the effect of path-dependency at the level of the whole sample. If there is a unique focal point in these games, however, this can be learned regardless of the order of play.

In the first and fifth round of each block the games were the same for all players. These games were used in questionnaires to investigate whether people choose the images they are most attracted to, and/or the images they think other people are most attracted to. In games with aesthetic objects, players may in fact choose the objects they like, and/or the objects they think other people like. While the first type of choice is associated with "primary salience", the second type is associated with "secondary salience" (see Section 2).

Before playing the twenty abstract games, subjects completed the questionnaire in relation to eight of these games (i.e. the first and last in each block). For each game, they were asked to indicate

i) the image they like most, and

ii) the image they think the other person likes most.

They completed exactly the same questionnaire again after playing the twenty games. The same procedure was followed for the twenty culture-laden games.

The reason for the questionnaire "before" and "after" the series of coordination games was to obtain information about whether players choose according to their "likings", whether there are trends in these choices, and whether there is consistency of "likings" before and after the coordination games.

3.3 Research questions

The specific questions that the experiment was designed to test are as follows.

i) Whether, prior to opportunities for learning, subjects coordinate more successfully than if they chose strategies at random;

ii) whether their performance improves with experience of play

   a. within a block;

   b. within a type;

   c. across types;

iii) whether there is a correlation in the performance of pairs in the two types;

iv) whether players learn from the behaviour of their co-player;

v) whether some pairs perform better than others to a degree that cannot be attributed to chance;

vi) whether different pairs coordinate on different rules;

vii) whether they use “common features” as rules in culture-laden games, and whether some features are chosen more frequently than others;

viii) whether they choose the images they like most and/or the images they think their co-players like most;

The questions i)-ii) look at the performance of pairs in the series of abstract games and culture-laden games, and investigate how successful people are at coordinating in these games prior to learning, and whether the performance improves with experience of games of the same type within a block, as well as across blocks, or different types of games. While the result from the test of hypothesis from question i) may provide evidence of the capacity of players of coordinating in games where strategies have aesthetic labels, those from the tests of the hypothesis from the questions ii) may give evidence of the ability of learning rules (sub-question a) and/or generic coordination skills (sub-questions b and c).

The questions iii)-iv) focus on the behaviour of individual pairs in the two series of games. A positive correlation in the success of pairs between abstract games and culture-laden games may support the idea that rules are transferable across types (when rules learned by repeating play of games of one type can be used to solve games of the other type). By randomly reassigning subjects to subjects within the population of players, moreover, it is possible to see whether the behaviour is consistent with players learning rules and/or generic coordination skills from the behaviour of their co-players.

The questions vi)-ix) explore the possibility of differences in the coordination of pairs, in particular whether some pairs of subjects are more successful at coordinating their actions (notice that the presence of quick learners within one pair is likely to benefit the learning of other players in the same group or pair), whether different pairs of players learn different rules (one way of checking it is to repeat the randomly reassignment test above for populations of equally successful pairs), and whether more successful pairs tend to coordinate on more "obvious" rules, like "common features" in culture-laden games.

The questions x)-xii), to answer which we use the data from the questionnaires, examine how people choose images in abstract games and culture-laden games. In particular, we are interested in whether subjects choose the images they like, and whether there is a similarity in "likings" between players within the same pairs. The data from the questionnaire, especially the information about how players choose images at the beginning of a series of games within a block and within a type, may be relevant to the problem of explaining how players coordinate on rules in these games.

3.4 Experimental procedures

The 118 subjects, from various cultural and educational backgrounds, came from the student population of the University of East Anglia. The group size in each session varied from 12 to 16 subjects. Once seated in front of the computer, subjects were asked to read the instructions displayed on the computer screen, and ask for questions of clarification.

The instructions provided subjects with the following information: that they would be paired with another subject at random; that they would not know and never know who the other subject is;[7] that they would be shown four pictures on the screen; *that the order of pictures would not be necessarily the same for the other player*; that they would have to choose the same picture as the other subject; that they would have to do so 40 times; that the games would be divided into eight blocks of five choice problems; that they will score one point for every time both they would choose the same image; that a pool of £1.25 per player

[7] To ensure that no communication would occur between subjects within a pair, players were allocated to two distinct areas. The computer programme was designed to arrange for random matching of players sitting in one area to those sitting in another.

at the end of each block would be divided between pairs, each pair's payment being proportional to the total number of points scored by that pair relative to the total number of points scored by all players in the session; that they would have to answer a few questions before the game started.

Following a demonstration of a possible coordination task[8], another set of instructions was given. Players were told they had to answer a few questions before being presented the series of coordination tasks. The eight sets of questions, reproducing the objects of some of the games displayed in the coordination tasks, were presented in the same order to all players. For each set, the subjects were asked to say "what picture [they] like most" and "what picture [they] think the other person likes most". Once all players had finished answering the questions, the series of coordination tasks started.

Since the games were symmetric, and to avoid introducing a second label (e.g. a number or a letter) which could have produced another rule of coordination, players were told that they could choose one object by clicking on the corresponding radio button. In each round subjects had to choose one object in a set four. The objective was to choose the same object as the other person in that round. Both players could see the same four objects on the screen, but the position of the objects was randomised to discourage players from choosing objects according to their position (e.g. "always choose the one on the left"). After the choice of each player was registered, the round was over and the computer informed each player of the opponent's choice, as well as the player's own choice, and the other possible choices.

At the end of each block of tasks, players were given additional information: (i) The total number of points scored over the five rounds; (ii) The total amount of money won so far. A printout of the screen of what the players saw during the session is offered in the appendix.

[8] The demonstration made no use of colour labels.

At the end of the fourth block of tasks, before the computer informed players of the total amount of money won at the end of the series of games, subjects were presented an identical series of questions reproducing the same objects as those presented at the outset of the series of tasks.

4. Results

The experimental data are summarised in Figure 3 and Figure 4.

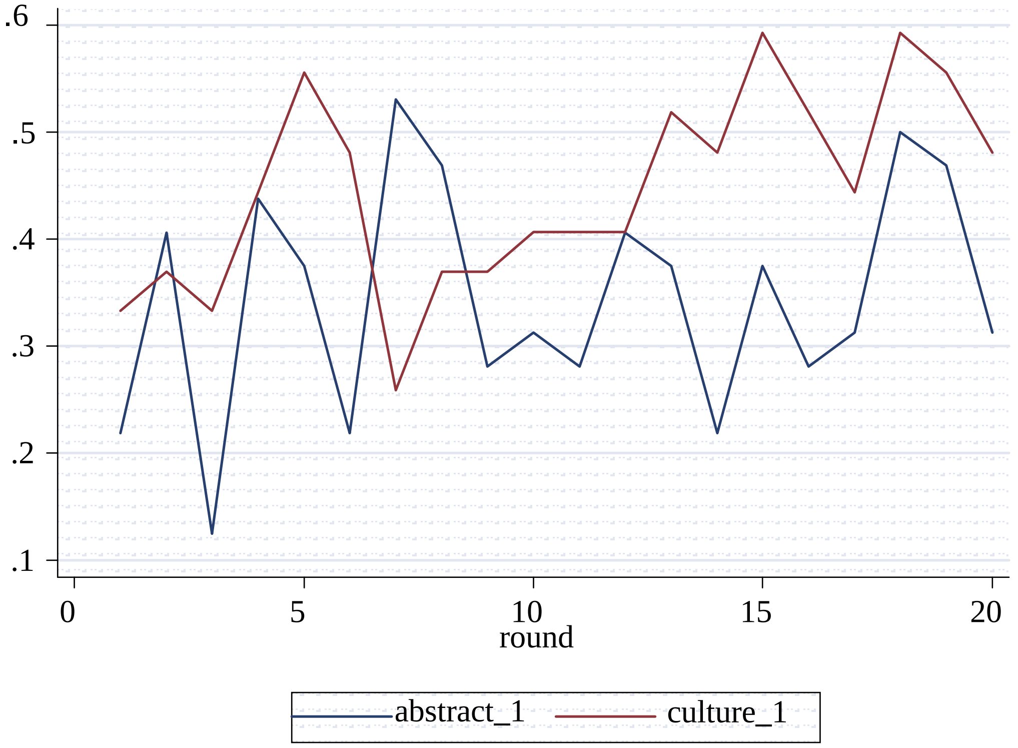


Figure 3: Coordination proportions in abstract games in “abstract-first” (average=0.345) and “culture-first” (average=0.446). Average coordination (all treatments)=0.392. Random coordination=0.250.

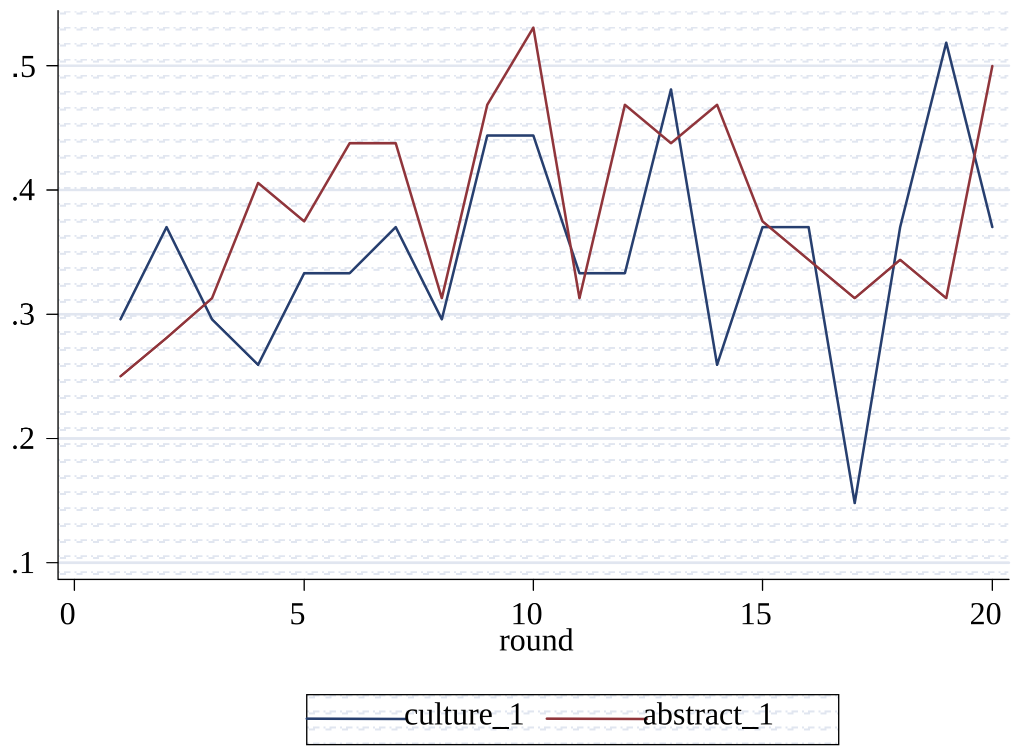


Figure 4: Coordination proportions in culture-laden games in “culture-first” (average=0.350) and “abstract-first” (average=0.384). Average coordination (all treatments)=0.369. Random coordination=0.250.

Figure 3 and Figure 4 in the Appendix show the distributions of outcomes for abstract games and culture-laden games in both treatments.

