# A Field Study of Social Learning

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Abstract: We present a field study of social learning. The setting is a pair of adjacent fast food restaurants serving very similar cuisine whose main clientele are the students at a nearby major university. We observed whether an uninformed customer's choice of restaurant depends on the relative queue lengths at the two restaurants. Observations were made at two separate observation periods, the start of the academic year, when a significant proportion of customers had little or no experience with either restaurant, and the middle of the year, when most customers already had previous experience with the restaurants. It is found, consistent with the social learning hypothesis, that relative queue length has a significant effect at the first period but not at the second.

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## 1. Introduction

Understanding the extent to which rational agents infer and act upon information from the behavior of others is essential for the analysis of many important economic phenomena. In particular, the literature on social learning by rational agents, beginning with the seminal papers of Welch (1992), Bikhchandani, Hirshleifer and Welch (1992, 1998), and Bennerjee (1992), shows that such learning can lead to herding or information cascades.

In the classical cascade paradigm, a sequence of decision makers, with common preferences, faces a choice between one of two options, A and B, and each agent receives an independent private binary signal about which choice provides the higher payoff and observes all her predecessors' choices. In this example, once one of the options is observed to have been chosen at least twice more than the other, it is optimal for all subsequent agents to choose it even if this choice contradicts their own signal. Thus all available information is not aggregated and, consequently, all agents may wind up making the wrong choice.

For example, if the first two agents choose action A, this reveals two signals in favor of A (assuming that the second person will follow her own signal). Then, each subsequent agent thinks that A is better even if her own signal favors B and thus also chooses A. More generally, when action and signal spaces are finite and each signal is imperfect, rational agents eventually herd, ignoring their own information and imitating others. Various studies have shown that these results may be modified or reversed if action or signal spaces are sufficiently "rich" or if agents are incompletely informed about predecessors' choices or the order in which they were taken. For example, Eyster and Rabin (2009) have shown that when agents have limited rationality and believe that predecessors act only on the basis of their own signal (or put "excessive" weight on their own signal), social learning can lead to worse outcomes than if agents only act on their own information.

These theoretical predictions have received support in the laboratory. A pioneering study supporting the information cascade models is Anderson and Holt (1997); see also Anderson and Holt (1996), Hung and Plott (2001); Çelen and Kariv (2004, 2005) and Alevy, Haigh and List (2007). Yet, the basic prediction of social learning has received little support in the field, which is what we do in the current paper.

The setting is a pair of adjacent fast food restaurants in Israel serving the same type of food whose main clientele are the students of a nearby major university. The restaurants are privately owned and are not part of a chain. In this setting we observed whether an uninformed customer's choice of restaurant reflects the choices of previous customers, as social learning theory would suggest. Specifically, consumer behavior was observed during two separate observation periods. At the first observation period, at the beginning of the academic year, as we argue below, a significant proportion of customers had little or no experience with either restaurant and thus had reason to look to other (presumably more experienced) customers' choices to learn about the relative qualities of the two stores. By contrast, at the second observation period, the overwhelming majority of customers already had considerable experience with the restaurants and were therefore less likely to be influenced by others' choices. Thus this setting allows us to distinguish between genuine social *learning* and merely imitative "copycat" behavior (or the desire to dine in the company of others as Becker (1991) has suggested). Specifically, the social learning hypothesis is supported if imitative behavior is more pronounced during the first period (when consumers have a greater need for information) than in the second period (when they do not).

### *What are consumers Learning?*

In the theoretical and experimental studies cited above, it is generally assumed that consumers have identical preferences and differ only with respect to their information. This does not seem to be the case in our setting. In particular, at the second observation period, when presumably most or all consumers' preferences are already well formed, they divide between the two restaurants (instead of herding at only one of them), suggesting that experienced consumers have different preferences between them. Instead, we conceive of inexperienced consumers at the first observation period as learning about their own tastes. The following is a schematic way to think of this. Suppose any individual has an ex ante preference for restaurant A with the probability p, where p is an unknown parameter with a prior of 0.5 common to all consumers (i.e., an inexperienced consumer with no additional information considers it equally likely that she will prefer either restaurnat). If such an individual has no additional information, she will choose one restaurant at random. Suppose she knows that a fraction alpha of consumers is informed (i.e., has already learned which store they prefer), and that this information is correlated with her preferences. Then if an uninformed consumer is Bayesian and observes that more consumers choose restaurant A than restaurant B, she should update her posterior of p to be >0.5.

