A rat model of impulsive choice behavior: Reward-related correlates of performance.

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Impulsive choice

High levels of impulsive choice:

ADHD (e.g., Barkley et al., 2001; Kuntsi et al., 2001; Solonto et al., 2001)

Gambling (e.g., Dixon et al., 2003; 2006)

Substance abuse (e.g., Kirby & Petry, 2004; Madden et al 1997; Mitchell, 1999; Vichinich & Simpson, 1998)

Relapse in smoking cessation treatment programs (Krishnan-Sarin et al, 2007; Yoon et al, 2007)

What do we mean by impulsive choice?

EASY DECISION: SMALL (S) OR LARGE (L)

One cookie or two?

What do we mean by impulsive choice?

EASY DECISION: SOONER (S) OR LATER (L)

In 10 minutes or in 30 minutes?

What do we mean by impulsive choice?

DIFFICULT DECISION:

SMALLER SOONER (SS) OR LARGER LATER (LL)

One cookie in 10 minutes or
two cookies in 30 minutes?

What do we mean by impulsive choice?

DIFFICULT DECISION: SS or LL?

One cookie in 10 minutes or two cookies in 30 minutes?

The impulsive choice would be to take the one cookie SS option. Why would people lose self-control?

What are momentary and molar maximizing?

WHAT GETS ME MORE COOKIE PER MINUTE DELAY?:

One cookie in 10 minutes or
two cookies in 30 minutes?

What are momentary and molar maximizing?

WHAT GETS ME MORE COOKIE PER MINUTE DELAY?:

One cookie in 10 minutes or
two cookies in 30 minutes?

I can wait three times the delay for twice the amount of cookie.

What are momentary and molar maximizing?

I'LL TAKE ONE COOKIE IN 10 MINUTES PLEASE

SS option

I'm living for the moment. I'm momentary maximizing.

What are momentary and molar maximizing?

WHEN CAN I CHOOSE AGAIN?

What are momentary and molar maximizing?

I HAVE TO WAIT TWO HOURS?

10 MIN  120 MINUTES **CHOICE**

CHOICE

30 MIN  120 MINUTES **CHOICE**

What are momentary and molar maximizing?

I'LL WAIT 30 MINS FOR TWO COOKIES

LL option

I'm looking at the bigger picture. I'm <u>molar maximizing</u>.

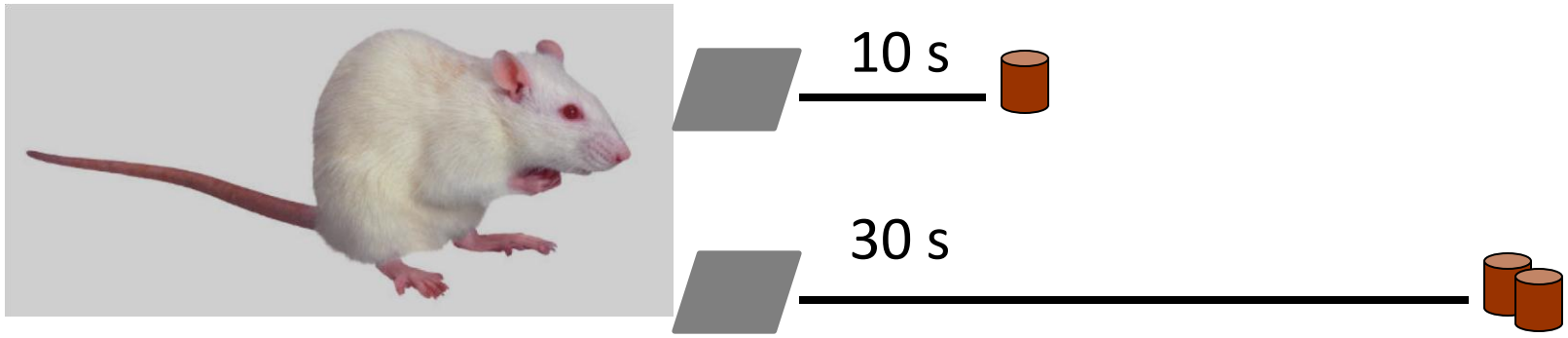
Individual differences in choice

Here be rats….. Gaaarghhh

Individual differences in choice

A rat version of the cookie dilemma:

<u>SS</u> 10s 1 PELLET **<u>LL</u> 30s 2 PELLET**



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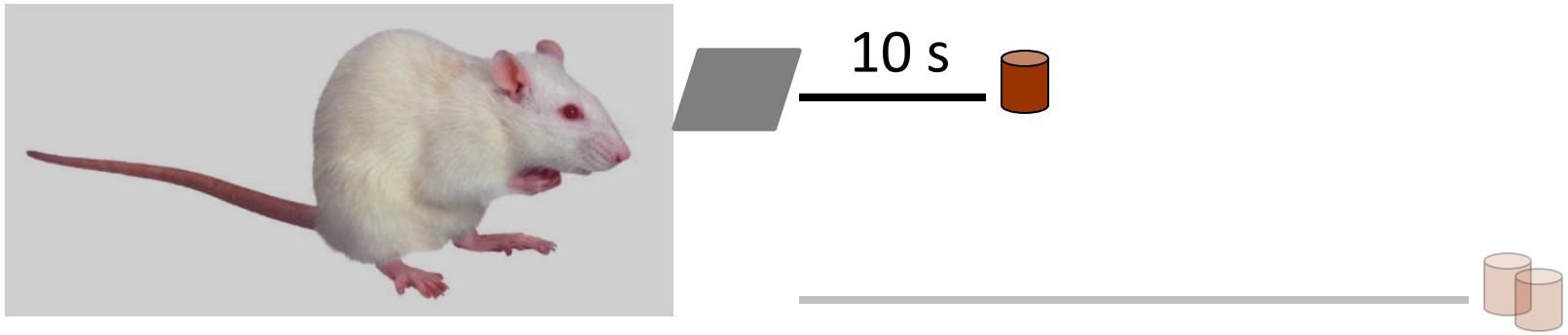

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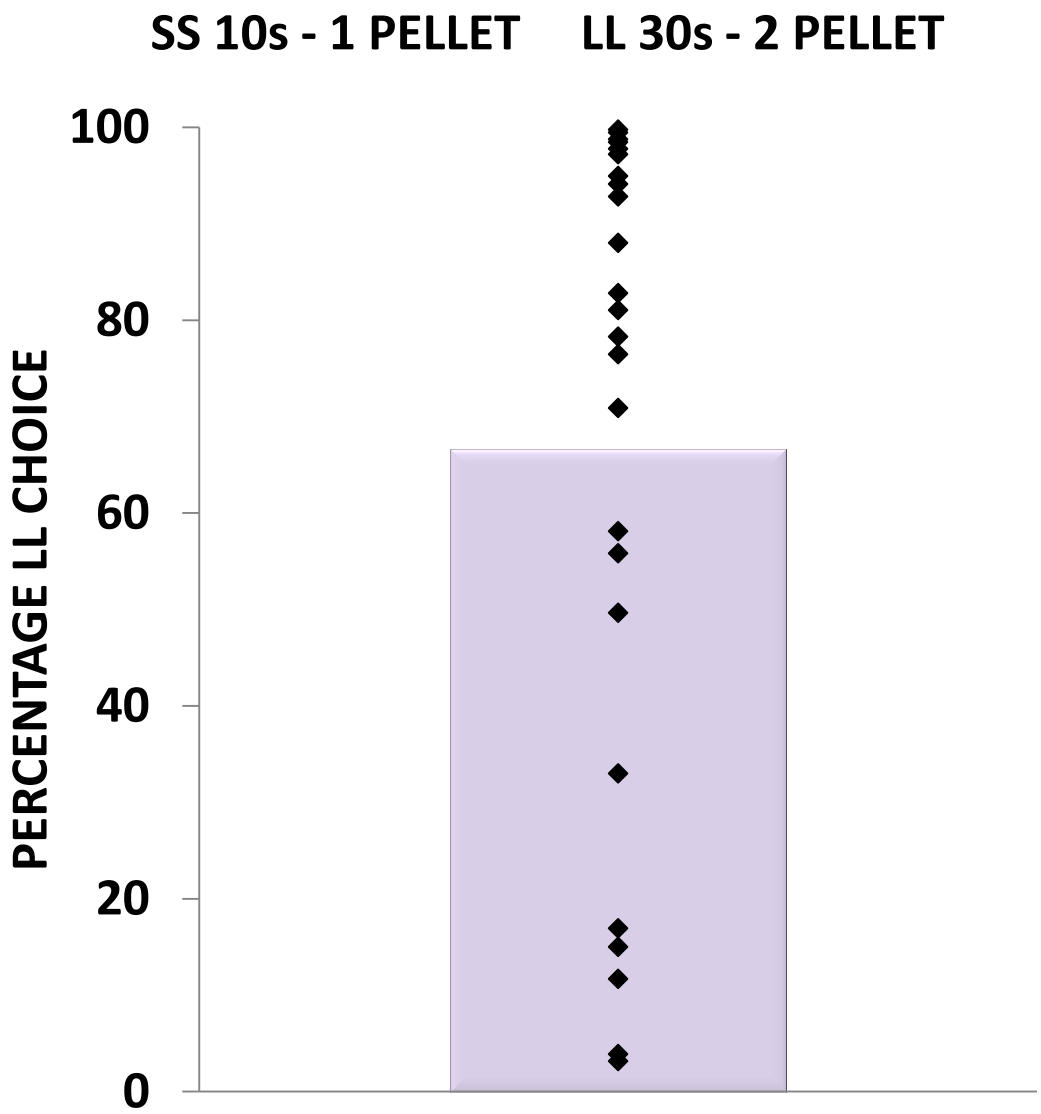
Individual differences in choice