The average rate of success was 0.392 in abstract games, and 0.369 in culture-laden games. Both these are significantly larger than the rate of success in case of subjects choosing strategies at random (i.e. 0.250). For each type, we compare the actual frequency of successful matches (462 in abstract games, and 435 in culture-laden games) to the frequency of successful matches in case of random choice (for each type, the total number of games is 1180). There is strong evidence that subjects were able to coordinate in each type of games more than randomly (Chi-square, $p<0.01$). In other words, subjects were able to coordinate successfully in both abstract games and culture-laden games.

To investigate whether the performance of subjects improves with experience of games of the same type within a block, or different blocks, or games of different types, we use a random-effect probit model. For each pair in each game, we regress coordination (equal to 1 if successful; 0 otherwise) against seven explanatory variables. *Round* is the number of previous games of the same type faced by subjects. This variable (0-19) picks up the effect of within-type learning (abstract=baseline). *Block* is the number of previous games of the same type in the same block faced by subjects. This variable (0-4) picks up the effect of within-block learning (abstract=baseline). *Second* is a dummy variable that distinguishes games according to whether or not they are played in the second part (equal to 1 if *second*; 0 otherwise). This variable captures the effect of across-type learning. *Culture* is a dummy variable which identifies the type of game played (this is equal to 1 if *culture-laden*; 0 otherwise). This variable incorporates the effect of differences in the performance of subjects in the two types. *Culturound* is a combination of the variables *culture* and *round*, to pick up any interaction between learning and type. *Culturblock* is a combination of the variables *culture* and *block*, to pick up any interaction between learning and block. *Cultursecond* is a combination of the variables *culture* and *second*, to pick up any interaction between cross-type learning and type. *Culturblock* is a combination of the variables *culture* and *second*, to pick up any interaction between cross-type learning and block.

Table 2: Random-effect probit regression results

match	Model 1	Model 2	Model 3	Model 4	Model 5
round	0.015(0.023)**	0.015(0.026)**	0.012(0.034)**	0.010(0.029)**	0.010(0.029)**
block	0.033(0.231)	0.042(0.029)**	0.042(0.029) **	0.042(0.029)**	0.042(0.029)**
second	0.271(0.004)***	0.271(0.004)***	0.236(0.005)***	0.261(0.000)***	0.176(0.001)***
culture	0.071(0.617)	0.099(0.447)	------	------	------
culturound	-0.010(0.298)	-0.009(0.343)	-0.004(0.555)	------	------
culturblock	0.019(0.618)	------	------	------	------
cultursecond	-0.179(0.259)	-0.179(0.259)	-0.105(0.403)	-0.158(0.072)*	------
constant	-0.621(0.000)***	-0.635(0.000)***	-0.588(0.000)***	-0.586(0.000)***	-0.586(0.000)***
/lnsig2u	-2.991	-2.991	-2.986	-2.992	-2.953
sigma_u	0.224	0.224	0.225	0.224	0.228
rho	0.048	0.048	0.048	0.048	0.050
Wald chi2	27.84	27.59	27.04	26.69	23.49
prob>chi2	0.000	0.000	0.000	0.000	0.000
No. obse	2360	2360	2360	2360	2360
No. groups	59	59	59	59	59

Note: *** = Statistically significant at the 1% level.

** = Statistically significant at the 5% level.

* = Statistically significant at the 10% level.

Table 2 gives the results of the probit model. It shows that: i) the coefficient of the variable *round* is positive and significant (Model 1-5); ii) the coefficient of the variable *block*, which is positive and not significant in Model 1, becomes significant in Model 2-5; iii) the coefficient of the variable *second* is positive and highly significant (Model 1-5); iv) the coefficient of the variable *culture* is positive and not significant (Model 1-2); v) the coefficient of the variable *culturound* is negative and not significant (Model 1-5); vii) the coefficient of the variable *culturblock* is positive and not significant (Model 1); v) the coefficient of the variable *cultursecond*, which is negative and not significant in Model 1-3, becomes moderately significant in Model 4. Hence, there is evidence which clearly points to the effect of the learning of players within the two types, and this evidence is stronger within the same block of games (notice the effect of "restarting" play between blocks, see Figure 3-4). Also, there is evidence of people learning from experience of different types of games, especially in the "culture-first" treatment.[9]

Table 3 summarises this evidence on the three types of learning by giving the predicted probabilities of matching in the two types of games in the two parts. These probabilities are based on the coefficients in Model 4 (see Table 2). In the first part, the increase in the predicted probability of coordination from the first to the last round equals to 6.7% (there is no significant difference between types here). Such improvement in the coordination of players may be due to the effect of within-type learning. The increase in the predicted probability of coordination is 6.4% higher within blocks (this percentage is obtained by comparing the predicted probabilities of coordination "within type" and "within block" in the last round, see Table 3). Notice that, given the existence of "restart" effects

[9] Note that the negative sign of the coefficient of the variable *cultursecond* indicates that the probability of coordination in culture-laden games in the second part is lower than the probability of coordination in the same type in the first part *and* the probability of coordination in abstract games in both parts. If we exclude the performance of subjects in the games played in the first part, then we will expect the probability of coordination in culture-laden games in the second part to further decrease.

Table 3: Predicted probabilities of coordination

	first part		second part		second part	
	abstract or culture		abstract		culture	
round	within_type	within_block	within_type	within_block	within_type	within_block
1	0.279	0.279	0.373	0.373	0.315	0.315
5	0.293	0.353	0.388	0.453	0.329	0.392
6	0.296	0.296	0.392	0.392	0.333	0.333
10	0.310	0.371	0.407	0.473	0.347	0.411
11	0.313	0.313	0.411	0.411	0.351	0.351
15	0.328	0.391	0.427	0.493	0.366	0.431
16	0.331	0.331	0.431	0.431	0.370	0.370
20	0.346	0.410	0.446	0.513	0.385	0.450

Note: Probabilities of coordination based on the coefficients in Model 4. First part: "within_type" is a combination of *constant* and *round*; "within_block" is a combination of *constant*, *round*, *block*. Second part (abstract): "within-type" is based on *constant*, *round*, *second*; "within_block" is based on *constant*, *round*, *block*, *second*. Second part (culture): "within_type" depends on *constant, round, second, second_culture*; "within_block" is a combination of *constant, round, block*, *second*, *second_culture*.

across blocks of tasks, the predicted probability of coordination "within block" is likely to reproduce more closely the actual improvement in the performance of pairs. In the second part, there is a further increase in the predicted probability of matching "within block". This is considerably larger in the "culture-abstract" treatment (9.4% in the first round, and 10.3% in the last round) than in the "abstract-culture" treatment (3.6% in the first round, and 4% in the last round). But there seem to be no substantial increase in the predicted probability of coordination "within block" in the second part. The latter result is interesting, because it reveals that no "within block" learning has effectively occurred in the second part. In other words, most of the learning abilities which seem to be responsible for the performance of subjects in the second part appear to be simply "transferred" from the first part to the second part.

While the effect of these learning abilities appears to be considerably larger in the "culture-abstract" treatment, its more limited effects in the "abstract-culture" treatment are surprisingly not much smaller than the effects of "within block" learning in the first part.

To examine whether subjects were capable of coordinating prior to learning, we look at the predicted probability of matching at the outset of the series of abstract games in the "abstract-first" treatment and culture-laden games in the "culture-first" treatment. The best model specification (Model 4) makes the predicted probability of matching at the outset equal to 0.279 for both types. By the use of the delta method (see e.g. Kmenta, 1986, p. 486), we construct a confidence interval for the predicted probability of matching in the first round (i.e. round 0). We find that the predicted probability of matching in this round is not significantly larger than 0.25 (t-test, $p<0.05$). This suggests that subjects were not able to coordinate successfully in these games prior to learning.

To see whether there is a correlation in the performance of pairs in the two types, we use a Spearman correlation test for the two treatments separately. (Because more across-type learning seems to have occurred in the "culture-first" treatment, we cannot exclude the possibility that people learned how to coordinate their actions in different ways in the two treatments.) In the "abstract-first" treatment, there is evidence of a positive correlation in the performance of subjects in the two types ($\rho=0.486$, $p<0.01$). In this treatment, the most (least) successful pairs in abstract games were also more (less) successful in culture-laden games. By contrast, there is no evidence of a correlation in the "culture-first" treatment ($\rho=-0.035$, $p=0.431$), where the most successful pairs in culture-laden games were also successful in abstract games, while the least successful pairs in culture-laden games were as much as successful in abstract games as the most successful pairs in culture-laden games were.

In both treatments, especially in the "culture-first" treatment, the performances of the least successful pairs in the first part seem to improve in the second part. By contrast, the performance of the most successful pairs in the first part seems to remain stable in the second part. (Therefore, it seems that most of the across-type learning which has occurred in the "culture-first" treatment was due to the learning abilities of the least successful pairs in the first part of the this treatment.)

This result suggests that the rules learned by the most successful pairs in the first part of both treatments were not transferable to other types. (If such rules could have been applied to other types of games, then the performance of pairs would have been higher in the second part.) Such rules did not seem to be learned by the least successful pairs, but these pairs still seem to be acquiring could acquire skills to successfully coordinate in the second part. That the greater improvement in the performance of the least successful pairs occurred in the "culture-first" treatment indicates that culture-laden games were better to teach generic coordination skills.

To test whether subjects learned from the behaviour of their co-player, rather than ignore the feedback of the other player's choice, we use a repeated random sampling procedure (see e.g. Efron and Tibshirani, 1993) which reassigns subjects to subjects within the population, calculates the average outcome within each sample, and finds the distribution of simulated outcomes for repeated random sampling. For both types and treatments, we compare the average actual outcome (see Fig. 3 and Fig. 4 in the Appendix) with the distribution of simulated outcomes, and find that the average actual outcome falls into the critical region of the distribution of simulated outcomes for abstract games ($f_{0.01} \cong 0.320 < 0.392$) and culture-laden games ($f_{0.01} \cong 0.318 < 0.369$). In other words, coordination decreases when subjects are reassigned to subjects from other pairs. The coordination of subjects within their actual pairs is supported by the learning from experience of playing the game of both subjects within a pair. Such experience is specific to the play of the game of the two subjects within the actual pairs.

