

## The Nature of Saliency: An Experimental Investigation of Pure Coordination Games

Author(s): Judith Mehta, Chris Starmer and Robert Sugden [AER, 1994]

Presented by: Tasnim Murad

### □ Main theme:

- Reporting an experimental investigation of Thomas Schelling's (1960) concept of a focal point.
- First objective is to replicate these experiments more formally, to discover how successful people are at playing pure coordination games than they would have chosen at random.
- Second objective is to discriminate experimentally between some alternative explanations-whether the preference depends on secondary saliency or Schelling Saliency.

### □ Some concepts:

#### *Focal point*

- The study confined attention to pure coordination games for two players. Player 1 chooses a strategy from the set  $\{S_{11}, \dots, S_{1n}\}$ , where  $n \geq 2$ ; player 2 chooses a strategy from the set  $\{S_{21} \dots S_{2n}\}$ . Let the chosen strategies be  $S_{1g}, S_{2h}$ , if  $g = h$  each player receives one unit of utility; if  $g \neq h$ , each receives zero. If both players choose the same label from  $\{l_1 \dots \dots l_n\}$ , each receives one unit of utility; otherwise, each receives zero.
- The study concentrated on one-shot games because it is in these games that the role of focal points is most clearly defined. In a one-shot pure coordination game, the problem of coordinating actions looks intractable.
- Schelling (1960) argues that ordinary human players of one-shot pure coordination games tend to choose those strategies whose labels are salient. An equilibrium which results from such choices is a focal point.

#### *Primary Saliency*

- One simple hypothesis which might conceivably explain Schelling's (1960) results is that players' responses are nonrational.
- For any particular player and any particular coordination game, there is some (possibly stochastic) process that brings one of the labels to the player's mind. We shall say that this label has primary saliency.
- The primary-saliency hypothesis is that each player chooses the strategy whose label has primary saliency for her.
- Among people with common experiences and cultural backgrounds, we might expect some correlation between what has primary saliency for one person and what has primary saliency for another.
- Thus, merely as an unintended result of nonrational play, it might expect the extent of coordination to be greater than would occur if players chose their strategies at random.

### ***Secondary Salience***

- A second possible hypothesis is that each player in a coordination game maximizes expected utility, relative to her beliefs about her opponent's choice of strategy, but expects her opponent to play according to primary salience.
- On this secondary-salience hypothesis, each player will choose the strategy whose label she believes most likely to have primary salience for her opponent. This strategy has secondary salience for the first player.
- The hypotheses of secondary and higher-order salience may be interpreted as hypotheses of bounded rationality, in contrast to the nonrationality of primary salience.
- We should expect that players who chose according to secondary salience would be more successful at coordinating with one another than they would have chosen according to primary salience.
- If a coordination game is played by many people drawn from some given population, and if those people choose according to secondary salience, we should expect the ranking of choices in terms of frequency to be similar to the ranking of the corresponding labels in terms of primary salience.

### ***Schelling Salience***

- The central idea seems to be this: when someone is playing a pure coordination game, she will look for a rule of selection which, if followed by both players, would tend to produce successful coordination.
- Instead, players choose according to Schelling salience, then these two rankings may be quite different, although they need not be. Differences are particularly likely to occur when two or more labels have primary salience for approximately equal proportions of the population

### **□ The Experiment**

- The experiment was designed to discriminate between (i) primary salience and (ii) secondary and Schelling salience. It recruited 178 subjects, mostly undergraduate students, on the campus of the University of East Anglia.
- The subjects were divided at random into two groups, group C (for "coordinating") and group P (for "picking"); there were 90 subjects in group C and 88 in group P. The groups took part in the experiment in separate rooms, so that neither group knew what the other was being asked to do.
- Subjects were not allowed to communicate with one another. Every subject was given exactly the same set of 20 instructions or "questions." A typical question was Schelling's "Write down any positive number."
- For group P, the rule is same but no obligation to be the answer similar to her pair.
- For group C the objective is to give the same answer as the person with whom she has been paired. She will score one point for every question for which her answer is exactly the same as the other player's.
- In event, subjects were paid £0.62 per point. For group P six prizes were allocated, four of £10 and one each of £20 and £30, would be distributed by lottery.

❖ The point of this experimental design is that the responses of group P provide evidence about which responses have primary salience in the population from which group C is drawn. By comparing the responses of the two groups, we can test whether subjects in group C are more successful at coordinating than they would have been, had they answered according to primary salience. If they are more successful in this sense, we may reject the hypothesis that coordination is solely the result of primary salience.