A rat version of the cookie dilemma:

SS 10s 1 PELLET LL 30s 2 PELLET

Inter-trial interval (ITI)120 s until next choice

Individual differences in choice



Moderating choice behavior

Why?

The ability to moderate choice behavior depending on outcome is important:

Underlying factors may be a cause of disorders,

e.g. Insensitivity to outcome delay

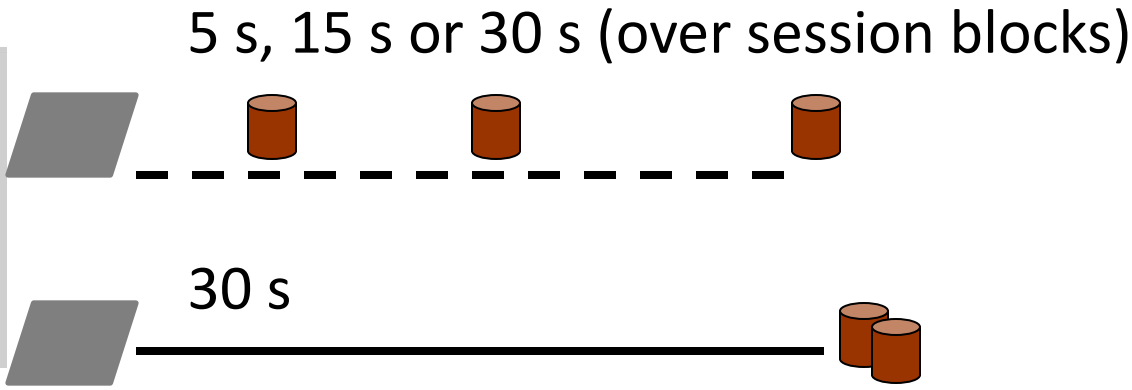
Insensitivity to outcome amount

Current motivational state

Moderating choice behavior

Manipulating the SS delay:

<u>SS</u> 1 PELLET **<u>LL</u> 30s 2 PELLET**

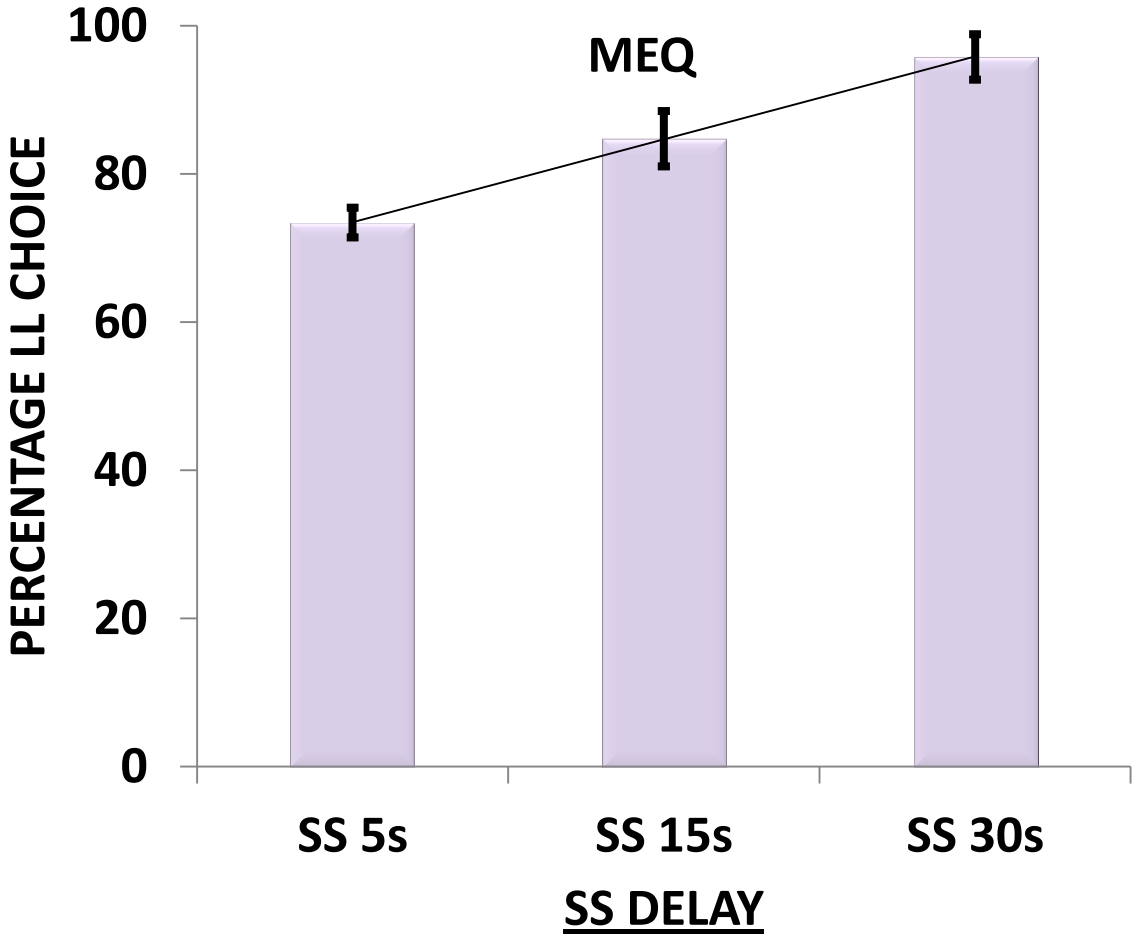


Moderating choice behavior

Manipulating the SS delay

SS 1 PELLET
LL 30s 2 PELLET

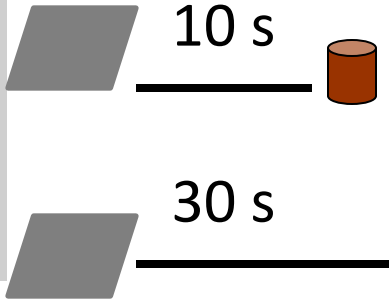
Increasing SS delay increases molar maximizing



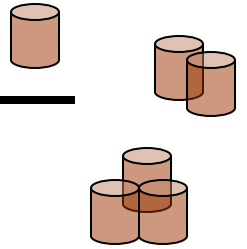
Moderating choice behavior

Manipulating the LL amount:

<u>SS</u> 10s 1 PELLET <u>LL</u> 30s



1 pellet, 2 pellet or 3 pellet (over session blocks)