The next four results come from the tests of the hypothesis of pair-specific learning.

i) Some pairs seem to exhibit a better capacity of coordinating actions. For each type, we derive the distribution of outcomes under the assumption that every pair has the same probability of matching (binomial distribution, for abstract games p=0.392; for culture-laden games p=0.369), and compare this distribution to the distribution of outcomes (see Fig. 5-6 in the Appendix) with appropriate classes aggregation (see e.g. Hogg and Tanis, 1993, p. 549). The two distributions are significantly different for abstract games (Chi-square, $p<0.05$). In culture-laden games, this difference is not statistically significant, so differences between pairs may be due to randomness.

ii) There is evidence that different pairs learned different rules.[10] For both types and treatments, we randomly reassign subjects to subjects within the populations of best-performing pairs and worse-performing pairs, find the distribution of simulated outcomes for repeated random sampling of the two groups, and compare these distributions with the average actual outcomes of the relevant samples. In abstract games, the average actual outcome is 0.526 for best-performing pairs, and 0.278 for worse-performing pairs. In culture-laden games, the actual outcome is 0.498 for best-performing pairs, and 0.267 for worse-performing pairs. Each of these outcomes falls into the critical region of the distribution of simulated outcomes for the relevant groups. (In abstract games, the critical value, at the 1% level, of the distribution of simulated outcomes is 0.189 for best-performing pairs and 0.175 for worse-performing pairs. In culture-laden games, the critical value is 0.135 for best-performing pairs and 0.175 for worse-performing pairs.) The lower performance of subjects, especially best-performing subjects, when reassigned to other subjects from the same group is

[10] We divide the population of pairs into two groups: best-performing pairs and worst-performing pairs. Best-performing pairs are pairs whose score is above the average score. Worse-performing pairs are pairs whose score is below the average score. According to this criterion, there are 27 best-performing pairs in abstract games and 26 best-performing pairs in culture-laden games. The number of worst-performing pairs in abstract games is 32. In culture-laden games, these are 33.

consistent with the hypothesis that subjects in different pairs in the two groups learn different rules. If all best-performing subjects coordinated on the same rule, then the random reassignment of "good" subjects to "good" subjects would not make a big difference to the performance of repaired subjects within this group.

iii) Best-performing pairs in both treatments appear to make use of "common features" as rules for coordination in culture-laden games more than worse-performing pairs do. For *each* best and worse-performing pair in each block, we count the number of subsequent matches on the same "common feature" (e.g. Style 1-1 in block 1, see Fig. 2 in the Appendix), and the number of subsequent matches on different features (e.g. Style 1-2, in block 1, see Fig. 2 in the Appendix). If players use "common features" as rules for coordination, then coordination will occur on the same feature in a block with frequency larger than ¼. There is evidence that this happens to best-performing pairs in all four blocks (Chi square, in block 1, 2, 4, $p<0.01$; in block 3, $p<0.05$), while the worse-performing pairs appear to use "common features" as rules only in block 2 (Chi-square, $p<0.01$) and block 4 (Chi-square, $p<0.01$).[11]

iv) Some "common features" in block 1-3 appear to be chosen more frequently than others. For *all* best and worse-performing pairs in each block, we compare the observed frequency distribution of successful matches with the expected distribution of equal frequencies. There is evidence that the proportion of best-performing pairs choosing some particular features (see Table 1 in the Appendix) is significantly larger than ¼ in block 1 (Chi-square, $p<0.01$), block 2 (Chi-square, $p<0.01$), and block 3 (Chi-square, $p<0.01$). For worse-performing pairs, the analogous proportion is significantly larger than ¼ only in block 1 (Chi-square, $p<0.01$).[12]

[11] For best-performing pairs, the frequency of successful matches on the same features is 27 in block 1 (n=38), 38 in block 2 (n=39), 16 in block 3 (n=37), 21 in block 4 (n=46). For worst-performing pairs, the frequency of successful matches is 8 in block 1 (n=19), 19 in block 2 (n=26), 6 in block 3 (n=16), 9 in block 4 (n=16).

[12] For best-performing pairs, the frequency distribution of successful matches on the four features is 6 (feature 0), 13 (feature 1), 39 (feature 2), 4 (feature 3) in block 1; 5 (feature 0), 33 (feature 1), 15 (feature 2), 11 (feature 3) in block 2; 7 (feature 0), 16 (feature 1), 12 (feature 2), 26 (feature 3) in block 3; 27 (feature 0), 19 (feature 1),

Result iii) seems to suggest that best-performing players were more capable of recognising "common features" and using these features as rules for coordination in culture-laden games.

However, there are features, for example, feature 2 in block 1 which appear to be chosen most frequently by both best and worse-performing pairs, even when (worst-performing) players do not appear to follow any particular rule. Both these pieces of evidence suggest that, while some pairs may in fact be more capable of selecting obvious rules, some patterns of coordination in the experiment may look as more natural ways of solving coordination problems.

In abstract games, there are no common features across the games within a block (see Section 3). So inferences about the rules used in this type must be speculative. But we look at the behaviour of best-performing pairs and try to infer the rule being followed within each pair using a subjective judgement. This is based on the colours of the four images within each game, in particular the colour which distinguishes every image within a game, and the actual sequences of abstract games faced by subjects. We find that the behaviour of about half the best-performing pairs can be explained by a "colour" rule, and that the most common colour rules are "blue" and "pale".

The experiment was not designed to test for primary and secondary salience. Nevertheless, the data from the questionnaire "before" the coordination games provide some clues that may be relevant to the problem of explaining how the coordination games were solved. These data are more relevant than those "after" because they are elicited before players can see what others do.

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12 (feature 2), 14 (feature 2) in block 4. For worse-performing pairs, the frequency distribution is 7 (feature 0), 12 (feature 1), 22 (feature 2), 6 (feature 3) in block 1; 11(feature 0), 19 (feature 1), 15 (feature 2), 7 (feature 3) in block 2; 10 (feature 0), 12 (feature 1), 7 (feature 2), and 10 (feature 3) in block 3; 6 (feature 0), 10 (feature 1), 15 (feature 2), 7 (feature 3) in block 4.

Table 2-5 in the Appendix is based on the data from the questionnaires for abstract games and culture-laden games in both treatments. It shows that: i) the proportion of subjects choosing the images they most like is always significantly larger than 25%; ii) the proportion of subjects choosing the images they think the other person most likes is always significantly larger than 25%; iii) the proportion of subjects choosing the images they most like is always almost significantly larger than that of subjects choosing the images they think the other person likes. In other words, players seem to choose their primary-salient and secondary-salient images, but the primary-salient images appear to be chosen more frequently than the secondary-salient ones.[13]

However, the series in Figure 5-8 show a negative trend in the proportions of subjects choosing their primary-salient images, and these proportions seem to be further declining within blocks. This is consistent with the results that there is pair-specific learning, and that some within-type learning occurs within blocks. Learning involves two players converging on a rule that picks out some features. If these features are not only "what a person likes", the proportion of primary-salient choices will decline. The choice of "personal favourites" may provide the basis of the rule that emerges. If this rule picks out features which are specific to blocks (for example, "common features" in culture-laden games), the choice of personal favourites at the start of a block may contribute to establish coordination within that block.

The data in Table 2-5 in the Appendix come from observations for best and worse-performing players. For these two categories, it appears that:

i) Best-performing pairs choose primary-salient images more than worse-performing pairs in both types and treatments. For abstract games, the proportion of best-performing

[13] The closest works to our paper are Mehta *et al.* (1994) and Bardsley *et al.* (2006). These papers report on experiments showing that people tend to coordinate on secondary-salient outcomes rather than primary-salient ones. By contrast, our results show that people at the outset and later in the experiment tend to choose primary-salient images rather than secondary-salient ones. One way of reconciling these results could make appeal to the rationality of players trying to coordinate "by salience" when no label is a focal point. The primary-salient choice can be "more rational" when no player knows what is primary-salient to others. The repetition of the game also enables players to signal their "personal favourites" to other(s).

players choosing what they most like before is 0.519 (see Table 2), while the analogous proportion of worse-performing pairs is 0.410 (see Table 3). For culture-laden games, the proportion of best-performing players is 0.589 (see Table 4), and the proportion of worse-performing pairs is 0.517 (see Table 5). (Notice that the proportion of subjects choosing the images they most like at the beginning of the sequence of tasks is larger for best-performing pairs than worse-performing pairs. Also, both best and worse-performing pairs seem to be choosing their favourite images in culture-laden games more frequently than in abstract games.)

ii) Best performing pairs have more similar tastes compared with worse-performing pairs in both types and treatments. The proportion of best-performing players who appear to like the same image as the other person before the coordination games is 0.306 in abstract games (see Table 6 in the Appendix) and 0.341 in culture-laden games (see Table 8 in the Appendix). For worse-performing pairs, this proportion is 0.230 in abstract games (see Table 7 in the Appendix) and 0.242 in culture-laden games (see Table 9 in the Appendix).

It seems, therefore, that some pairs are more successful than others because they choose primary-salient images, and/or also because they happen to have similar tastes.

The diagram in Figure 9-12 in the Appendix comes from observations of primarily salient choices of best and worse-performing pairs in both types and treatments. It shows that:

i) Best-performing pairs in abstract games choose primarily salient images more frequently than worse-performing pairs. The number of best-performing pairs where at least one player chooses his/her favourite images in more than half of the games included in the questionnaires is 19 (out of 27) (see Figure 9). The number of worse-performing pairs where at least one player chooses his/her favourite images in more than half of the games included in the questionnaires is 12 (out of 32) (see Figure 10).

ii) Worse-performing pairs in culture-laden games choose primarily salient images almost as frequently as best-performing pairs do. The number of best-performing pairs where at least one player chooses his/her favourite images in more than half of the games included in the questionnaires is 22 (out of 26) (see Figure 11). The number of worse-performing pairs where at least one player chooses his/her favourite images in more than half of the games included in the questionnaires is 21 (out of 33) (see Figure 12).

iii) Some best-performing pairs in both types seem to choose "common favourites", while others choose images which are primarily salient to their co-players (see Figure 9, 11). In abstract games, the number of best-performing pairs where both players choose their favourite images in more than half of the games included in the questionnaires is 5 (out of 19), while the number of best-performing pairs where players choose the images which are primarily salient to their co-players in more than half of the games included in the questionnaires is 14 (out of 19). In culture-laden games, 7 (out of 22) best-performing pairs choose their "common favourites" in more than half of the games included in the questionnaires, and the players in 15 (out of 22) pairs choose the images which are primary-salient to their partners.

It is possible that the best-performing pairs that chose "common favourites" in both types were luckier than others by having more similar tastes. (This would explain the difference between best and worse-performing pairs in culture-laden games.) Perhaps some of these pairs could develop rules based on "common favourites", while others simply chose their primary-salient images without learning from the choices of their co-players. Instead, the best-performing pairs that choose the primary-salient images to their co-players have probably less similar tastes, but succeed in developing rules based on the primary-salient images to their co-players. A similar argument can apply to those best-performing pairs which do not appear to choose any personal favourite. These might be players who, instead of learning a rule based on the primary-salient images of their co-players, turn on rules based on e.g. their *beliefs* about the primary-salient choices to their co-players, or properties of the games which are unrelated to personal favourites.

All these observations throw light on how players, particularly best-performing pairs, coordinate in abstract games and culture-laden games. But a useful check on the validity of these responses is to test for consistency of "likings" between questions "before" and "after" the coordination tasks. Table 6-9 shows that there is some correlation between the images that players like "before" and "after" playing the games. The fact that there is consistency, for both best and worse-performing pairs, suggests that these responses are informative about some stable characteristic of the players, which gives credibility to our interpretation of choices as evidence of "personal favourites". Also, it suggests that the difference between best and worse-performing pairs is not in their "aesthetic attunement", but in their choice of "personal favourites" in reasoning about coordination, and coincidence of "likings" at the start of the game.

5. Conclusions

The evidence of behaviour from earlier one-shot, coordination experiment is well-known, and the conclusions following the results of these experiments have been widely accepted as models of coordination. However, the question of how coordination is achieved in such one-shot, coordination problems has not been explored. As far as we know, our study is the first attempt to investigate experimentally how people learn the cultural rules of salience used in these coordination experiments (and real-life coordination problems).

