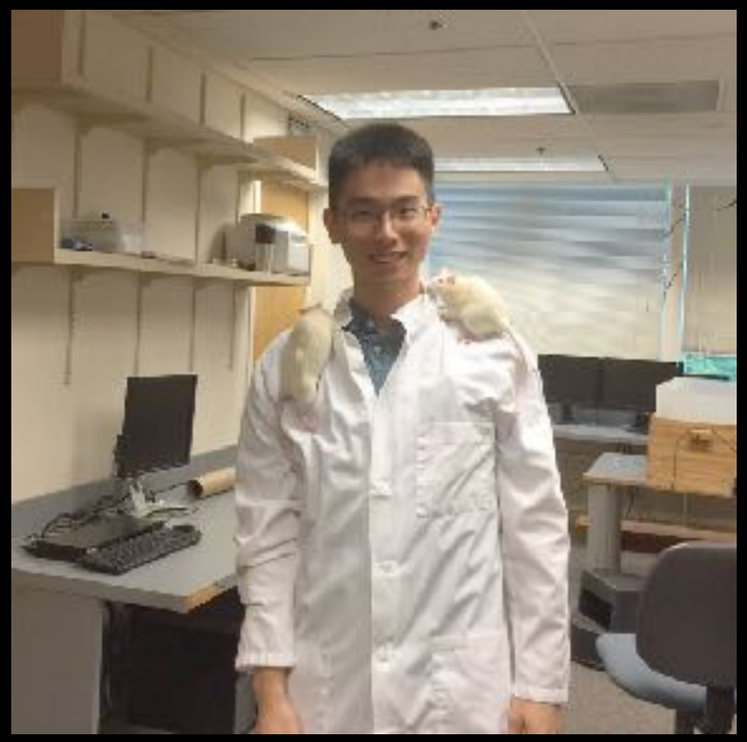
Behavioral economics of food and social reinforcement