Thus, in our empirical setting, a new freshman with no previous experience with these restaurants has a prior of 0.5 that she will prefer restaurant A. She also knows that about 2/3 of students are already informed about their own preference (this is a three-year college). So if she observes more students choosing A than B, then (assuming she does not perfectly distinguish between freshmen and older students), her posterior probability about p should be updated to $p>0.5$. It follows that at the first observation period, an inexperienced (Bayesian) freshman who observes a longer queue at restaurant A than B will infer that her own preference is more likely to be for store A and join the queue for store A. By contrast, an experienced student's choice will not depend on relative queue lengths. Therefore, if such a student has learned that she prefers restaurant B she will choose it even if the queue for store A is longer. This implies that, at the beginning of the year, when restaurant A has a longer queue than B, a randomly selected consumer is more likely to go to restaurant A than if restaurant B has a longer one (and similarly for restaurant B when it has a longer queue).

This can lead to herding behavior on the part of inexperienced students. Suppose an inexperienced student observes a customer at restaurant A and no customers at restaurant B. The customer at restaurant A may be an inexperienced consumer who chose store A by chance, or an experienced consumer who actually has some private information regarding the relative quality of the restaurants. So it is rational for the new student to choose A as well. By contrast, at the second observation period, almost all students are probably already experienced. Therefore the queue length should have much less influence on a consumer's choice.

To support the intuition, consider music purchase. Say that you decide to familiarize yourself with Cuban music, about which you have very little knowledge. A good first step might be to go online and see what the most popular artists/albums are--and start there. With time, you will probably develop your own taste and learn more about your own preferences, and will have less need for others' recommendation (Salganik, Dodds and Watts, 2006).

## 2. Detailed Description of the Field study

The two fast food restaurants are situated literally back to back (see photos) in an outdoor food court located right outside the main entrance to the Bar Ilan University Campus near Tel Aviv – a large University in Israel with a student body of almost 20,000. The location of the food court, Nve Ilan is a quiet residential area, not very centrally located. Each of the restaurants serves both falafel and shwarma sandwiches in pita bread, and are popular with the University students. The restaurants are also frequented by local residents, but the majority of patrons are students (and some faculty and administrative staff). As can be seen from the photos, the restaurants are outwardly very similar, have almost identical décor and signs and the food and service are very similar. As is typical of such restaurants, the store-front of each restaurant has a shelf containing bowls of condiments which patrons can add to their pita sandwiches.

Importantly, there is a common seating area in front of the restaurants which is used by patrons of both restaurants. This rules out the possibility that choice of restaurant is dictated by the desire to dine in larger company. Directly adjacent to these restaurants is an upscale café (of the Aroma chain) and a Thai fast food restaurant.

***Data collection***

The data collection procedure was very simple. Research assistants were seated in the seating area in front of the restaurants during the key hours, 11 AM to 3 PM, which are the busiest hours. Whenever a new customer approached one of the restaurants to be served, the number of customers standing in front of each restaurant (just prior to her arrival) was recorded. These included customers waiting to be served as well as customers who had already been served and were standing at the storefront eating their sandwiches or adding condiments to them. Then the restaurant chosen by the new customer was recorded. If several customers arrived in a group and chose the same restaurant, they were recorded as a single observation, unless they went to different restaurants, in which case they were recorded as separate observations.

It is important to note that the waiting time is very short in both restaurants; In 77% of the cases we measured, a customer was served within less than a minute (even if there were four or five customers in line), and in only 6% of the cases were customers made to wait more than 2 minutes for service. This suggests that shortening waiting time is probably not a significant consideration in consumer choice.

We observed customer behavior during two different time periods. The first period was during the first two weeks of the academic year, in October 2009. This is the time when about a third of the students – the freshmen - are new to the campus and presumably most of them have never eaten at the restaurants before.

The second observation period was in the middle of the academic year (specifically mid April), when all potential student have already had plenty of recent experience with the restaurants and probably formed fairly strong beliefs and preferences.

In other words, on average customers come to the field with more informative private signals at the second observation period than at the first one. Theory would therefore predict less 'information cascading' during the second than the first time period**.**

## 3. Results

An observation is the choice of the restaurant by a newly arrived customer, presented as a function of the number of people in queue A and in queue B at the time of her arrival. The number of observations in each queue situation is presented in Tables 1a for the beginning of the year and 1b for the middle of the year. The total number of observations is 1,324 for the beginning of the year and 1,153 for the middle of the year.