Our results show that people are capable of learning rules over a class of different but related aesthetic games. A comparison with games with cultural content and "common features" shows that coordination is not only explained by the use of rules built-into the design of the experiment but also the learning of rules which have emerged in the experiment. We also find evidence that rules are learned by experience of pairs of players within blocks of games of the same type, and that experience with games of different types can effectively support the coordination of players by the use of generic coordination skills (where culture-laden games are better for teaching generic coordination skills).

We have also tested a variety of hypothesis which may account for the nature of learning in our games. The results show the following: 1) learning is pair-specific, which may explain why salience is culturally specific; 2) some pairs exhibit a better capacity of coordinating actions, which may be due to either "fortune" (i.e. when two players hit on the same rule) and/or a player's skills (where a better player can teach rules and/or generic coordination skills to the other player); 3) people seem to start playing by choosing their favourite images, then they occasionally converge on rules based on "common favourites", develop rules close to one person's favourite images, or rules where the choice of favourite images of no player appears to be involved. Our findings provide evidence of the emergence of cultural rules of salience in coordination problems with aesthetic labels. This is a contribution to the explanation of the origin of the cultural notions of salience which seem to be responsible of coordination in previous experiments.

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Appendix

Figure 1: Abstract games, block 1.

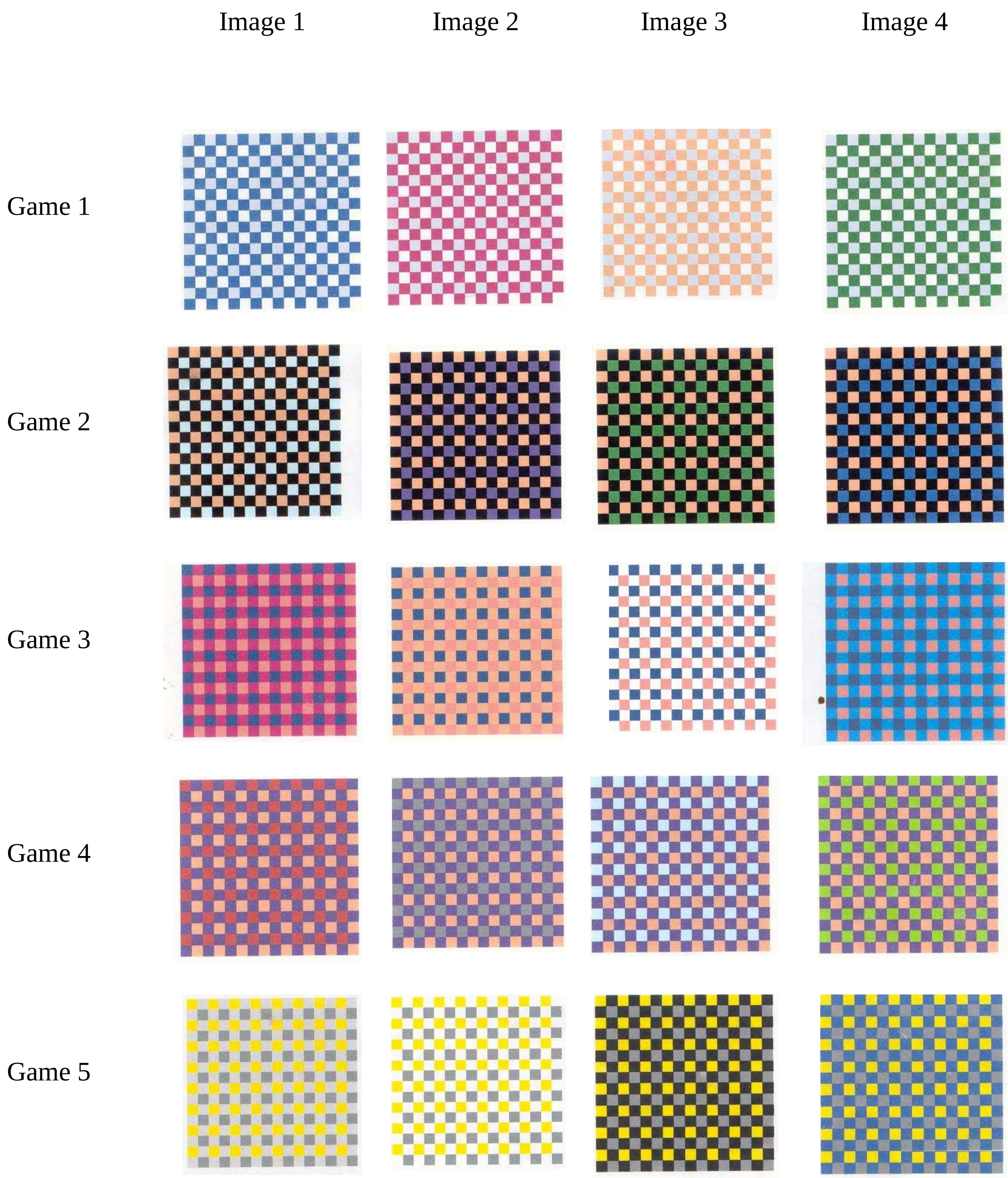


Figure 1 (continue): Abstract games, block 2.

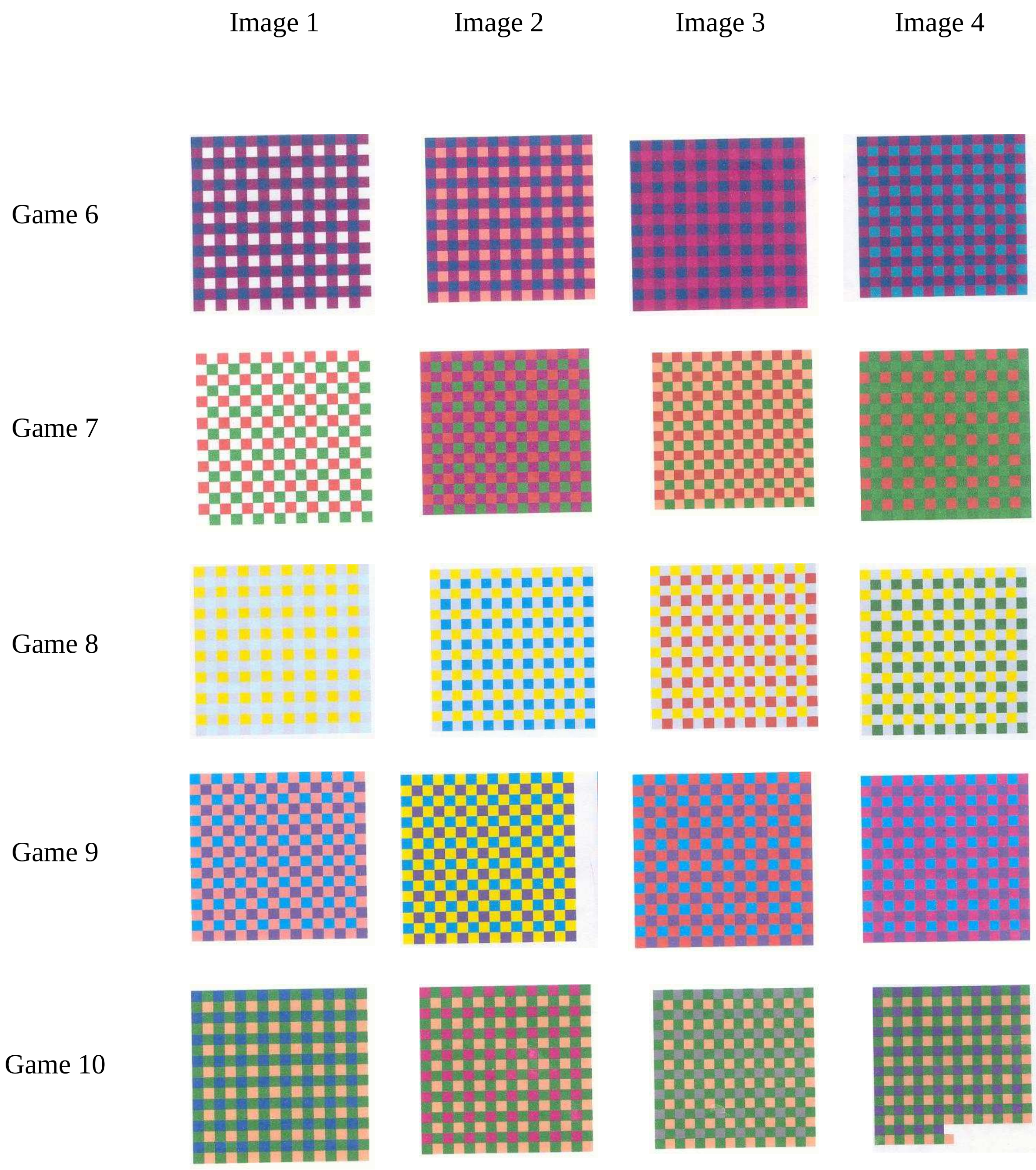


Figure 1 (continue): Abstract games, block 3.

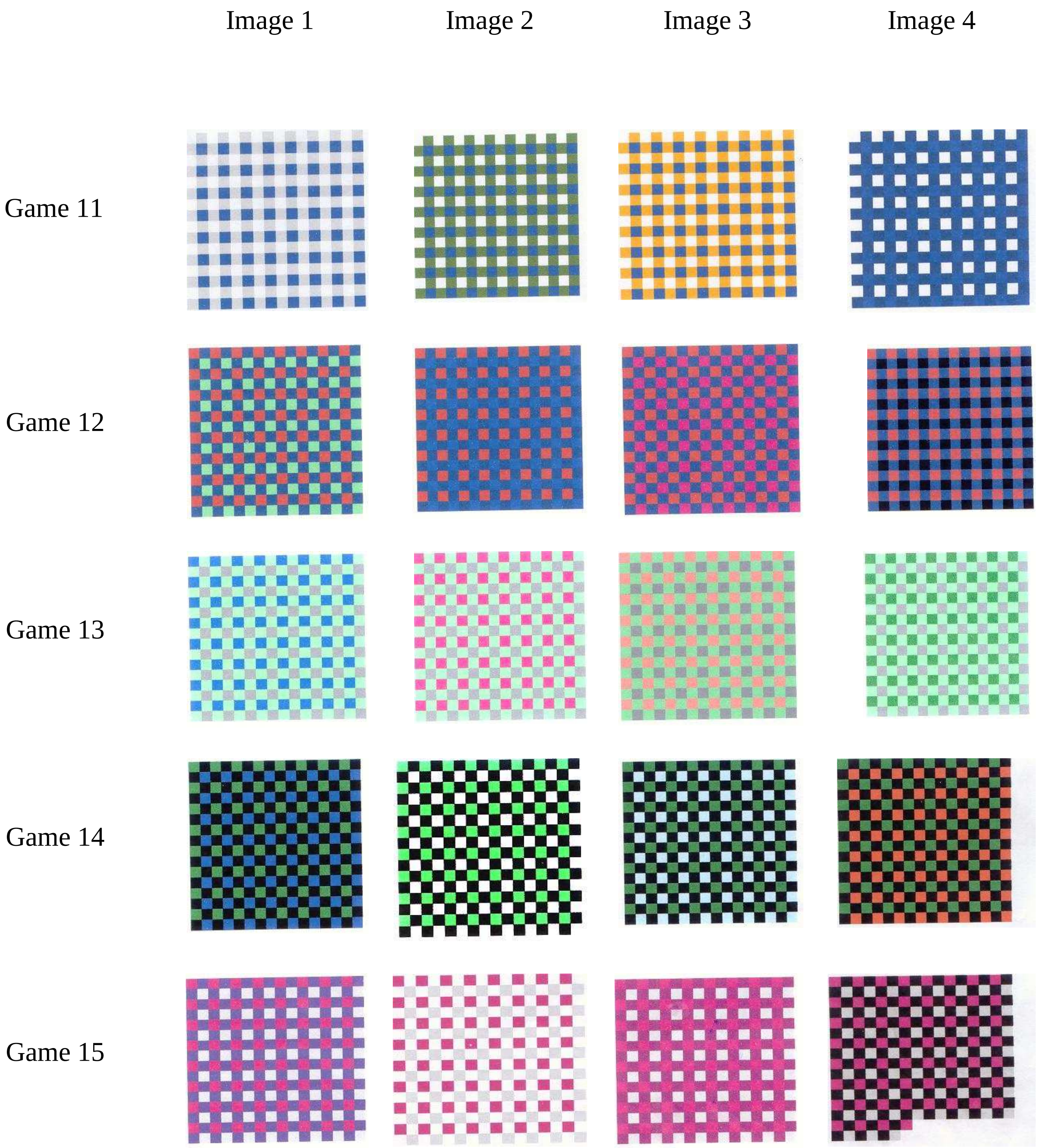


Figure 1 (continue): Abstract games, block 4.