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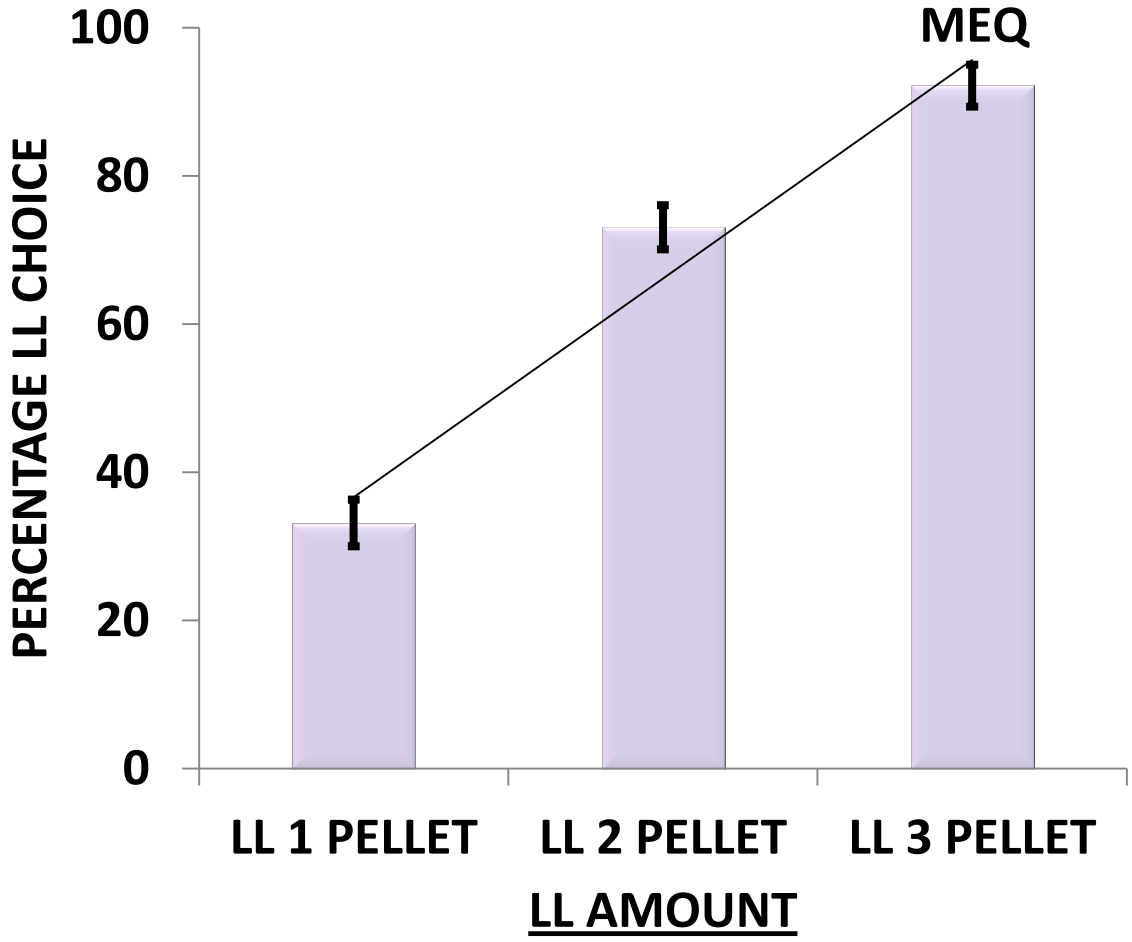

Moderating choice behavior

Manipulating current motivational state:

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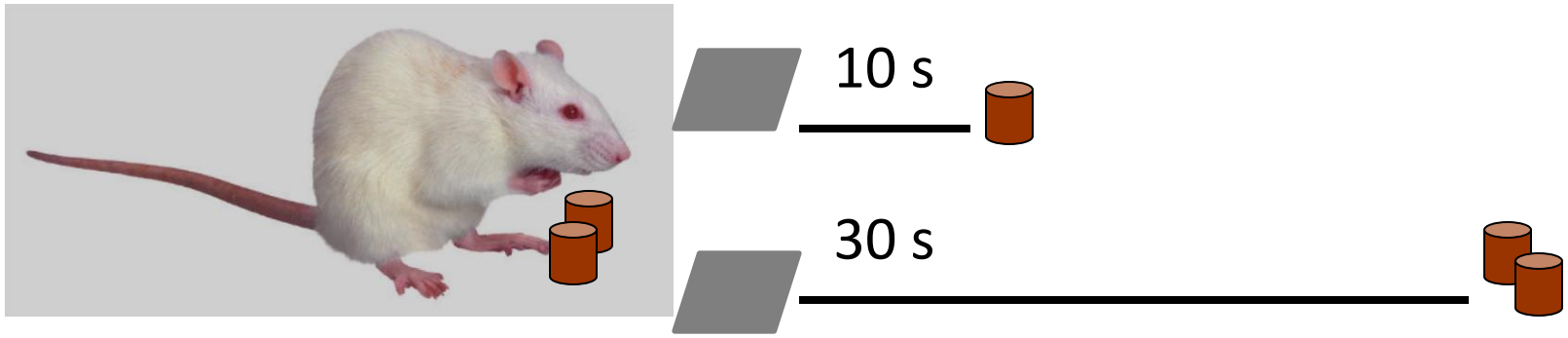

Moderating choice behavior

Manipulating current motivational state:

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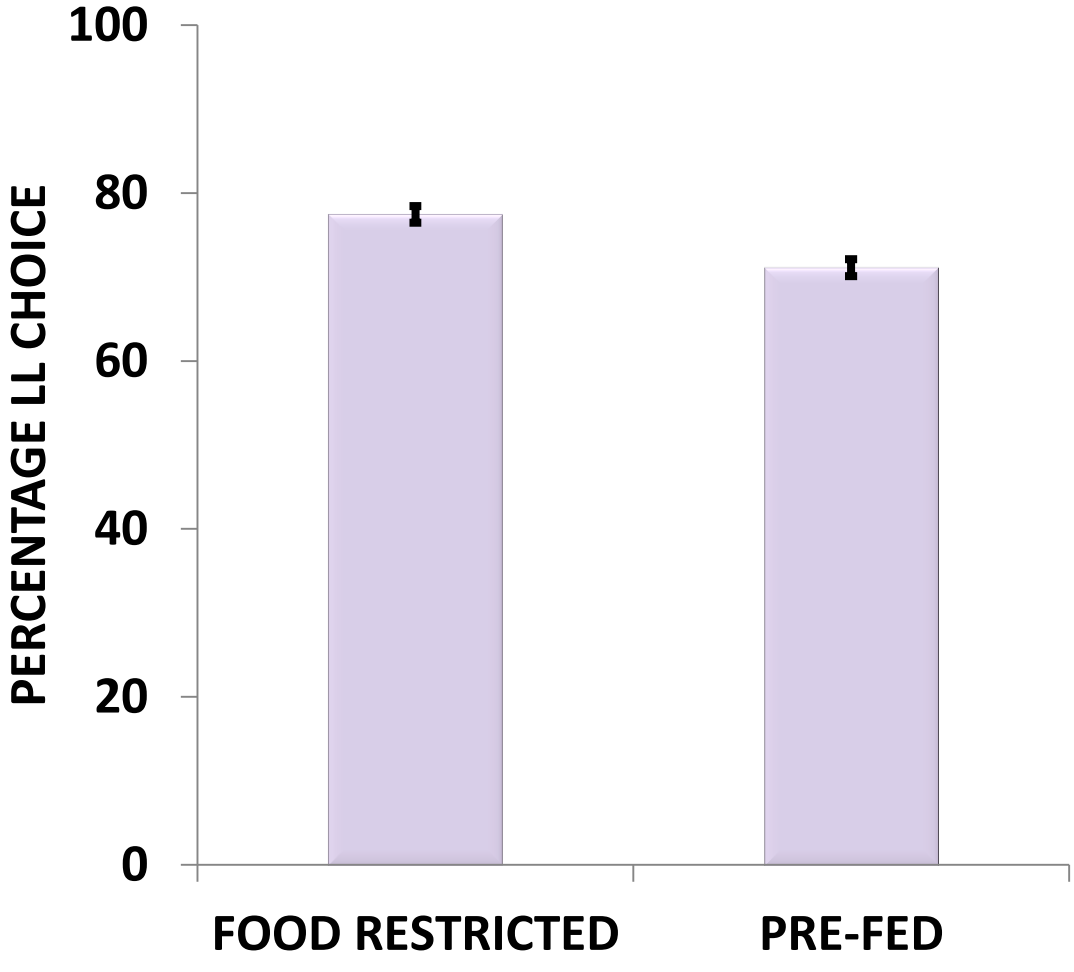
<u>LL</u> 30s 2 PELLET

Pre-feeding increases momentary maximizing



Predicting choice behavior

Correlating performance on other behavioral tasks with choice behavior.

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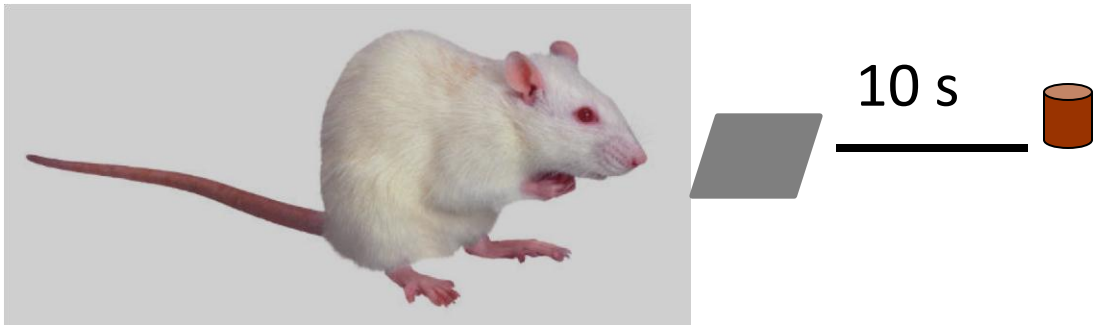
If performance on simple tasks can predict choice behavior they can be used in screening.