ABAI Stockholm 2019

acknowledgements

Cyrus Kirkman

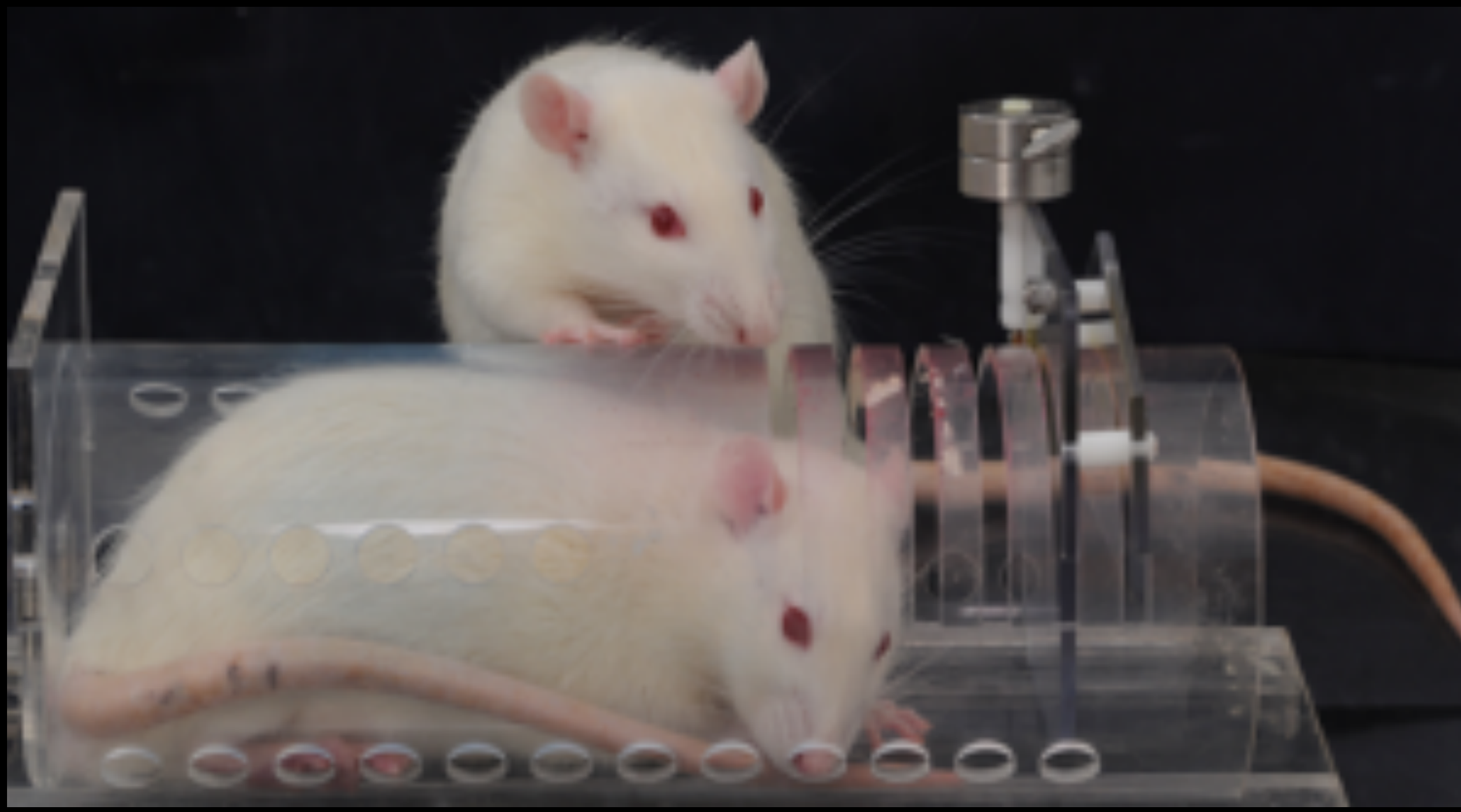


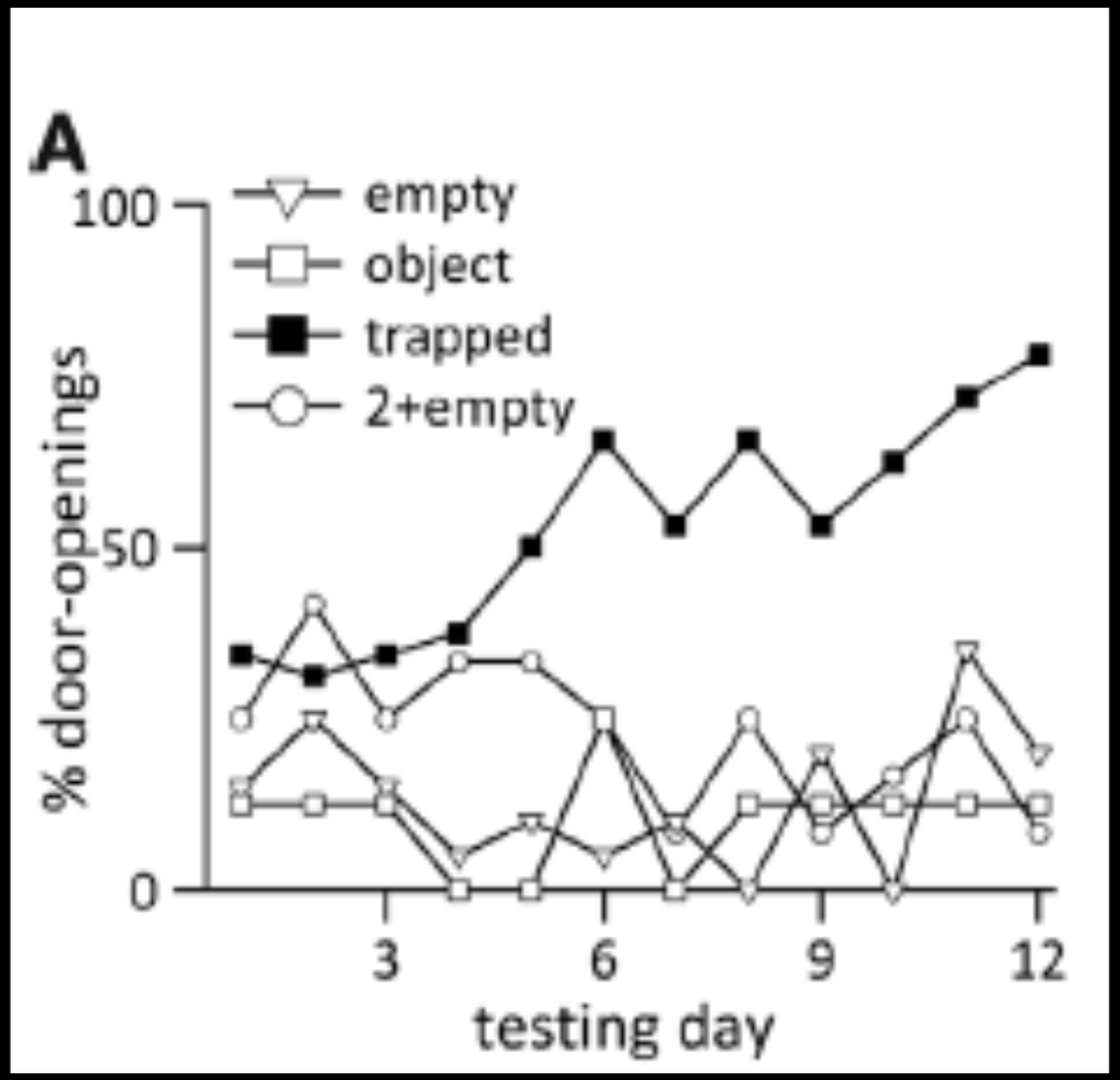
Matt Wan

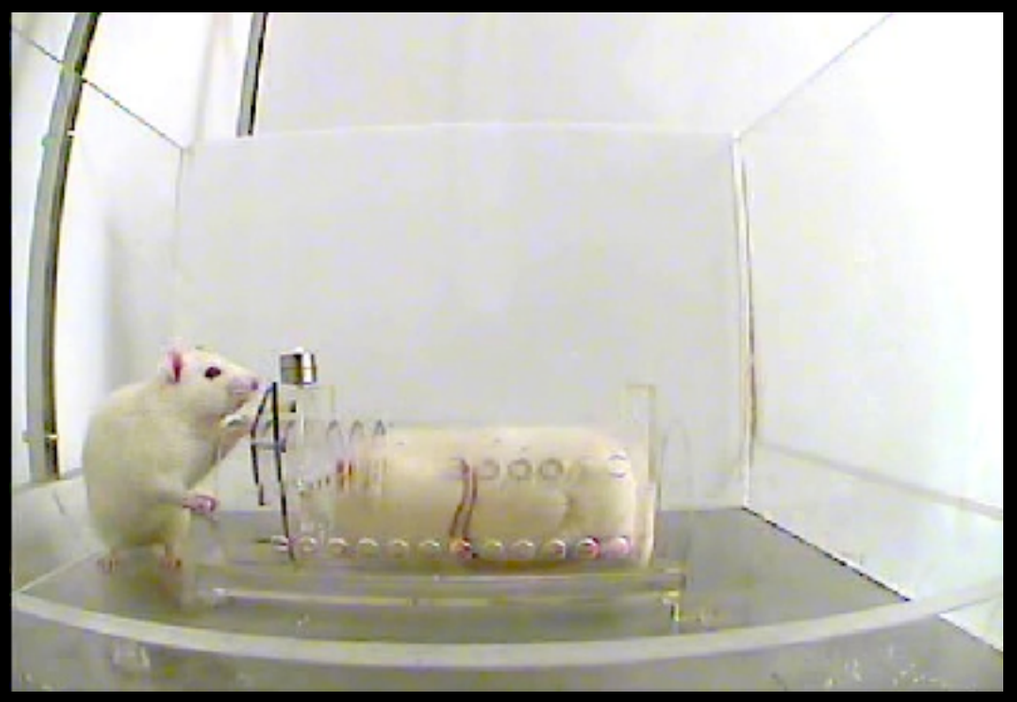
Carol Franceschini

Empathy and Pro-Social Behavior in Rats

Inbal Ben-Ami Bartal,[1] Jean Decety,[1,2,4] Peggy Mason[3,4]




A
100
50
0
% door-openings
empty
object
trapped
2+empty
3
6
9
12
testing day

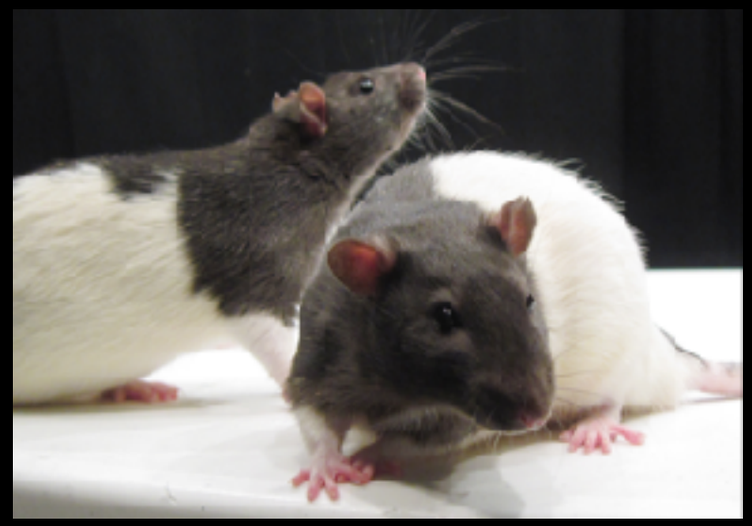


Interpretations

- Empathy, social contagion
- Social reinforcement

Social reinforcement

- Access to another rat serves as social SR+
  - Evans et al. (1994)
  - Everitt (1990)
  - Hauser & Gandelman (1985)
  - Lee et al. (1999)
  - Trezza et al. (2011)
  - Wilsoncroft (1969)



To free, or not to free: Social reinforcement effects in the social release paradigm with rats

Lisa C. Hiura[a], Lavinia Tan[b], Timothy D. Hackenberg[b,*]

[a] Department of Psychology, Cornell University, Ithaca, NY 14853, United States
[b] Department of Psychology, Reed College, Portland, OR 97202, United States

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ABSTRACT

The present research measured social reinforcement in rats, using a social-release procedure in which lever presses permitted 10-s access to a familiar social partner. The work requirements for reinforcement increased systematically according to progressive-ratio (PR) schedules. Social and food reinforcement value were compared across blocks of sessions (Experiment 1) and concurrently within the same sessions (Experiment 2). To assess motivational effects, response and reinforcer rates for both reinforcer types were studied under food restriction, social restriction, and combined food and social restriction. Responding was maintained by both reinforcers, albeit at substantially higher levels for food than for social access. Responding for social access decreased to low levels under extinction conditions, demonstrating functional control by the social-reinforcement contingency. Sensitivity to social restriction was seen in some conditions in Experiment 2, in which social reinforcers were earned earlier in the session (at lower food prices) under social restriction than under the other deprivation conditions. Altogether, results are consistent with a social reinforcement conceptualization, and demonstrate an important role for social contact in social release behavior. The study demonstrates a promising set of methods for analyzing and quantifying social reinforcement.