➤ In order to perform such a test, we need a measure of the extent of coordination in the responses of a group of subjects, each of whom plays the same coordination game.

This is measured by what we shall call the coordination index,  $c$ . Let  $N$  be the number of subjects in a group and let  $k$  be the number of distinct responses given by those subjects to a particular question. Let  $m_1, \dots, m_k$  be the numbers of subjects giving each of the responses  $1, \dots, k$ . Then, for the relevant question, the coordination index is given by

$$c = \sum_{i=1}^k (m_i/N)[(m_i-1)/(N-1)]$$

➤ The value of  $c$  ranges from 0 to 1. If subjects choose randomly from among  $s$  possible responses, the expected value of  $c$  is  $1/s$ . Since we wished to find out whether subjects who were trying to coordinate could achieve a higher value of  $c$  than ones who were "just picking,"

➤ Thus, it tried to design each question so that at least two responses would be likely to have primary salience for a significant number of subjects.

The first 10 questions were open ended like birth date, name of a flower, color, city etc. Rule of closeness for question 11-16 and rule of odd-one-out were expected to follow by the subjects. but, since nothing in the framing of the questions seemed to suggest a rule of closeness or "odd-one-out" interpretation, it was not expected that this rule would be overwhelmingly attractive to subjects who were not trying to coordinate.

## □ Results

❖ Were group C subjects more successful at coordinating than they would have been had they responded in the same way as group P subjects?

➤ For questions 11-20, which were less open-ended, we show all responses which were given by at least 10 percent of subjects. In describing responses to question 11-16, (L, L, R, R) denotes "circles 1 and 2 assigned to the left-hand square; circles 3 and 4 assigned to the right-hand square," and similarly for other combinations of L and R. The response which is implied by the rule of closeness is also indicated.

➤ In describing responses to questions 17-20, (2,5) denotes "circle divided along spokes 2 and 5," and similarly for other combinations of numbers. The response which we have regarded as the "odd one out" is also indicated.

❖ Were group C subjects more successful at coordinating than they would have been had they responded in the same way as group P subjects? It is obvious from Table 2 that the answer is a clear "yes."

- For questions 11-20, it seems reasonable to divide possible responses into three classes. Class I contains just one response: the one that is prescribed by the rule of closeness (in questions 11-16) or by the odd-one-out rule (in questions 17-20). These are the responses which, before carrying out the experiment, it was expected to be most salient in the Schelling sense.
- Class II contains all those responses, not in class I, that divide the circles equally between the two squares (questions 11-16) or divide the circle into two equal parts (questions 17-20). Class III contains all other responses.
- Table 3 presents subjects' responses in this form. 30.1 percent of group P's responses fall into class 1, 37.8 percent into class II, and 32.0 percent into class III.
- However, this skewed distribution of responses is much more marked for group C (which has 50.2 percent of responses in class I, 38.0 percent in class II, and 11.8 percent in class III).
- For every question except number 13, the hypothesis that the two distributions are drawn from a single population can be rejected ( $p < 0.05$  for a chi-square test of goodness of fit).

### **Secondary Salience or Schelling Salience?**

The experiment was not designed to discriminate between secondary salience and Schelling salience.

- On question 1 (years), 25.0 percent of group P subjects gave their years of birth; because of the significance of this private form of primary salience, and because of the similarity of age among subjects, the modal response in group P was "1971." The current year (1990) was given by only 6.8 percent of group P subjects; but in group C, 61.1 percent of subjects responded "1990."

Thus, the current year has Schelling salience-whether it has primary salience or not.

- This study finds failure of questions 11-20 to discriminate between secondary salience and Schelling salience. Class I was the most frequent response for Group C and even for group-P subjects might tend to use the rule of closeness and the odd-one-out rule.
- Group C used the features of salience hypothesis too. Thus, the distinctions between primary, secondary, and Schelling salience then become less significant.

### **□ Conclusion:**

- Our results confirm that players of pure coordination games are more successful at coordination than they would have been had they ignored all labelling and thus chosen strategies at random.
- Two alternative hypotheses which might account for such success: "secondary salience" and "Schelling salience." This experiment was not designed to allow to discriminate between these two hypotheses by formal statistical tests.
- However, the results suggest that Schelling salience may be playing a significant role. A major priority must now be to construct a more formal theory of Schelling salience which will generate specific hypotheses that can be tested experimentally.