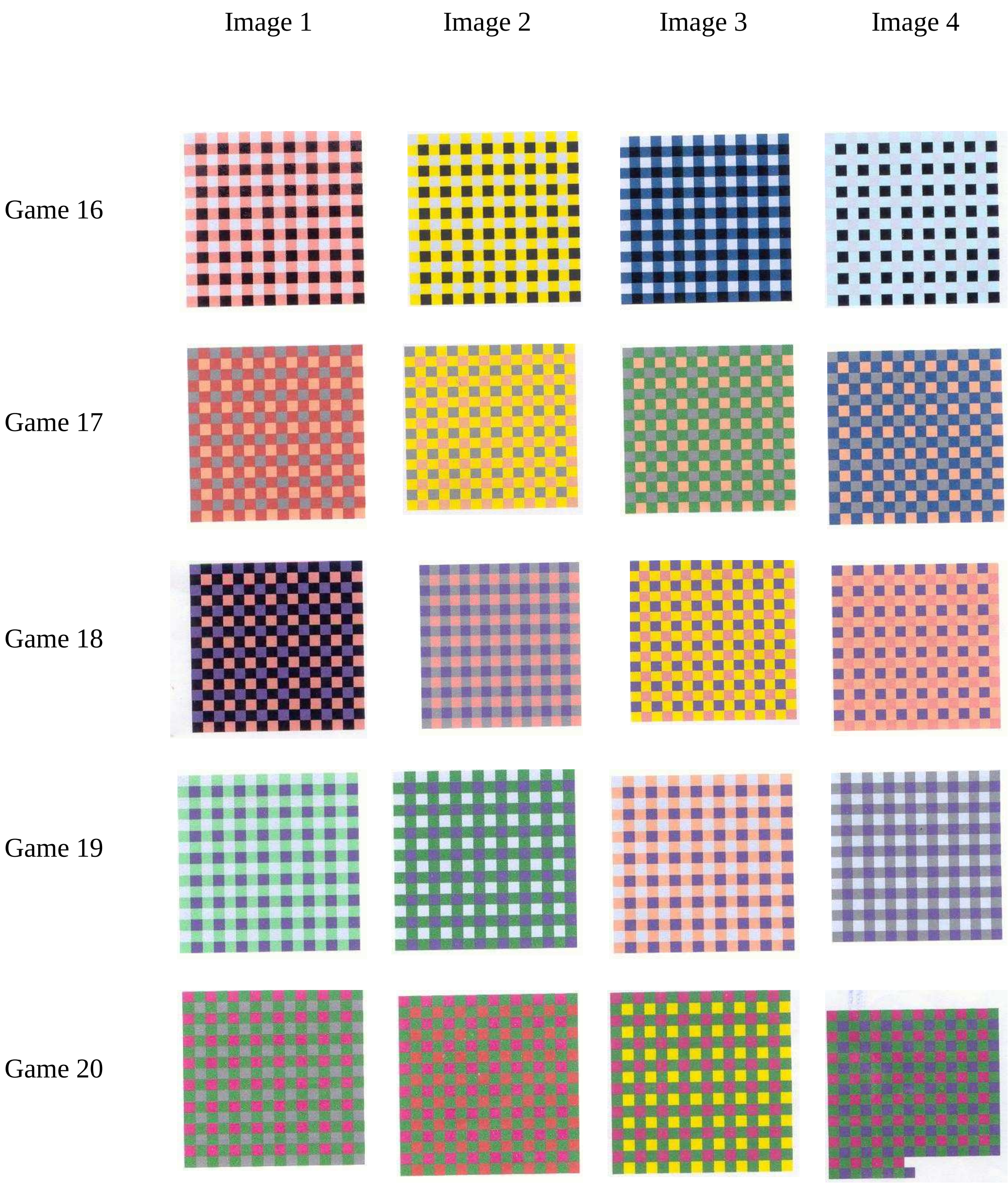


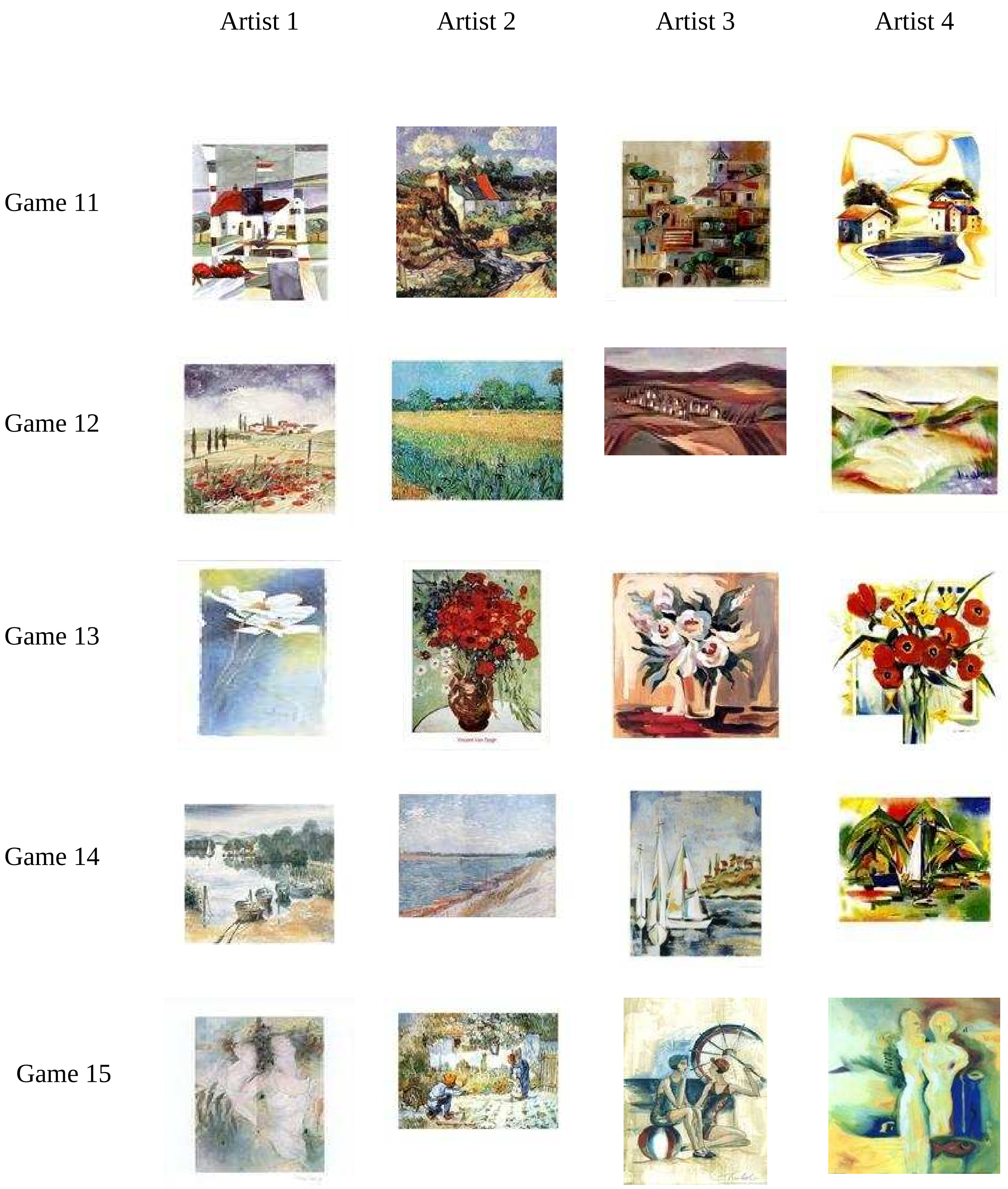
Figure 2: Culture-laden games, block 1 (fabrics).

Note: Source: http://www.reproductionfabrics.com/

Figure 2 (continue): Culture-laden games, block 2 (fabrics).