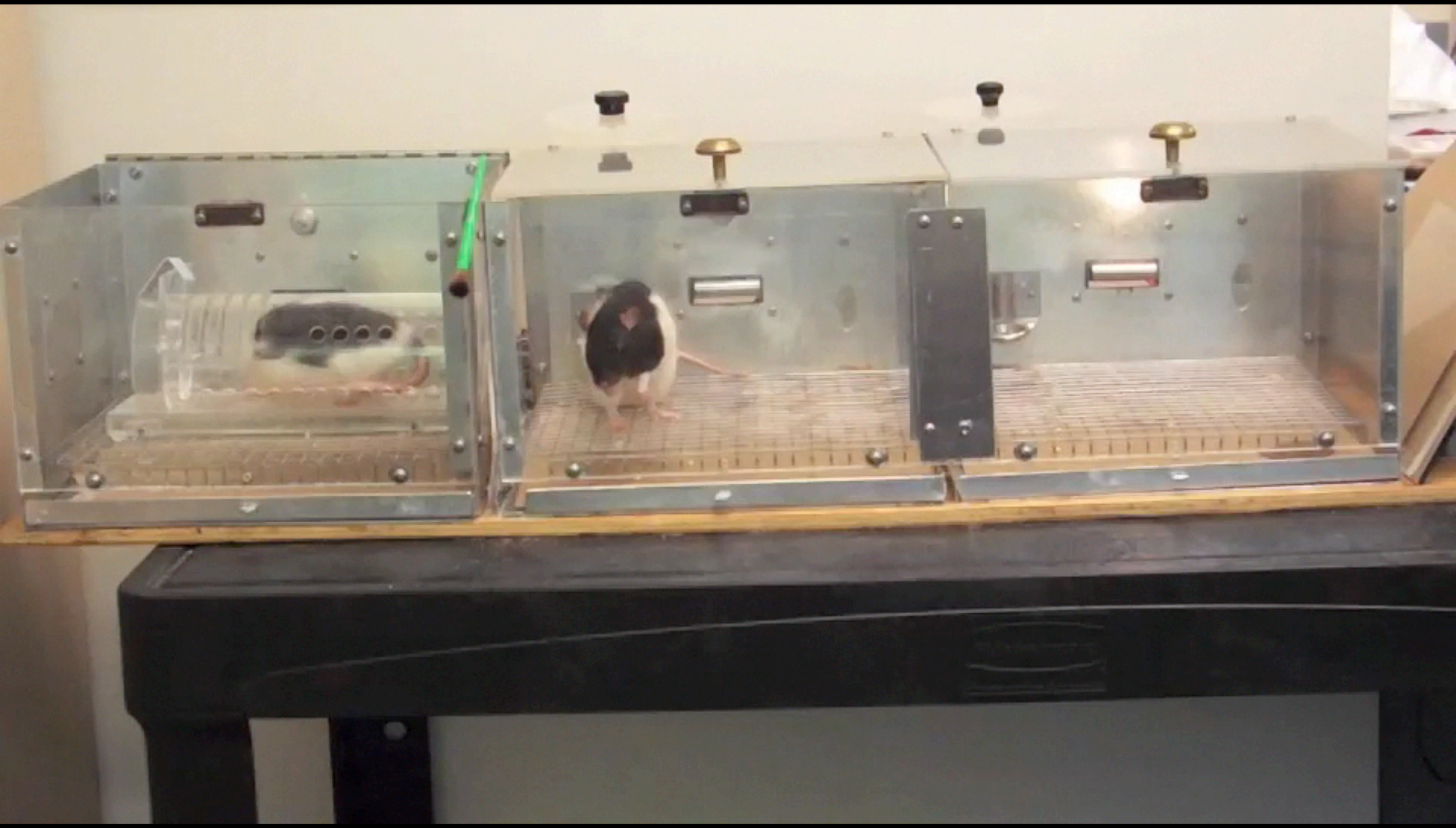
1. Introduction

Prosocial behavior has been defined as behavior that produces benefits for another (Cronin, 2012; West et al., 2007), but the mechanisms are not well understood. To the extent that behaving for the good of another incurs costs to the individual, instrumental (cost-benefit) models must assume additional benefits for the individual that outweigh the costs. In some cases, the benefits to the individual are readily apparent, as in some forms of cooperation, with mutual benefits for both organisms (Dias and Carter, 2009; Kopuch and Popik, 2011; Plotnik et al., 2011; Tan and Hackenberg, 2016).

In other cases, the benefits to the individual are less apparent, as in some forms of what might be termed *helping* or *rescue* behavior, in which one organism releases another from a trap or restraint (Ben Ami Bartal et al., 2011; Newbahari et al., 2009). In the Ben-Ami Bartal et al. study, for example, two familiar (*cagemate*) rats were placed in an arena, one of which began each session in a transparent tube-like restrainer. A second rat was unrestrained, and could move freely around the rest of the arena. A latch on one side of the restrainer could be lifted, releasing the restrained rat, for the remainder of the 60-min session. No explicit training was provided, though the response was prompted by lifting the door halfway up at the 30-min mark. After an average of 7 sessions, 23 of the 30 rats acquired the door-opening response; and once the response was acquired, it generally continued to occur in subsequent sessions and with shorter latencies (i.e., earlier in the session). The door-opening response was also selective, in that it occurred only under conditions with a live rat in the restraint; it did not occur when the restrainer was empty or occupied by a toy rat.

Door opening under these conditions thus appears to be a learned prosocial response, but how best to explain it? Ben-Ami Bartal et al. (2011) favored an empathy-based explanation, according to which distress is socially transmitted, from the restrained to the free rat via social contagion; this, in turn, motivates pro-social behavior (see also Ben-Ami Bartal et al., 2014; Sato et al., 2015). By this view, the prosocial behavior incurs costs that exceed any obvious benefits to the individual, and must therefore be due to altruism.

An alternative, and far simpler, explanation is that door opening for the unrestrained rat is an operant response, established and maintained by social reinforcement: access to the other rat (Schwartz et al., 2017; Silberberg et al., 2014). This possibility was considered but rejected by Ben-Ami Bartal et al. (2011), largely on the basis of a control condition, in which door opening permitted release but precluded direct social