The percentage of observations in which restaurant A was chosen as a function of the number of people in restaurant A and B is presented in Table 2a for the first observation period and in Table 2b for the second period.

Recall that our purpose is to determine whether the difference between the number of customers in each queue affects consumer choice. Figure 1 presents this data. At the beginning of the year, 366 (63%) out of 580 of arriving customers went to A when there were more customers in restaurant A,. When there were more customers in B, only 189 (40%) out of 478 went to A. A binomial test of proportions reveals that the difference is statistically significant ($z$=7.64, $p$<.001). At the end of the year, the numbers are 192 (49%) out of 389 who go to A when there are more people in A, and 202 (47%) out of 431 who do so when there are more people in B. The difference at the end of the year is not statistically significant ($z$=.71, $p$=.48). Thus the data supports the social learning hypothesis.

Figure 2 presents the fraction of new customers which chose restaurant A, as a function of difference between the number of customers in each queue, for the two observation periods. The figure shows that effect of the difference in queue length is more pronounced at the first observation period.

To more formally test whether the trend shown in Figure 2 is statistically significant, we ran a logit regression where the dependent variable gets the value 1 if restaurant A is chosen and zero if store B is chosen. The independent variables are *Additional, period* and an interaction variable, *Additional•period*. The variable *Additional* measures the effect of an additional customer at the queue for restaurant A on customer choice. *Period* is a dummy variable which equals 0 for observations at the first period and 1 for observations at the second period. *Additional•period* is the interaction effect of these variables (their product). The marginal effects associated with the variables in the regression are listed in Table 3a for different base values of A-B, where A-B is the difference between the number of customers at restaurant A and the number at B. Thus *Additional* measures the marginal effect of an additional customer at A on the probability of choosing store A at the first observation period while the sum of *Additional* and the interaction variable *Additional•period,* measures the effect of an additional customer at the second period. The marginal effects of *Additional* and the interaction variable are both highly significant (*p* values of less than .01). The table shows that for all listed values of A-B, an additional customer increases the probability of choosing restaurant B by between about 3.4 percent to about 4.8 percent at the first period. In sharp contrast, the sum of *Additional* and the interaction variable is only about -0.001 in all cases. Thus an additional customer has virtually no effect at the second period.

Table 3b gives the results of the same regression when the dependent variable is the probability of choosing store B as a function of the difference B-A. The results are very similar to those in Table 3a. Thus we conclude that the difference in the number of customers has a highly significant effect at the first period but a negligible effect at the second period. As argued above, we view these results as evidence in support of social learning.

## 4. Conclusion

In this paper we present evidence in support of the economic theory of social learning. In our empirical setting, uninformed consumers' preferences are hypothesized to be correlated with those of other, more informed consumers. As predicted by theory, we find that social learning is important at the initial stage, when new consumers are poorly informed about their preferences between different products. At this stage, such a consumer uses the observed choices of other consumers as a source of information about her preferences. Once she has gained sufficient personal experience, she ignores these outside signals. Hence the simple social interactions in our setting seem to be consistent with the theoretical model.

As the development of social networks accelerates the flow of information in society, understanding social learning becomes increasingly important. Nevertheless, there is little research testing the social learning hypothesis outside of the laboratory. It is thus encouraging that our results offer strong support for the theory in a real world setting.

| | | # in queue-B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **# in queue A** | **0** | 106 | 79 | 62 | 38 | 20 | 13 | 1 | 1 |
| | **1** | 101 | 69 | 68 | 30 | 17 | 2 | 6 | |
| | **2** | 84 | 60 | 47 | 33 | | 24 | 10 | 1 |
| | **3** | 39 | 31 | 36 | 25 | 33 | 3 | 3 | |
| | **4** | 26 | 17 | 28 | 24 | 18 | 25 | 4 | 5 |
| | **5** | 13 | 2 | 28 | 11 | 20 | 1 | | |
| | **6** | 5 | 3 | 3 | 9 | 2 | 2 | | |
| | **7** | 1 | | 8 | 5 | | | 3 | |
| | **8** | 5 | | 6 | 5 | | | | |
| | **9** | 3 | | | | | | | |