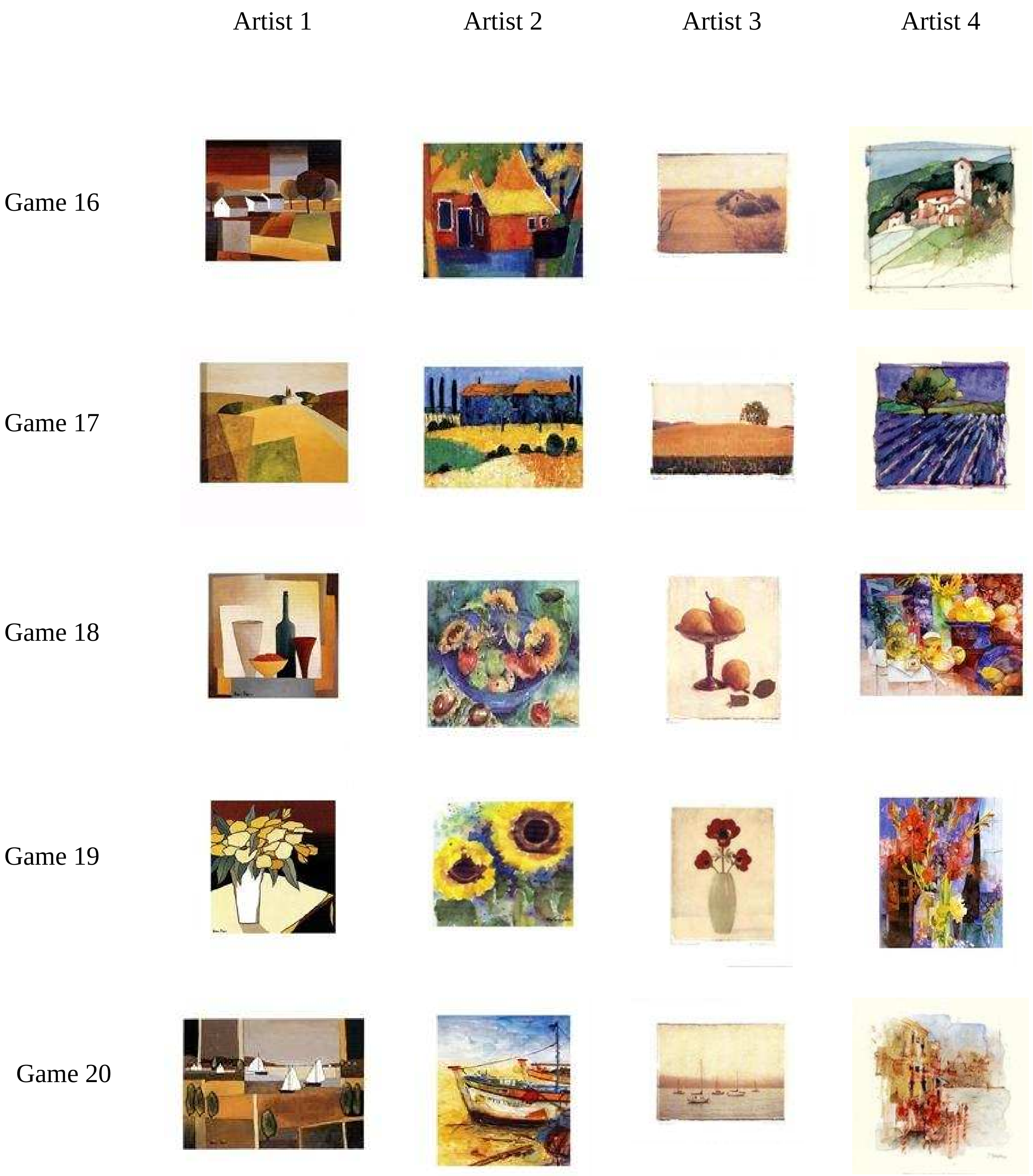
Note: Source: http://www.reproductionfabrics.com/

Figure 2 (continue): Culture-laden games, block 3 (paintings).



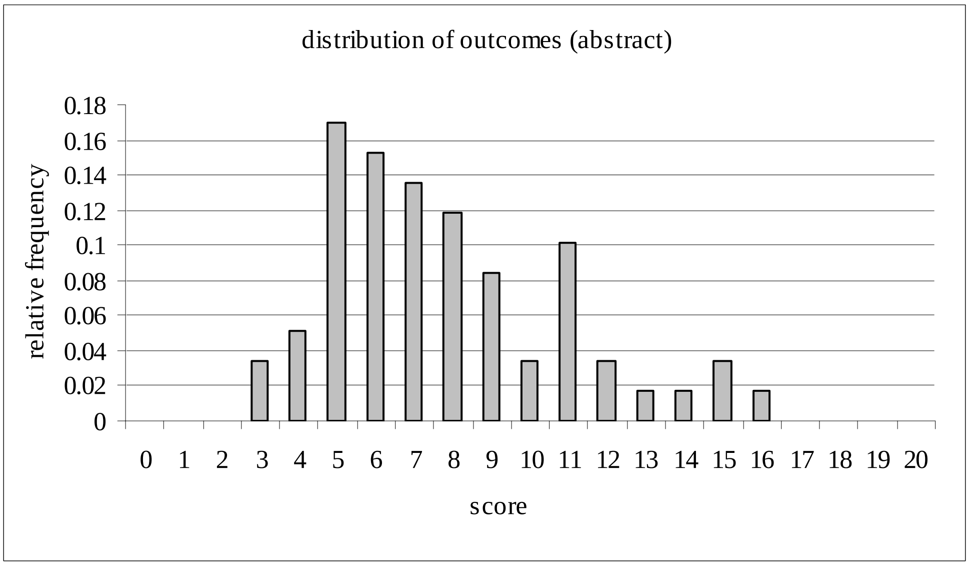
Note: Source: http://www.art.com/

Figure 2 (continue): Culture-laden games, block 4 (paintings).



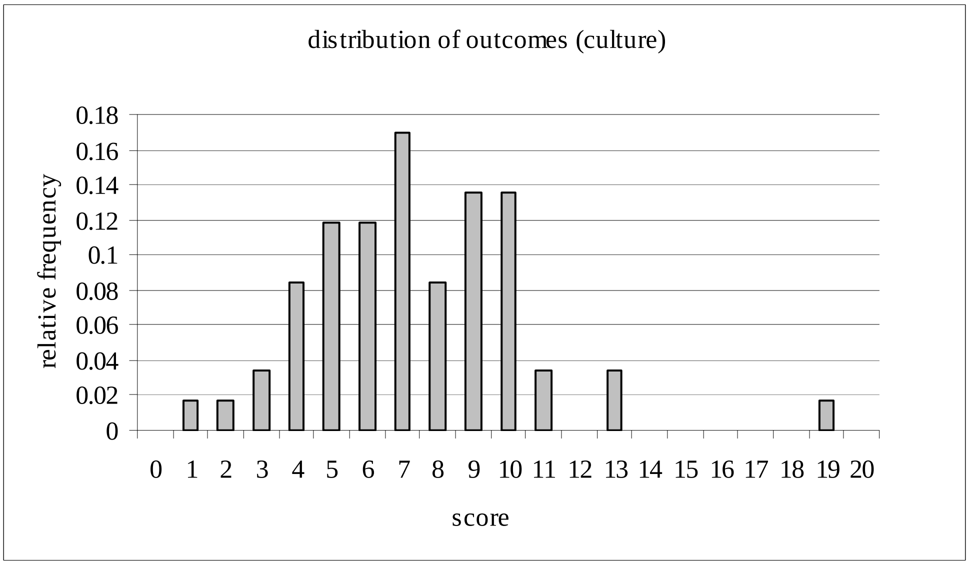
Note: Source: http://www.art.com/

Figure 3 – Distribution of outcomes in abstract games (all treatments)



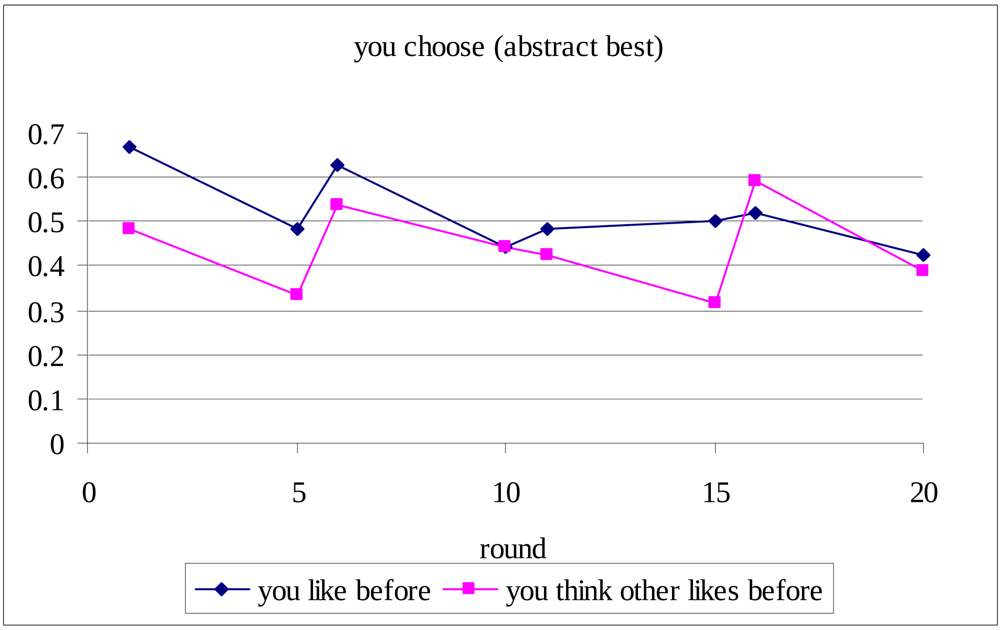
Note: Mean score=7.831; median score=6.796; lowest score=3; highest score=16

Figure 4 – Distribution of outcomes in culture-laden games (both treatments)



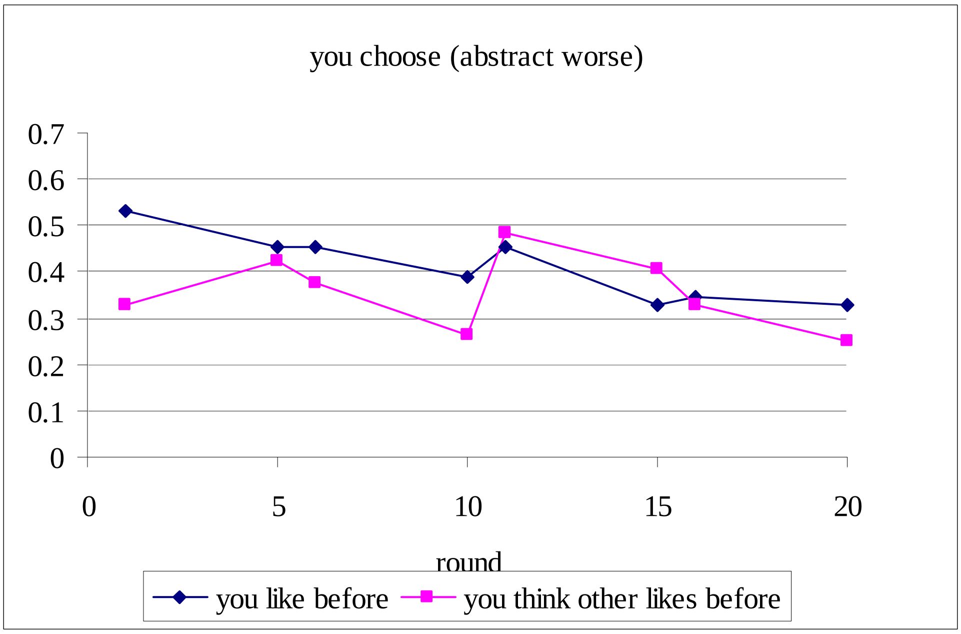
Note: Mean score=7.373; median score=6.896; lowest score=1; highest score=19

Figure 5: Best-performing players in abstract games using primary salience and secondary salience



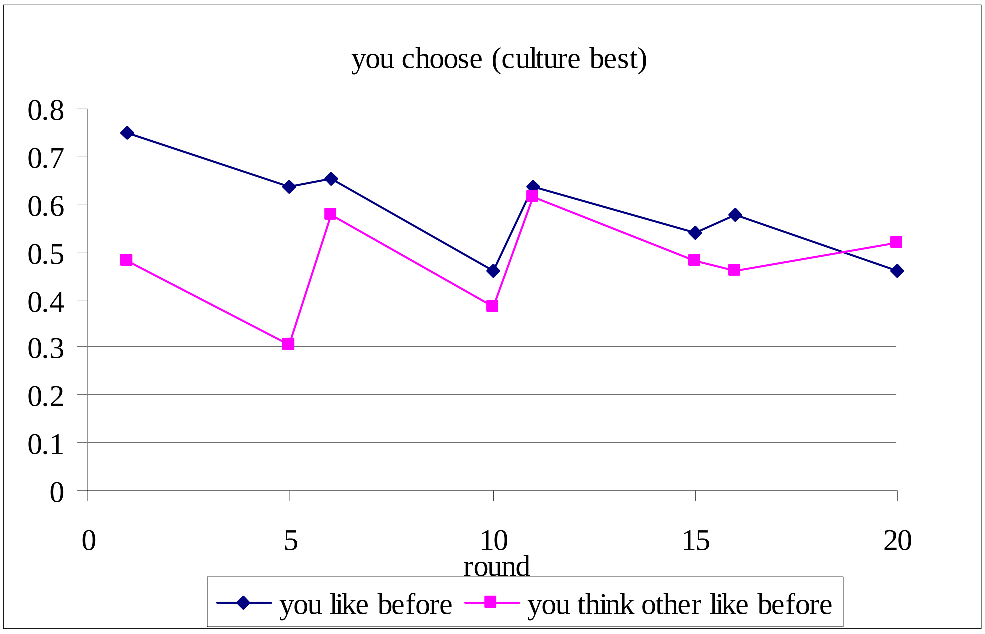
Note: “you like"=primary salience (average=0.519), "other likes"=secondary salience (average=0.440). Random choice=0.25.

