Foraging Strategies and Personality

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Introduction

Herrnstein's (1961) Matching Law establishes that in an individual foraging task (one forager, *n* locations), participants divide their time in proportion to the food income available in each location. This "probability matching" is observed in animals (Gallistel et al., 2007) and humans (e.g., Bliss, Gilson, & Deaton, 1995; Koehler & James, 2010). Probability matching does not maximize reward, leading researchers to ask what factors affect strategy choice. West and Stanovich (2003) showed that adults using a "maximizing" strategy (i.e., spending most of their time in the most productive zone) had higher cognitive abilities than individuals employing matching. Likewise, Koehler and James (2010) suggest that matching is a heuristic that comes to mind easily, but when asked to deliberate over alternatives individuals are more likely to choose a better strategy, i.e., maximizing. Furthermore, Derks and Paclisanu (1967) found that matching emerges around age 6, while younger children maximize. A third potential strategy option would be to adopt no strategy at all, spending time equally between the two zones, which would be referred to as "chance" strategy.

Although previous studies have focused on the behavioral patterns exhibited in a foraging task, few have investigated how other factors, like personality traits or social environment, may be related to strategy choice. **Here we investigate (a) what strategies (i.e., matching, maximizing, or chance) preschoolers and adults employ in a novel computerized "foraging" task, (b) whether shyness/fear is related to strategy choice, (c) whether strategy and or shyness/fear are related to reward obtainment, (d) and whether behavior differs when more than one individual is foraging in the same environment.**

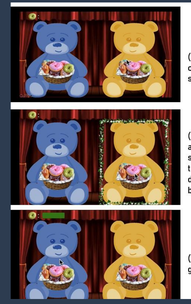
Methods

Participants: For the individual foraging task, data collection is ongoing, with plans for 25 adults and for 25 children to participate. Thus far, five adults (age range=18-22, 3 female) and five children (with a parent observing) (2 of these children were dropped due to failure to complete the experiment) (age range=3.2-3.6, 1 female) have participated. For an analogous group foraging task, data was collected in 2017 (vanMarle, Seok, and Billingsly) and was reanalyzed to focus on the behaviors of individuals within the task, in which sixteen children (age range= 2.5-5, 11 female) participated as a group.

Procedure: For the individual task, test sessions took place individually over Zoom. Parents of children and adult participants completed the Rothbart Temperament Questionnaires for Fear and Shyness (Rothbart et al., 2001, Evans & Rothbart, 2007), and then children and adults played a 15-minute computer game in which they hovered the cursor over the location they thought would be "rewarded" next, in an attempt to garner the most rewards (Figure 1). Rewards were delivered in an unpredictable concurrent VI schedule and reward ratios vary (1:1, 2:1, 5:1, twice each) by session. A single participant ran in six 90-second sessions. The more productive location was counterbalanced within subjects. (Figure 1)

In the group task, sessions took place within the participants' preschool classroom, wherein they were freely allowed to move inside a testing area divided into two colored end zones separated by a neutral zone. Rewards were distributed on the same VI schedule (with counterbalancing), but rewards consisted of 20 pennies that were divided evenly between all individuals in the zone at the time of the reward. (Figure 2)

Figure 1



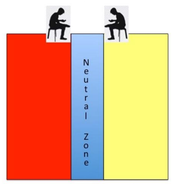
(a) Participants are free to move their cursor within the foraging environment shown.

(b) Bears distribute doughnuts on a fixed-ratio variable-interval schedule. If the participant has their cursor on the bear when it distributes a doughnut, they will be rewarded.

(c) Rewards accumulate as a green bar at the top of the screen.

Individual Task

Group Task

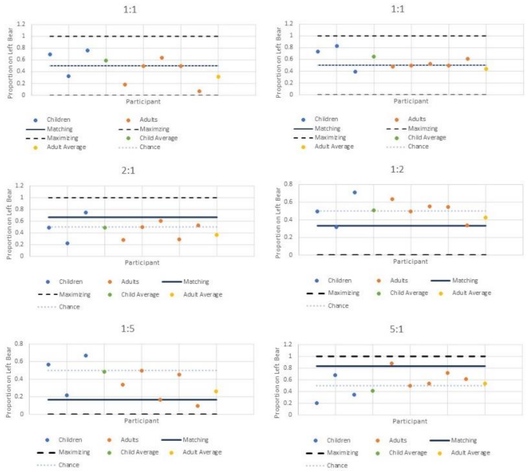


Researchers seated in each zone distributed rewards. All participants began each session in the "neutral zone" and were allowed to move freely throughout.