If performance on other tasks is related to choice behavior the tasks may share underlying factors useful in intervention.

Predicting choice behavior

Outcome efficiency: differential reinforcement of low rates (DRL)

DRL 10s and DRL 30s (separate sessions and levers)



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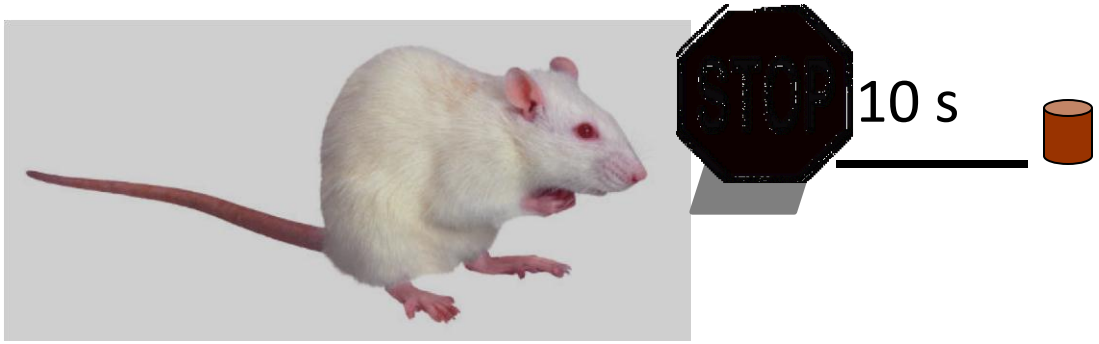
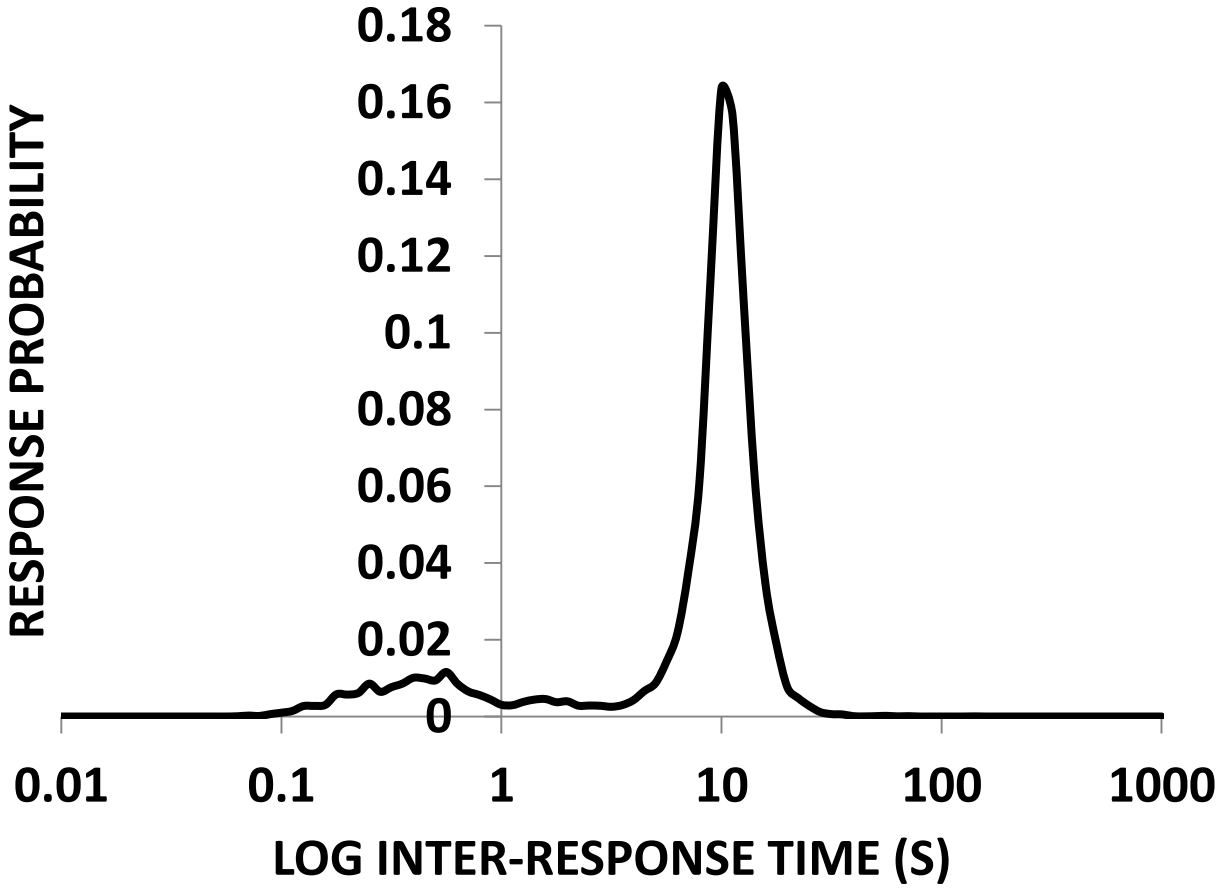