Figure 6: Worse-performing players in abstract games using primary salience and secondary salience



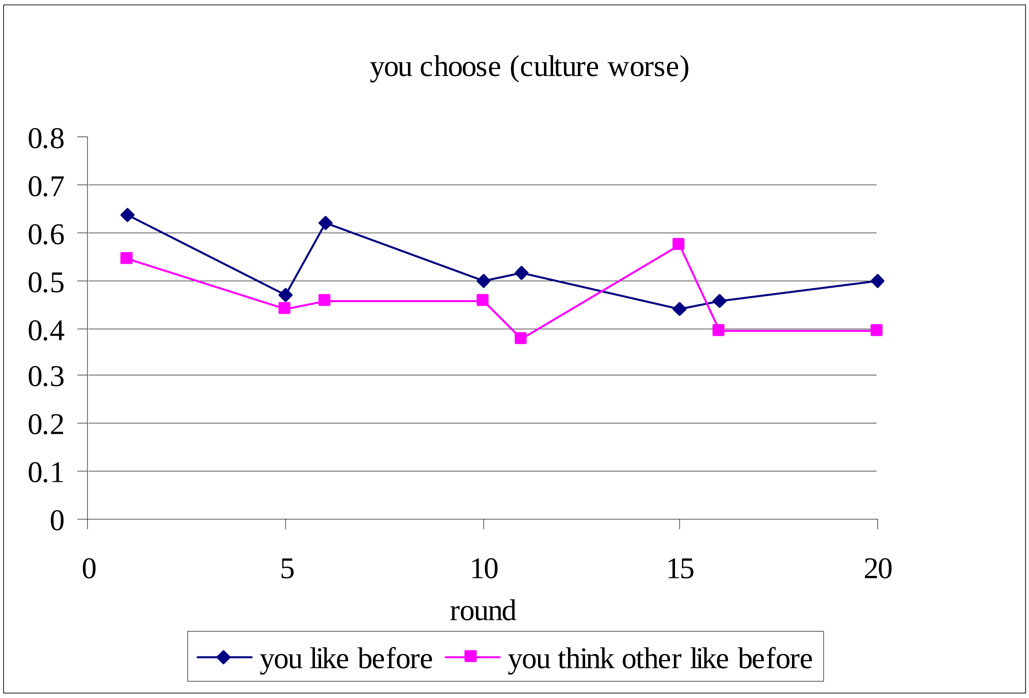
Note: “you like"=primary salience (average=0.410), "other likes"=secondary salience (average=0.357). Random choice=0.25.

Figure 7: Best-performing players in culture-laden games using primary salience and secondary salience



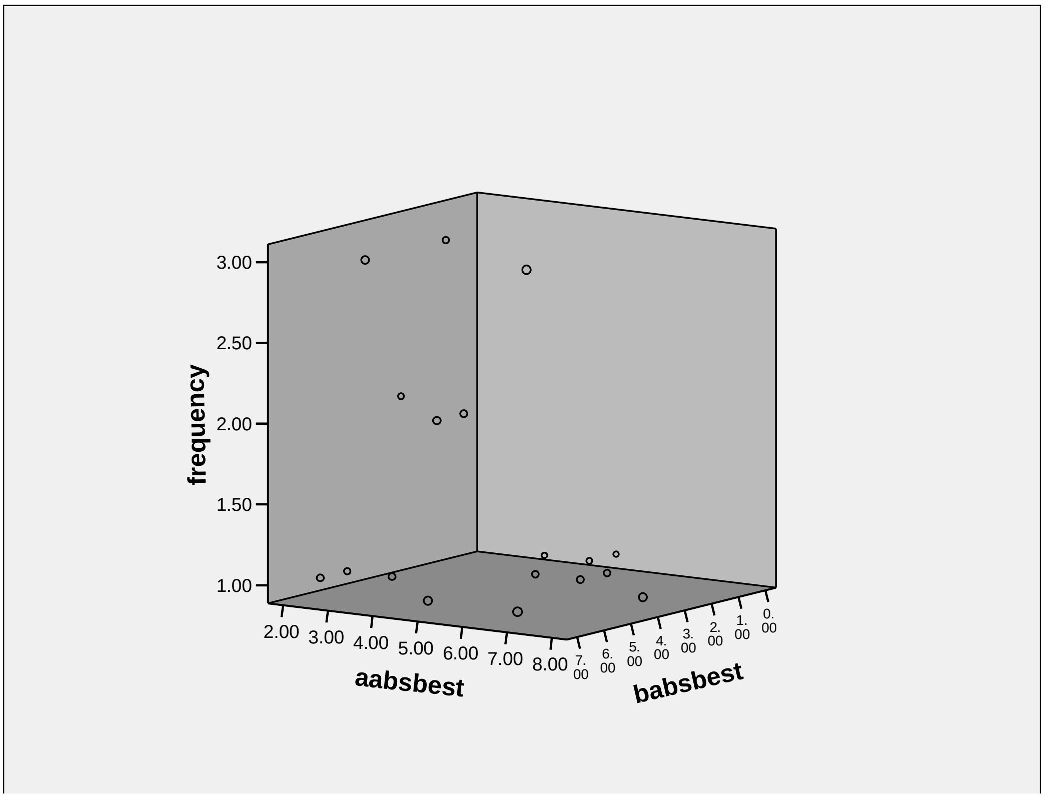
Note: “you like"=primary salience (average=0.589), "other likes"=secondary salience (average=0.478). Random choice=0.25.

Figure 8: Worse-performing players in culture-laden games using primary salience and secondary salience



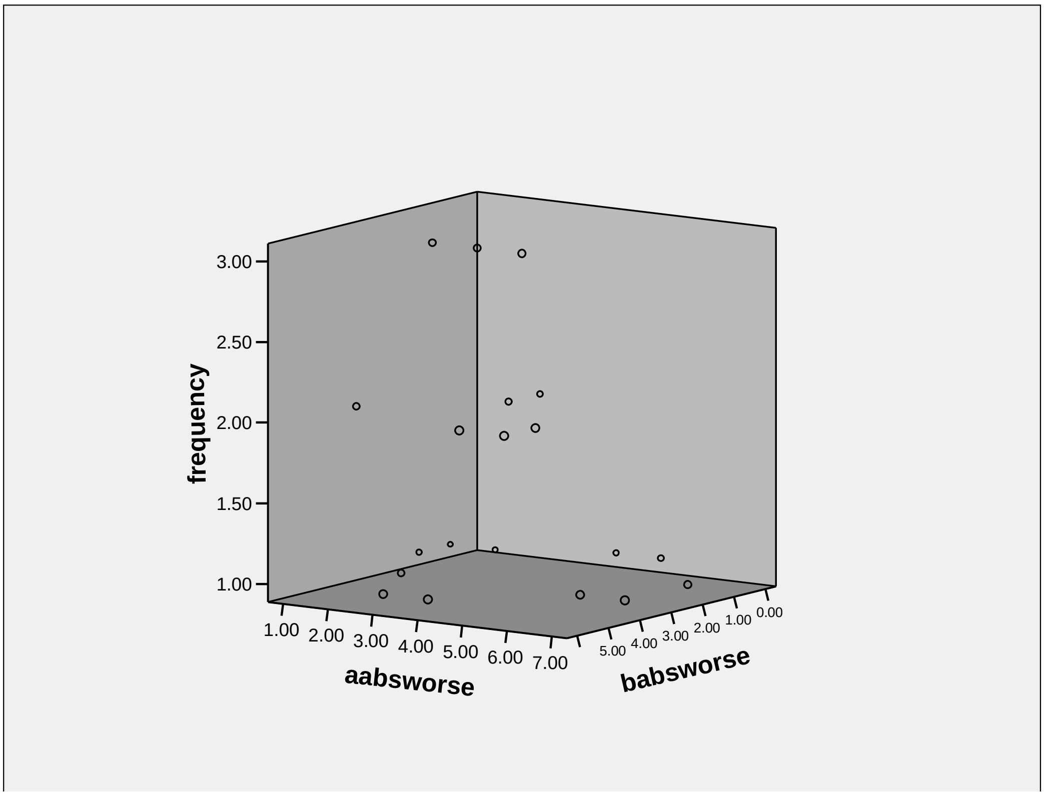
Note: “you like"=primary salience (average=0.517), "other likes"=secondary salience (average=0.455). Random choice=0.25.

Figure 9: Players choosing primary-salient images in best-performing pairs in abstract games



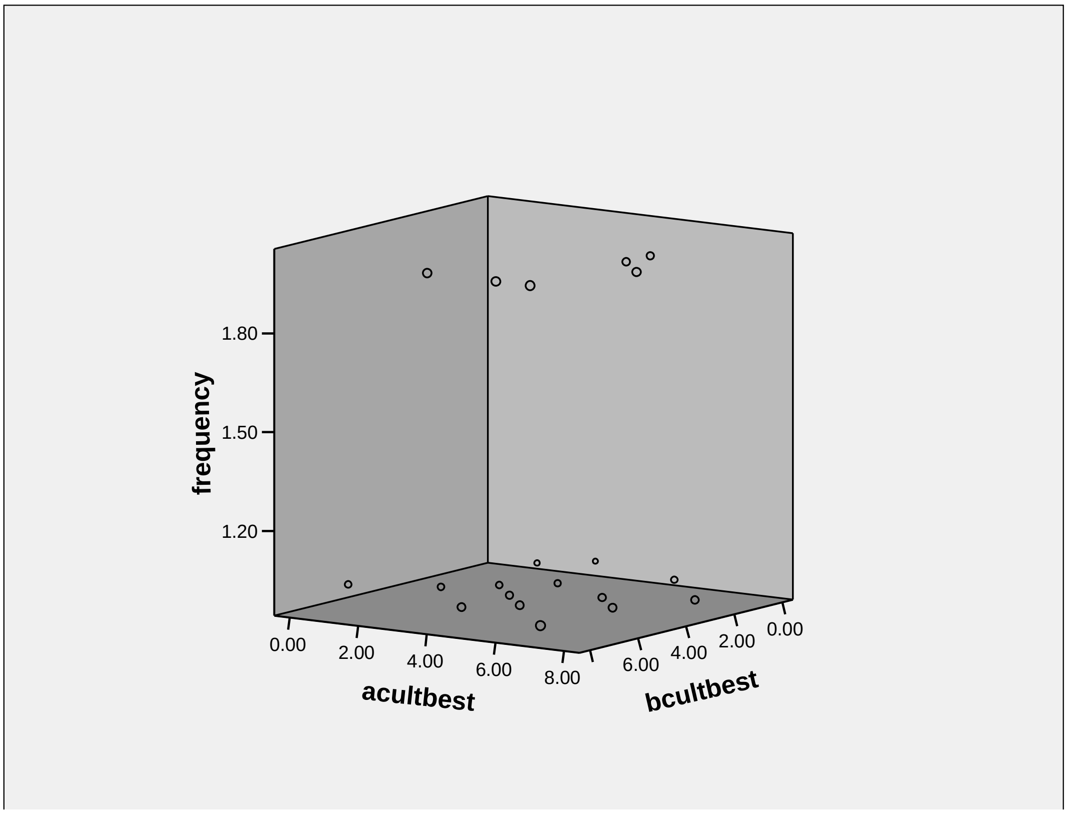
Note: “aabsbest”=player “a”, “babsbest”=player “b”. Number of primary-salient choices of players in best-performing pairs in abstract games. Number of abstract games in questionnaires=8.