Figure 2

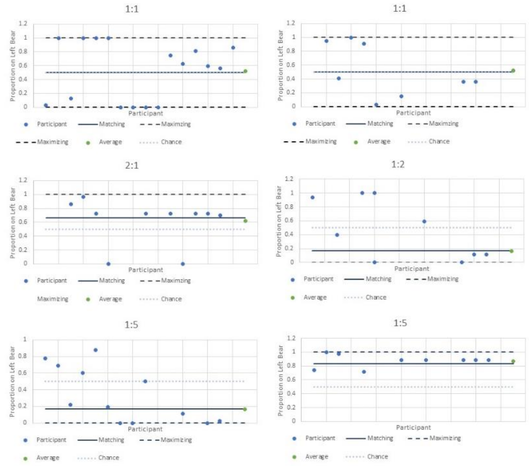
Individual Foraging

Proportion of time spent on the left bear by participant per session



Group Foraging

Proportion of time spent in the red zone by participant per session



Conclusions

While keeping in mind that our sample sizes are extremely small, and any patterns must be interpreted with caution, neither children nor adults adopted an obviously maximizing or obviously matching strategy in this individual (online) free-operant foraging task, and there did appear to be a difference in strategy use between those foraging alone versus in a group. Given that we originally planned to conduct the entire study in-person, we cannot be certain that strategy choice is not related to age, since we had little time to pilot our online version of the protocol. Nonetheless, we plan to continue data collection to achieve our planned number of participants before concluding there is not a relationship between strategy choice and age. We also wish to explore whether other differences in the tasks (ex. the online versus in person nature) could have caused the difference in strategy use.

We did find preliminary evidence that temperament is related to reward obtainment. We plan to further collect data and verify that patterns hold in a larger sample, and explore other potential strategies that participants might adopt, particularly ones that would explain why children outperform adults.

Results

Due to challenges in the transition to online data collection, which led to limited participation thus far, we only have preliminary results for the individual task and are not reporting significance tests. We found that in the individual task, neither children nor adults chose exclusively a matching, maximizing or chance strategy, whereas in the group task, children matched on average and many individuals appeared to be selecting a matching or maximizing strategy within a session (Figure 3).

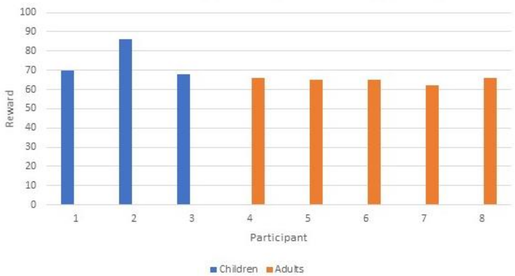
Evolutionarily, we would expect some differences in strategy between the individual and group foraging tasks. While foraging alone, and individual must only maximize their own chance of success, whereas when foraging in a group, the social nature of humans would make it beneficial to distribute rewards such that the entire population can succeed.

In the group task, individual children reaped equivalent rewards. For both total number of rewards and total number of times rewarded, rewards were equivalent across individuals (4/6 and 5/6 sessions had non-significant chi-squares ((p>.05), respectively).

Temperament data was not collected on the group participants, but for the individual participants, higher measures of shyness on the Rothbart Questionnaire were associated with lower rewards in both children and adults (r(3)=-0.87 in children, r(5)=-0.81 in adults), whereas fear was associated with higher rewards (r(3)=0.99 in children, r(5)=0.27 in adults). In connection with temperament and strategic behavior, more fearful adults were more likely to switch more often, (r(5)=0.79), whereas shyer children were less likely to switch (r(3)=-0.53). On the whole, children reaped more rewards (M=74.67, SD=9.86) than adults (M=64.8, SD=1.64) (see Figure 4), and switched slightly more frequently (M=16.11 switches per session, SD=7.43) than adults (M=11.53 switches per session, SD=6.98).

Figure 3

Total Rewards by participant and age group



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