Concurrent schedule

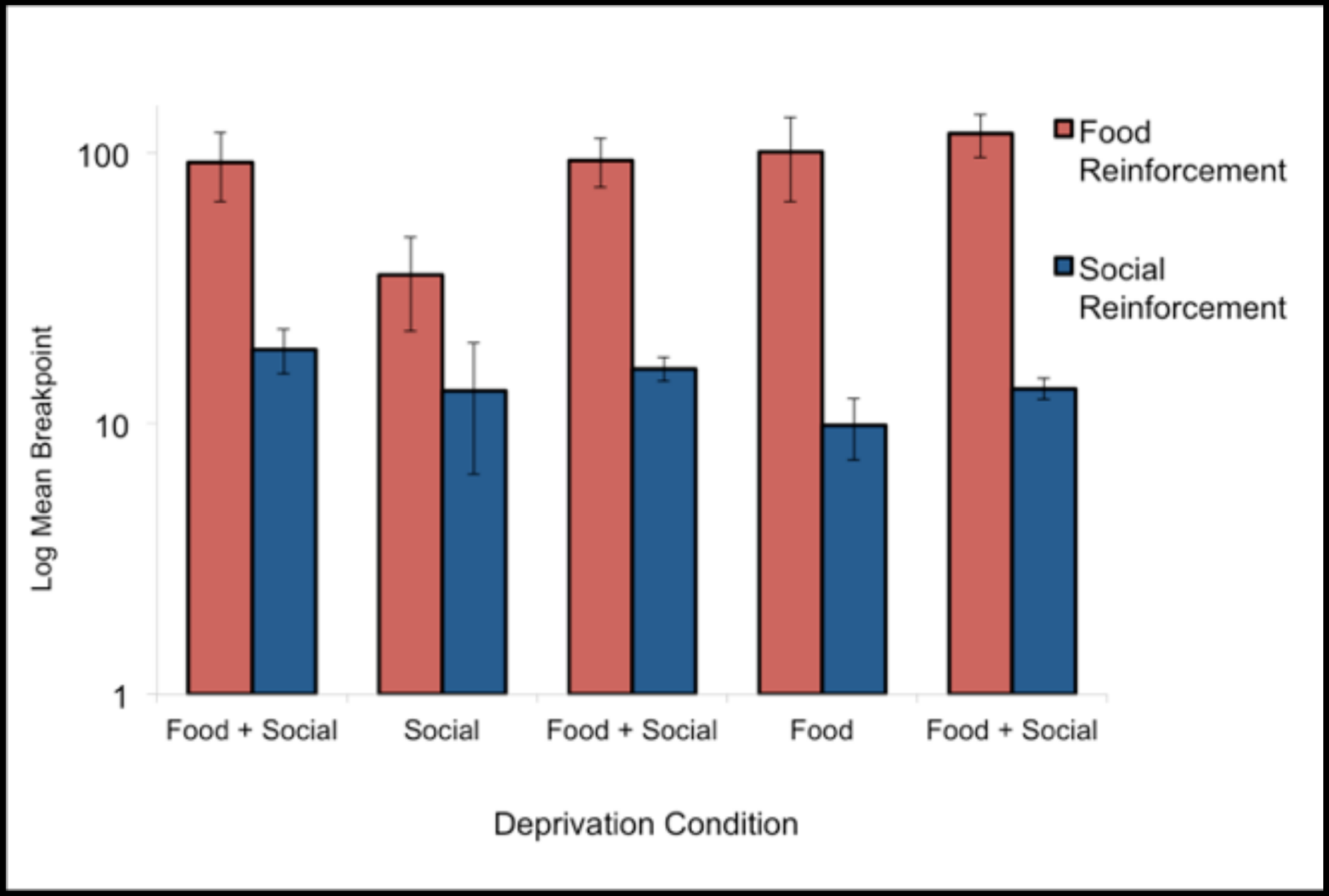
PR 5

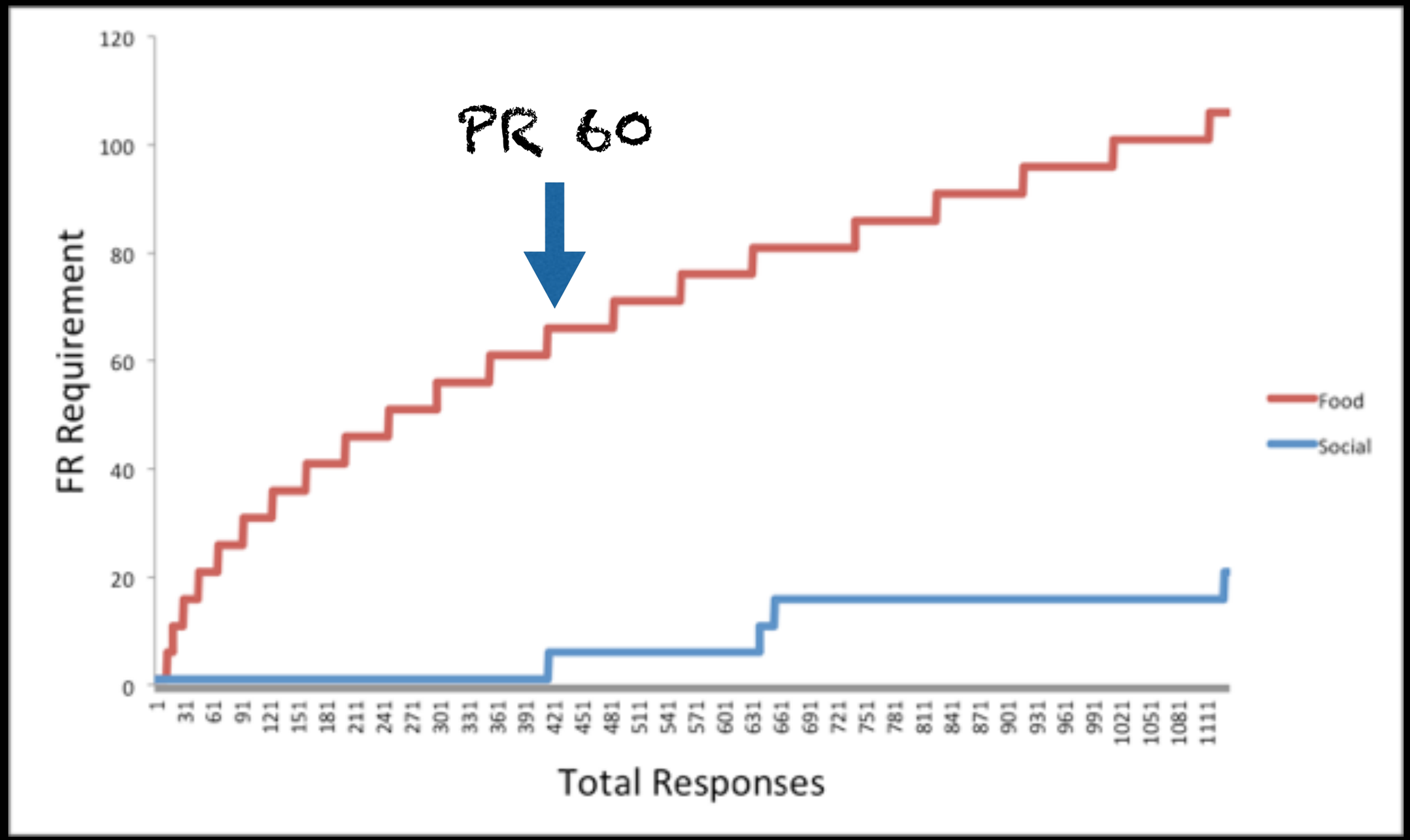
30 s social access

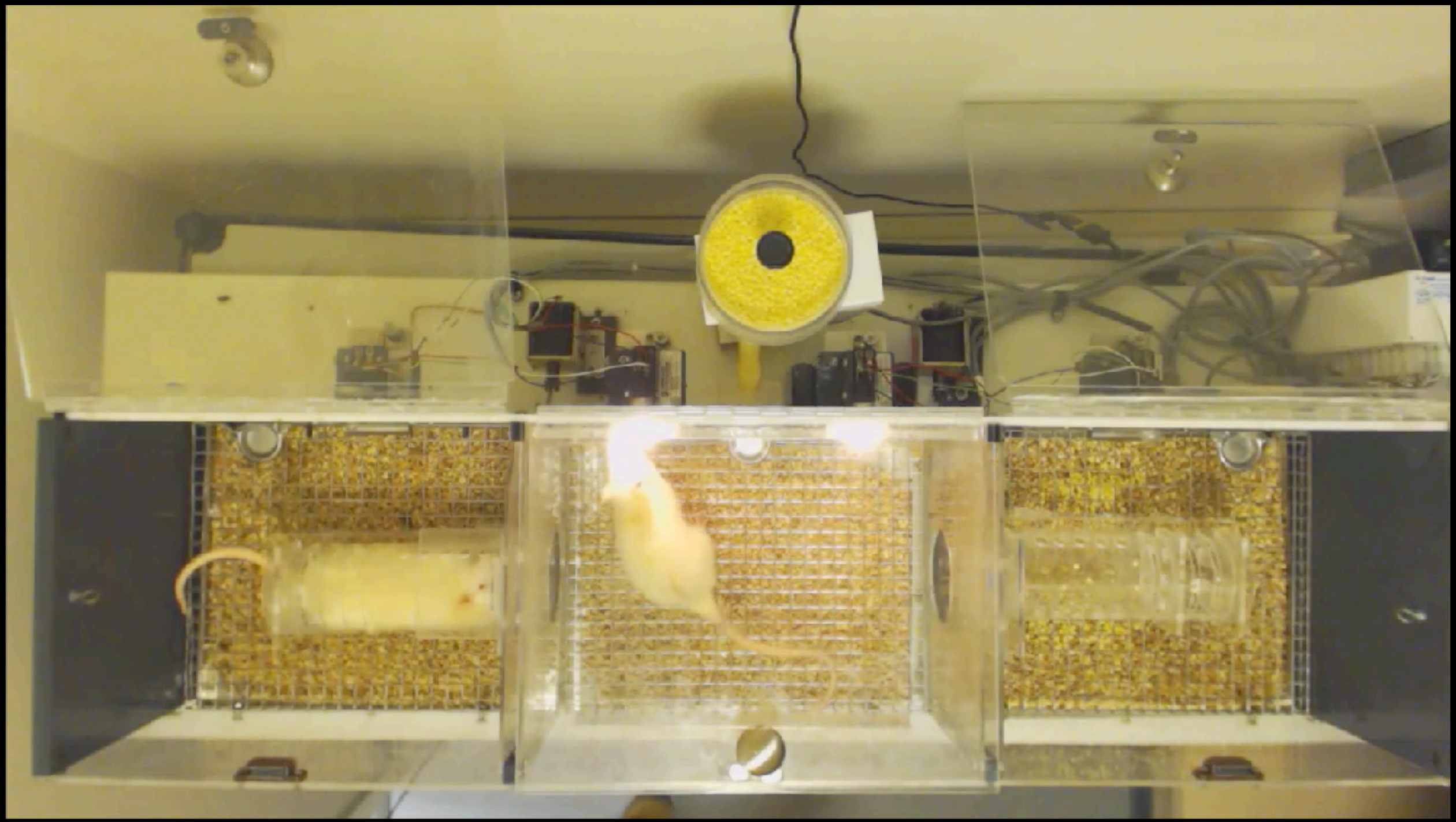
PR 5

food

Food strongly preferred across motivational conditions




PR 60
FR Requirement
120
100
80
60
40
20
0
1
31
61
91
121
151
181
211
241
271
301
331
361
391
421
451
481
511
541
571
601
631
661
691
721
751
781
811
841
871
901
931
961
991
1021
1051
1081
1111
Total Responses
Food
Social