| | | # in queue-B | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **# in queue A** | **0** | 143 | 71 | 49 | 45 | 22 | 6 | 4 | 7 | 3 | 4 | |
| | **1** | 75 | 88 | 46 | 39 | 10 | 6 | 4 | 7 | 4 | | |
| | **2** | 31 | 52 | 61 | 7 | 10 | 8 | 5 | 4 | 2 | | |
| | **3** | 15 | 28 | 28 | 19 | 17 | 9 | 3 | 4 | 2 | 1 | 1 |
| | **4** | 17 | 18 | 14 | 13 | 16 | 9 | | 2 | 2 | 3 | 1 |
| | **5** | 1 | 4 | 9 | 3 | 2 | 2 | 7 | | 1 | | |
| | **6** | 7 | 5 | 4 | 6 | 2 | 4 | 3 | 5 | | | |
| | **7** | 5 | 8 | 8 | 2 | 2 | 4 | 3 | | 1 | | |
| | **8** | 2 | | | 6 | 1 | | 1 | | 1 | | |
| | **9** | | | | 1 | 1 | 2 | | | | | |
| | **10** | | | | | | | 1 | 1 | 2 | 1 | |

Table 1a (top figure, beginning of year) and 1b (bottom figure, end of year): Number of observations as a function of the number of people in each queue. For example, in Table 1a we have 60 observations in which when the new person approached the restaurants there were 2 people in queue A and 1 in queue B.

| | | # in queue-B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| # in queue A | 0 | 58 | 46 | 39 | 21 | 60 | 31 | 0 | 0 |
| | 1 | 59 | 58 | 56 | 27 | 35 | 100 | 83 | |
| | 2 | 57 | 53 | 68 | 30 | | 33 | 70 | 0 |
| | 3 | 59 | 61 | 61 | 52 | 33 | 67 | 67 | |
| | 4 | 88 | 53 | 0 | 75 | 83 | 8 | 100 | 0 |
| | 5 | 69 | 100 | 82 | 36 | 65 | 0 | | |
| | 6 | 100 | 100 | 1000 | 33 | 100 | 100 | | |
| | 7 | 0 | | 63 | 60 | | | 100 | |
| | 8 | 100 | | 100 | 60 | | | | |
| | 9 | 33 | | | | | | | |

| | | # in queue-B | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| # in queue A | 0 | 53 | 48 | 53 | 40 | 55 | 50 | 75 | 57 | 100 | 75 | |
| | 1 | 52 | 57 | 43 | 49 | 50 | 50 | 25 | | 0 | | |
| | 2 | 42 | 52 | 61 | 57 | | 88 | 60 | 50 | 50 | | |
| | 3 | 33 | 43 | 54 | 63 | 29 | 33 | 33 | | 50 | 0 | 0 |
| | 4 | 47 | 50 | 57 | 62 | 44 | 44 | | 50 | 50 | 67 | 0 |
| | 5 | 100 | 50 | 33 | 67 | 0 | 0 | | | 0 | | |
| | 6 | 43 | 60 | 100 | 67 | 100 | 75 | | | | | |
| | 7 | 40 | | 50 | 0 | | | 67 | | 100 | | |
| | 8 | 0 | | | 17 | | | | | 100 | | |
| | 9 | | | | 100 | 100 | 50 | | | | | |
| | 10 | | | | | | | 100 | 0 | 50 | 0 | |

Table 2a (top figure, beginning of year) and 2b (bottom figure, end of year): Percentage of observations that ended up with the person choosing restaurant A as a function of the number of people in each queue.

| A-B | (1) *Additional* | (2*) period* | *(3) Additional period* |
|---|---|---|---|
| -5 | 0.041*** (0.003) | 0.025 (0.017) | -0.042* (0.006) |
| -4 | 0.044*** (0.005) | 0.027 (0.018) | -0.045*** (0.007) |
| -3 | 0.046*** (0.005) | .0286 (.019) | -0.048*** (0.008) |
| -2 | 0.048*** (0.006) | 0.030 (.019) | -0.049*** (0.009) |
| -1 | 0.0488*** (0.007) | 0.030 (0.020) | -0.050*** (0.009) |
| 0 | 0.0486*** (0.007) | 0.030 (0.020) | -0.050*** (0.009) |
| 1 | 0.047*** (0.006 | 0.030 (0.020) | -0.049*** (0.009) |
| 2 | 0.045*** (0.006) | 0.029 (0.019) | -0.047*** (0.008) |
| 3 | 0.043*** (0.00485) | 0.027 (0.018) | -0.044*** (0.007) |
| 4 | 0.034*** (0.004) | .026 (0.017) | -0.041*** (0.006) |
| 5 | 0.036*** (0.003) | 0.023 (0.016) | -0.037*** (0.005) |