Figure 10: Players choosing primary-salient images in worse-performing pairs in abstract games



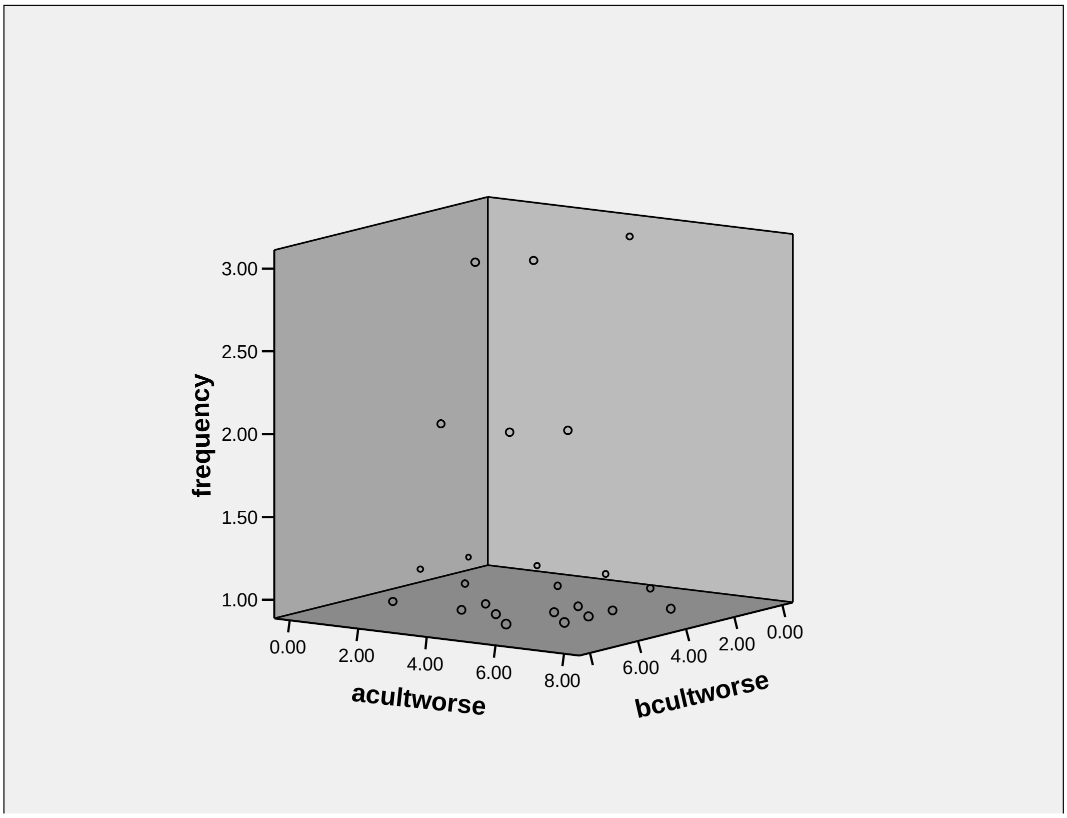
Note: “aabsworse”=player “a”, “babsworse”=player “b”. Number of primary-salient choices of players in worse-performing pairs in abstract games. Number of abstract games in questionnaires=8.

Figure 11: Players choosing primary-salient images in best-performing pairs in culture-laden games



Note: “aabsbest”=player “a”, “babsbest”=player “b”. Number of primary-salient choices of players in best-performing pairs in culture-laden games. Number of culture-laden games in questionnaires=8.

Figure 11: Players choosing primary-salient images in worse-performing pairs in culture-laden games



Note: “aabsbest”=player “a”, “babsbest”=player “b”. Number of primary-salient choices of players in worse-performing pairs in culture-laden games. Number of culture-laden games in questionnaires=8.

Table 1 – “Common features” in culture-laden games

Best-performing pairs

Number of matches	Block	Use common features	Dominant feature
62	1	yes**	2
64	2	yes**	1
61	3	yes	3
72	4	yes**	None

Note: Summary of the results from test of hypothesis about coordination on “common features” in culture-laden games, and most frequently chosen features in culture-laden games for best-performing pairs. The double asterisk denotes significance at the 1% level.

Worse-performing pairs

Number of matches	Block	Use common features	Dominant feature
47	1	no	2
52	2	yes**	None
39	3	no	None
38	4	yes**	None

Note: Summary of the results from test of hypothesis about coordination on “common features” in culture-laden games, and most frequently chosen features in culture-laden games for worst-performing pairs. The double asterisk denotes significance at the 1% level.

Table 2: Best-performing players in abstract games choosing according to personal favourites

ABSTRACT		Best-performing pairs								
you choose	round	1	5	6	10	11	15	16	20	average
you like before		0.667	0.481	0.630	0.444	0.481	0.500	0.519	0.426	0.519
other like before		0.481	0.333	0.537	0.444	0.426	0.315	0.593	0.389	0.440

Note: "you like"=primary salience, "other likes"=secondary salience; "before"=based on data from the questionnaire before the coordination tasks; "after"=based on data from the questionnaire after the coordination tasks. Proportion of subjects using primary salience=0.519 (standard dev.=0.086); proportion of subjects using secondary salience=0.440 (standard dev.=0.096);

Table 3: Worse-performing players in abstract games choosing according to personal favourites

ABSTRACT		Worse-performing pairs								
you choose	round	1	5	6	10	11	15	16	20	average
you like before		0.531	0.453	0.453	0.391	0.453	0.328	0.344	0.328	0.410
other like before		0.328	0.422	0.375	0.266	0.484	0.406	0.328	0.250	0.357

Note: "you like"=primary salience, "other likes"=secondary salience; "before"=based on data from the questionnaire before the coordination tasks; "after"=based on data from the questionnaire after the coordination tasks. Proportion of subjects using primary salience=0.410 (standard dev.=0.074); proportion of subjects using secondary salience=0.357 (standard dev.=0.080);

Table 4: Best-performing players in culture-laden games choosing according to personal favourites

CULTURE		Best-performing pairs								
you choose	round	1	5	6	10	11	15	16	20	average
you like before		0.750	0.635	0.654	0.462	0.635	0.538	0.577	0.462	0.589
other like before		0.481	0.308	0.577	0.385	0.615	0.481	0.462	0.519	0.478

Note: "you like"=primary salience, "other likes"=secondary salience; "before"=based on data from the questionnaire before the coordination tasks; "after"=based on data from the questionnaire after the coordination tasks. Proportion of subjects using primary salience=0.589 (standard dev.=0.100); proportion of subjects using secondary salience=0.478 (standard dev.=0.099);

Table 5: Worse-performing players in culture-laden games choosing according to personal favourites

CULTURE		Worse-performing pairs								
you choose	round	1	5	6	10	11	15	16	20	average
you like before		0.636	0.470	0.621	0.500	0.515	0.439	0.455	0.500	0.517
other like before		0.545	0.439	0.455	0.455	0.379	0.576	0.394	0.394	0.455

Note: "you like"=primary salience, "other likes"=secondary salience; "before"=based on data from the questionnaire before the coordination tasks; "after"=based on data from the questionnaire after the coordination tasks. Proportion of subjects using primary salience=0.517 (standard dev.=0.074); proportion of subjects using secondary salience=0.455 (standard dev.=0.072);

Table 6: Similarity of tastes and aesthetic attunement of best-performing pairs in abstract games

ABSTRACT		Best-performing pairs								
a: you like before	round	1	5	6	10	11	15	16	20	average
b: you like before		0.370	0.333	0.333	0.259	0.333	0.259	0.333	0.222	0.306
a: you like after		0.537	0.630	0.759	0.481	0.574	0.667	0.611	0.574	0.604

Note: "a"=player, "b"=opponent"; "before"=questionnaire before the coordination tasks; "after"=the questionnaire after the coordination tasks. Proportion of subjects with shared tastes p=0.306. Proportion of subjects with stable preferences p=0.604.

Table 7: Similarity of tastes and aesthetic attunement of worst-performing pairs in abstract games

ABSTRACT		Worse-performing pairs								
a: you like before	round	1	5	6	10	11	15	16	20	average
b: you like before		0.344	0.313	0.250	0.281	0.188	0.125	0.219	0.125	0.230
a: you like after		0.594	0.672	0.672	0.547	0.703	0.641	0.484	0.578	0.611

Note: "a"=player, "b"=opponent"; "before"=questionnaire before the coordination tasks; "after"=the questionnaire after the coordination tasks. Proportion of subjects with shared tastes p=0.230. Proportion of subjects with stable preferences p=0.611.

Table 8: Similarity of tastes and aesthetic attunement of best-performing pairs in culture-laden games

CULTURE		Best-performing pairs								
a: you like before	round	1	5	6	10	11	15	16	20	average
b: you like before		0.308	0.538	0.346	0.308	0.269	0.154	0.269	0.538	0.341
a: you like after		0.808	0.827	0.712	0.558	0.769	0.635	0.712	0.635	0.707

Note: "a"=player, "b"=opponent"; "before"=questionnaire before the coordination tasks; "after"=the questionnaire after the coordination tasks. Proportion of subjects with shared tastes p=0.341. Proportion of subjects with stable preferences p=0.707.

Table 9: Similarity of tastes and aesthetic attunement of worst-performing pairs in culture-laden games

CULTURE		Worse-performing pairs								
a: you like before	round	1	5	6	10	11	15	16	20	average
b: you like before		0.212	0.182	0.364	0.152	0.152	0.364	0.212	0.303	0.242
a: you like after		0.818	0.758	0.742	0.788	0.758	0.727	0.697	0.697	0.748

Note: "a"=player, "b"=opponent"; "before"=questionnaire before the coordination tasks; "after"=the questionnaire after the coordination tasks. Proportion of subjects with shared tastes p=0.242. Proportion of subjects with stable preferences p=0.748.