Concurrent FR FR

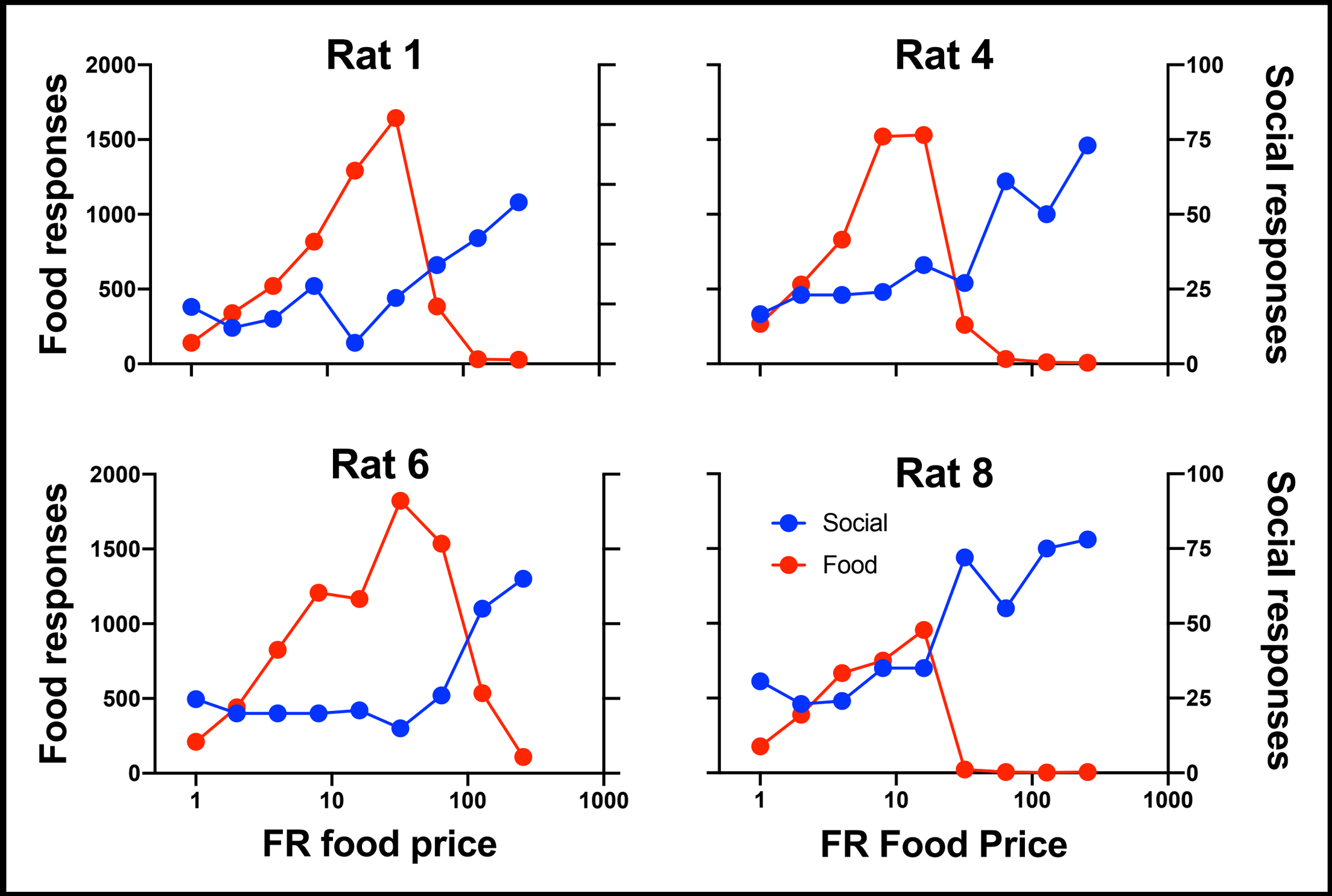
10 s social access

food

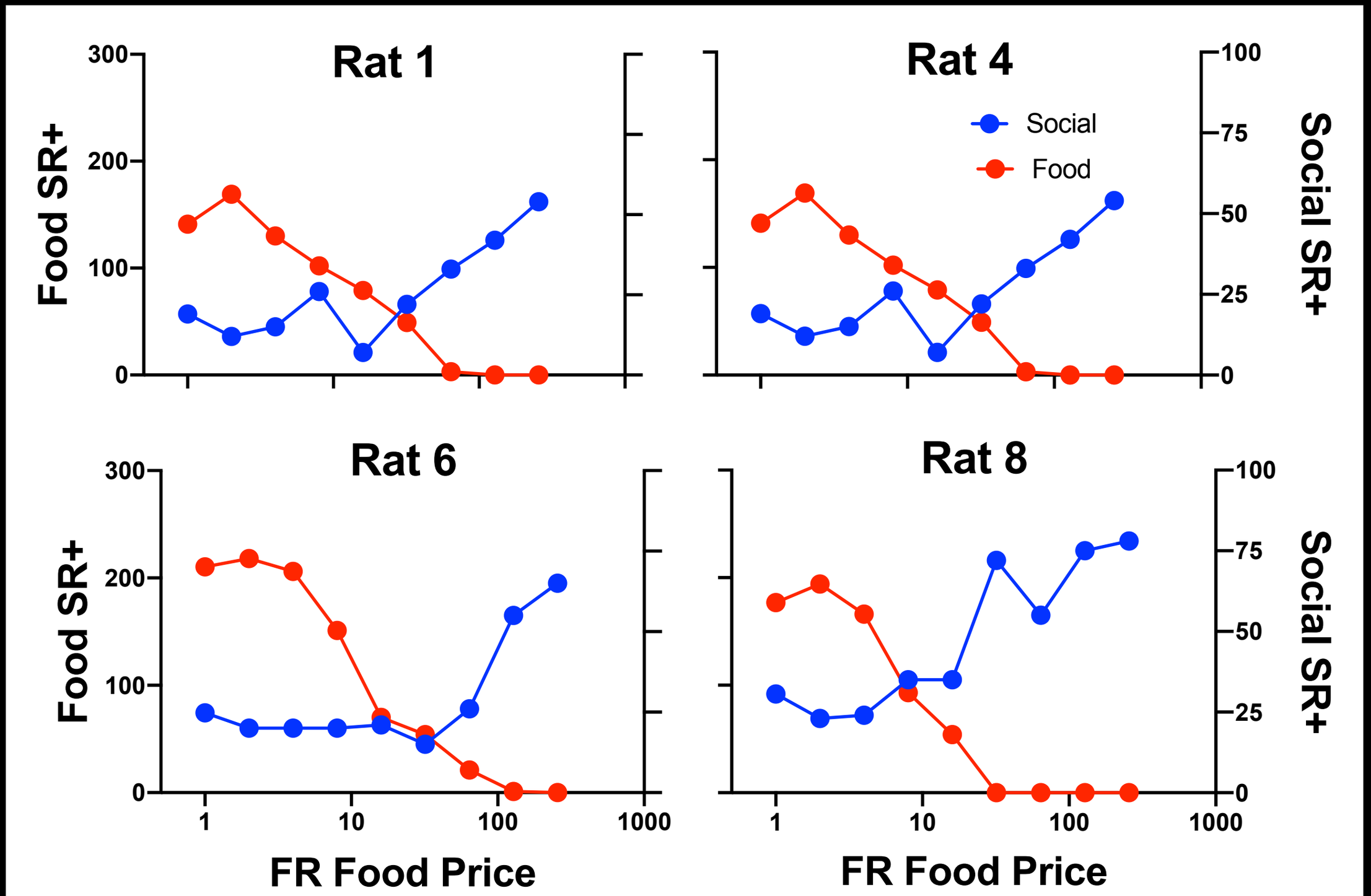
Phase 1: FR 1 FR 1-FR 256

Phase 2: FR 1-FR 64 FR 1

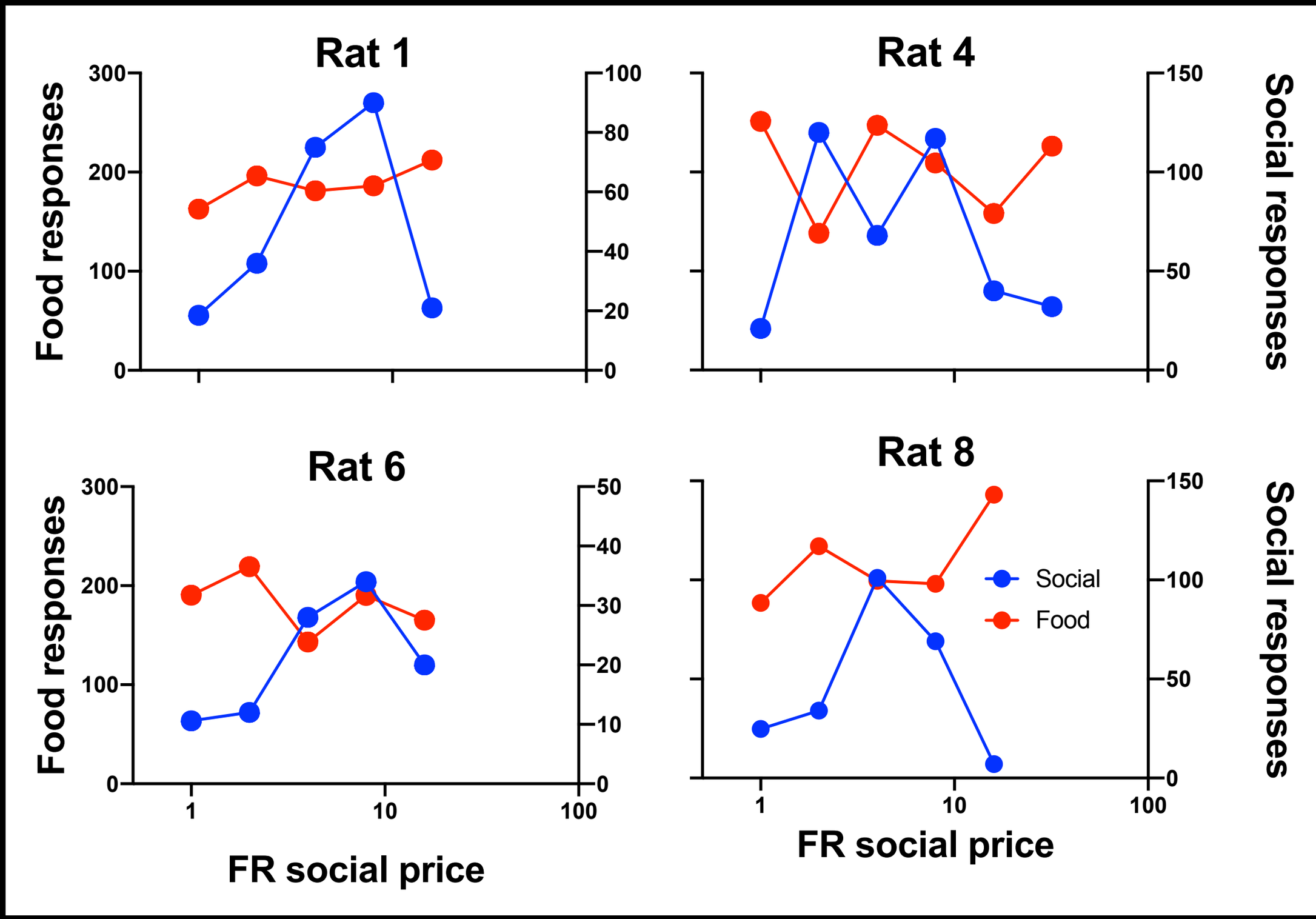
Phase 1


Rat 1
Rat 4
Rat 6
Rat 8
Food responses