Table 3a: The marginal effects associated with the variables in the logit regression for different base values of A-B, where A-B is the difference between the number of customers at restaurant A and the number at B. *Additional* measures the marginal effect of an additional customer at B on the probability of choosing store B at the first observation period while the sum of *Additional* and the interaction variable *Additional• period,* given in column 4, measures the effect of an additional customer at the second period. Standard errors are in parentheses. Three asterisks indicate a *p* value of less than one percent.

| B-A | (1) Additional | (2) period | (3) Additional period |
|---|---|---|---|
| -5 | 0.036<br>(0.003) | 0.023<br>(0.016) | 0.037<br>(0.005) |
| -4 | 0.040***<br>(0.004) | 0.026<br>(0.017) | -0.041***<br>(0.006) |
| 0.-3 | 0.0430***<br>(0.005) | 0.027<br>(0.018) | -.0443***<br>(0.007) |
| -2 | 0.0456***<br>(0.006) | 0.029<br>(0.019) | -0.047***<br>(0.008) |
| -1 | 0.0475***<br>(0.006) | 0.030<br>(0.020) | -0.049***<br>(0.009) |
| 0 | (0.049)***<br>(0.007) | 0.030<br>(0.020) | -0.050***<br>(0.009) |
| 1 | 0.0488***<br>(0.007) | 0.030<br>(0.020) | -0.050***<br>(0.009 |
| 2 | 0.048***<br>(0.006) | 0.030<br>(0.020) | -0.049***<br>(0.009) |
| 3 | 0.046***<br>(0.006 | 0.029<br>(0.019) | -.0478***<br>(0.008) |
| 4 | 0.044***<br>(0.005) | 0.027<br>(0.018) | -0.045***<br>(0.007) |
| 5 | 0.041***<br>(0.004) | 0.025<br>(0.017) | -0.043***<br>(0.006) |

Table 3b: The marginal effects associated with the variables in the logit regression for different base values of B-A. *Additional* measures the marginal effect of an additional customer at B on the probability of choosing store B at the first observation period while the sum of *Additional* and the interaction variable *Additional•period,* given in column 4, measures the effect of an additional customer at the second period. Standard errors are in parentheses. Three asterisks indicate a *p* value of less than one percent.

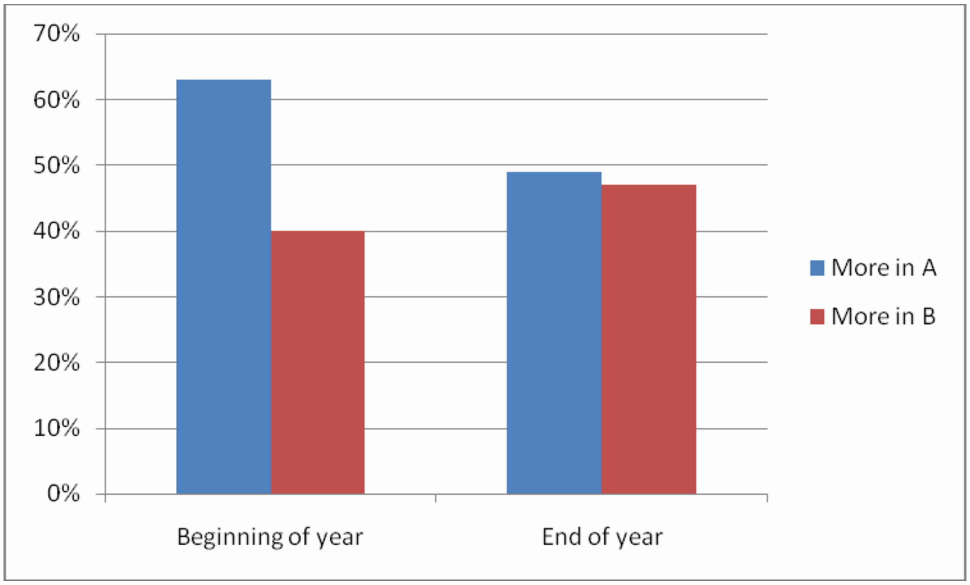


Figure 1: The percantage of cusomers going to restaurant A depending on whether there were more or less costumers in it, and during the beginning and the end of the year.

Where the next person goes as a function of Number in (A - B)
Fraction of people going to A
1
0.5
0
-5
-4
-3
-2
-1
0
1
2
3
4
5
# in A-B
Beginning of year
End of year



Views of the Two Adjoining Fast Food Restaurants

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