Social responses
2000
1500
1000
500
0
100
75
50
25
1
10
100
1000
FR food price
FR Food Price
Social
Food

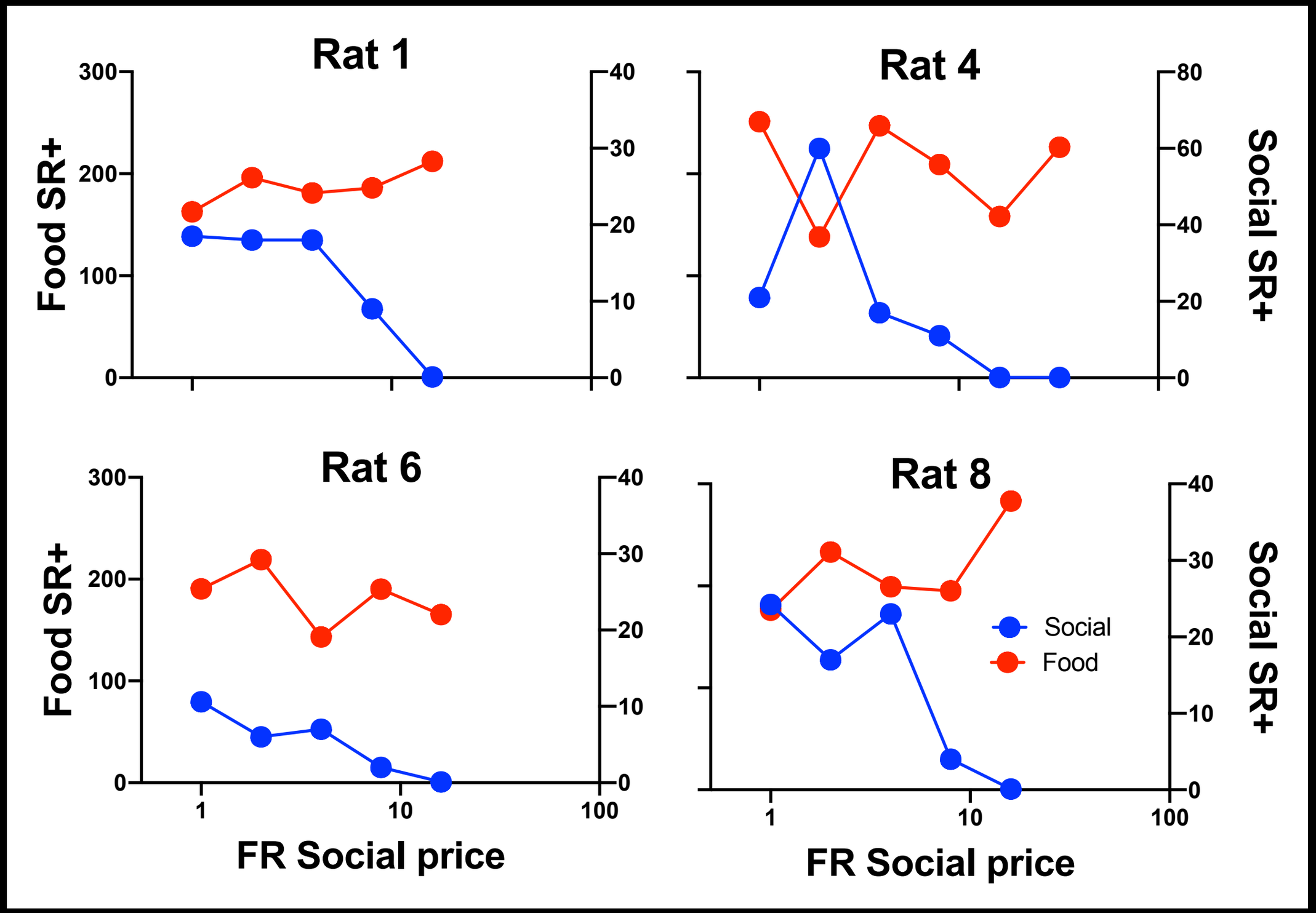
Phase 1


Rat 1
Rat 4
Rat 6
Rat 8
Social
Food
Food SR+
Social SR+
300
200
100
0
75
50
25
1
10
1000
FR Food Price

Phase 2

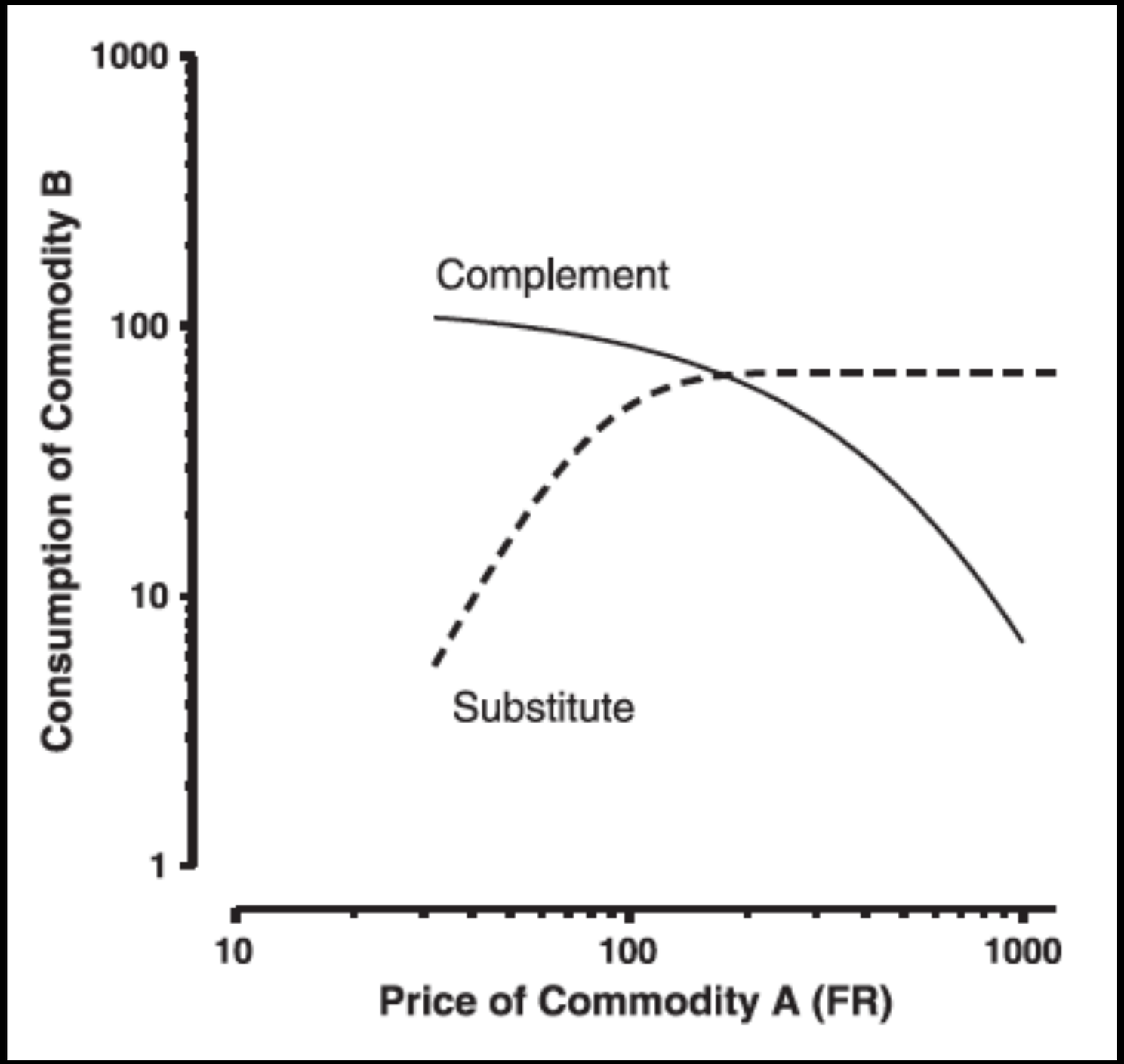

Rat 1
Rat 4
Rat 6
Rat 8
Food responses
Social responses
300
200
100
0
100
80
60
40
20
0
150
100
50
0
50
40
30
20
10
0
1
10
100
FR social price
Social
Food

Phase 2


Rat 1
Rat 4
Rat 6
Rat 8
Food SR+
Social SR+
300
200
100
0
40
30
20
10
0
80
60
40
20
1
10
100
FR Social price
Social
Food

Through an economic lens...

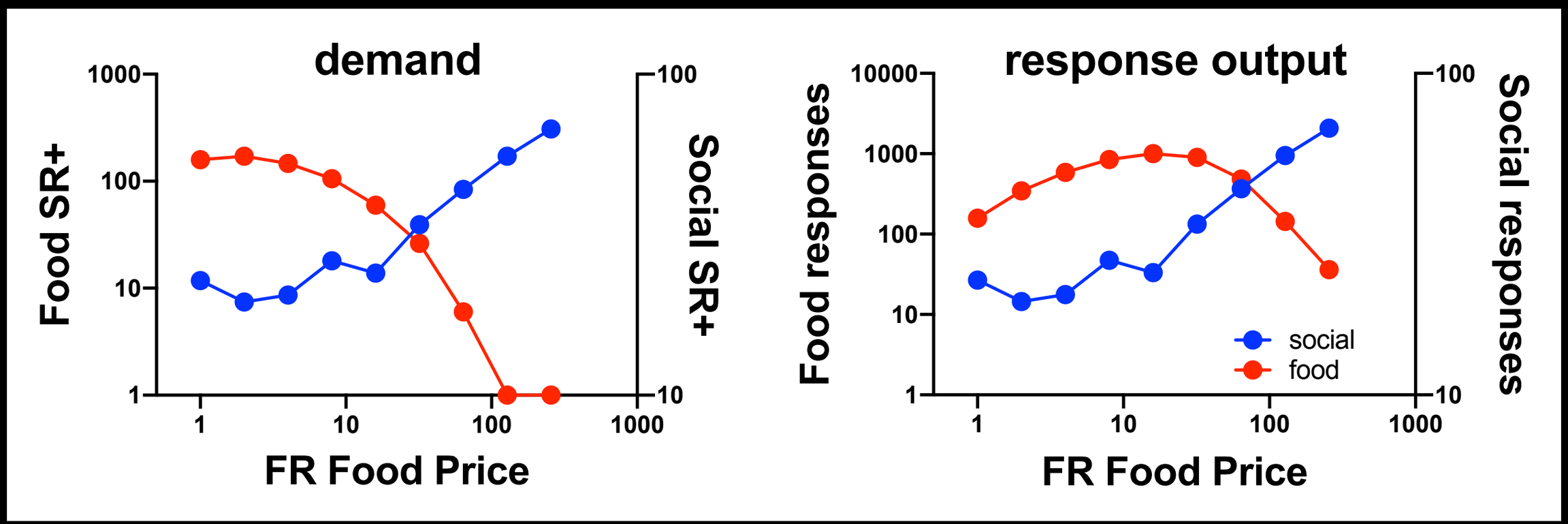
Reinforcer interactions



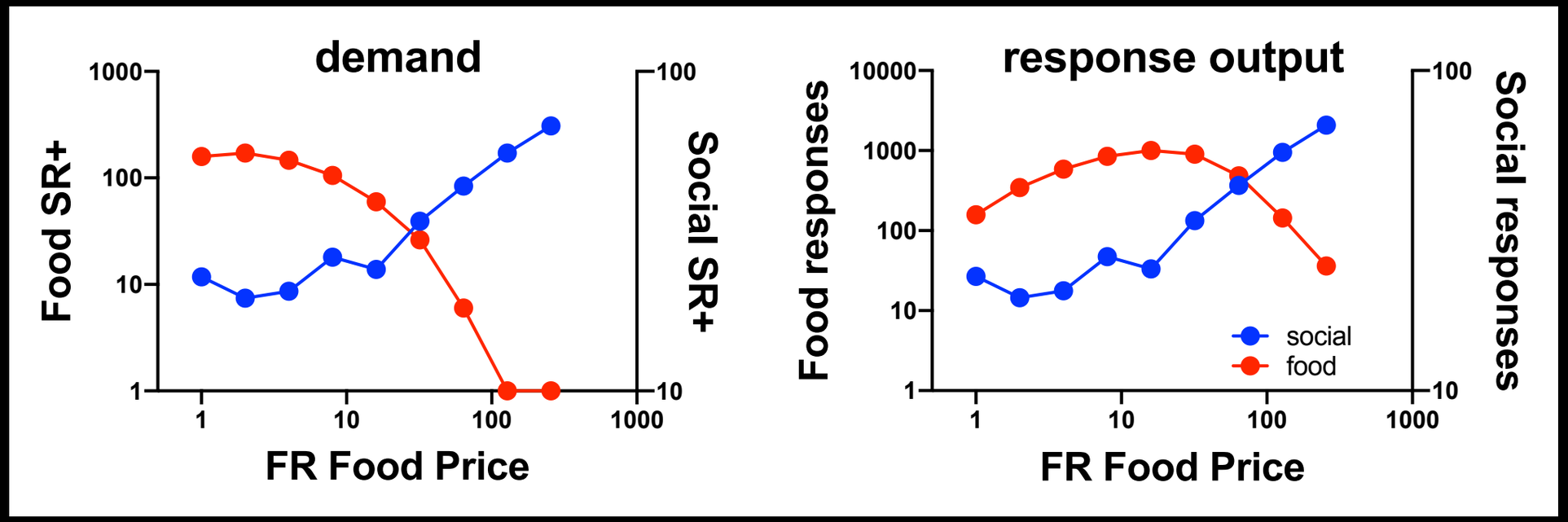
substitutes:
change in opposite direction

complements:
change in same direction

- Own-price elasticity: demand for A as a function of price change in A
- Cross-price elasticity: demand for B as a function of price change in A



Phase 1



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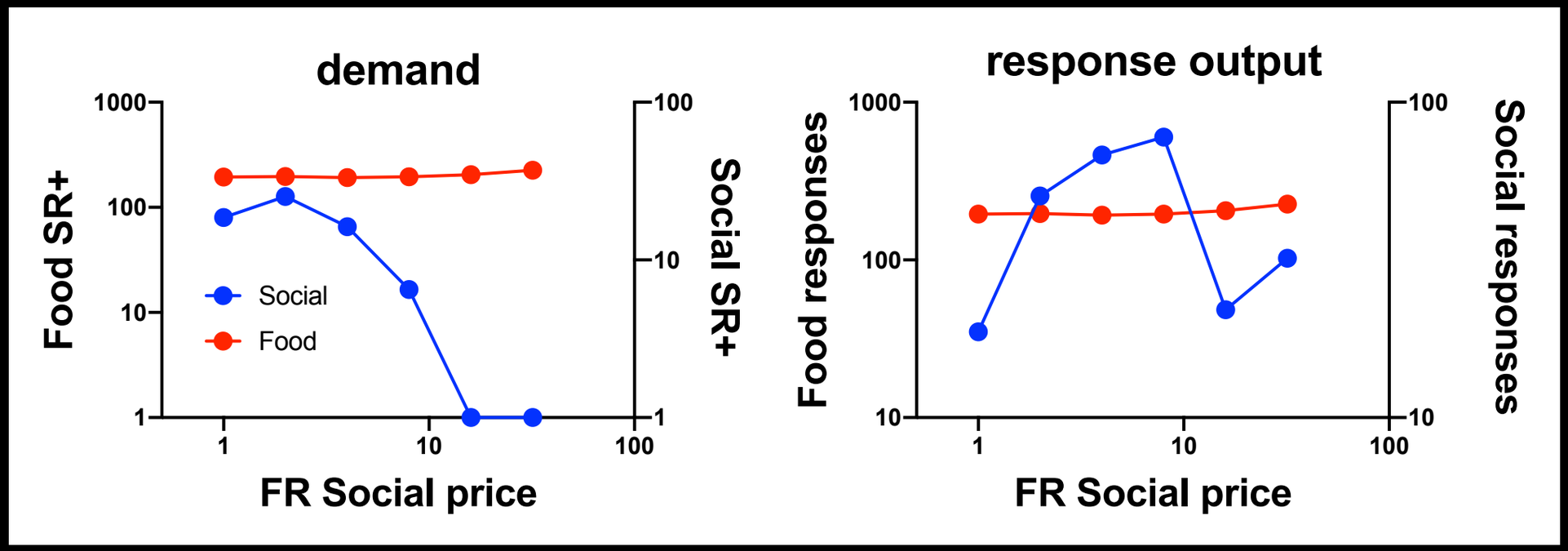
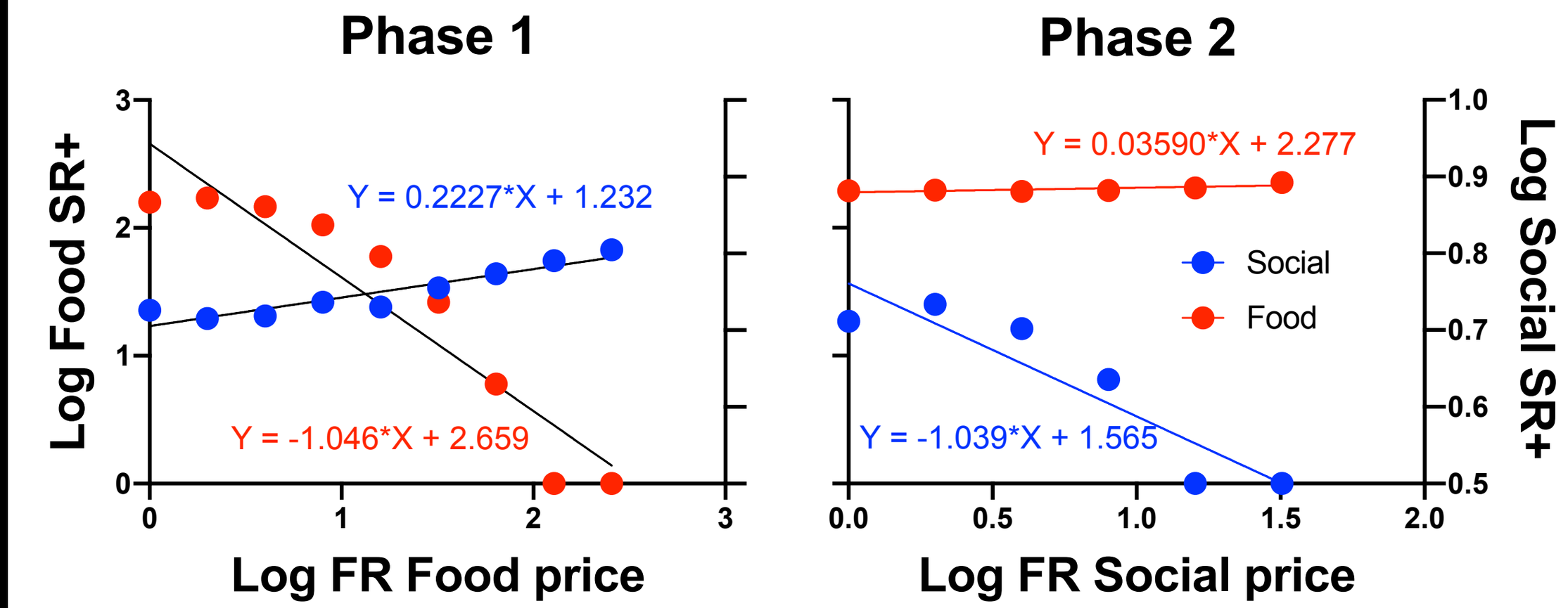


Phase 2



own-price elasticity: negative slope

cross-price elasticity: positive slope for social

Discussion

- substitutable reinforcers
  - positive slope for social suggests a substitutable relationship
- some caveats
  - satiation effects
  - closed vs open economy
  - income effects

hack@reed.edu