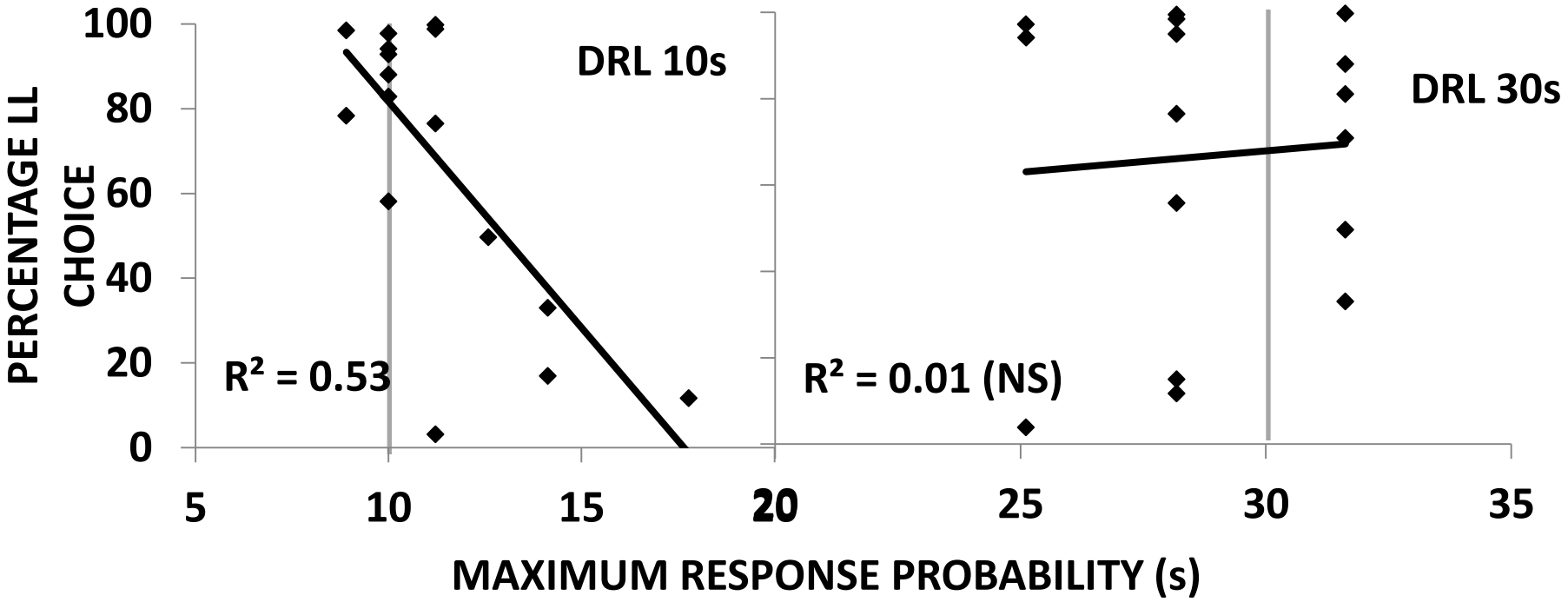
Predicting choice behavior

Outcome efficiency: DRL 10s



Predicting choice behavior

Outcome efficiency: Correlation with choice



Outcome efficiency on DRL 10s predicts molar maximizing

Predicting choice behavior

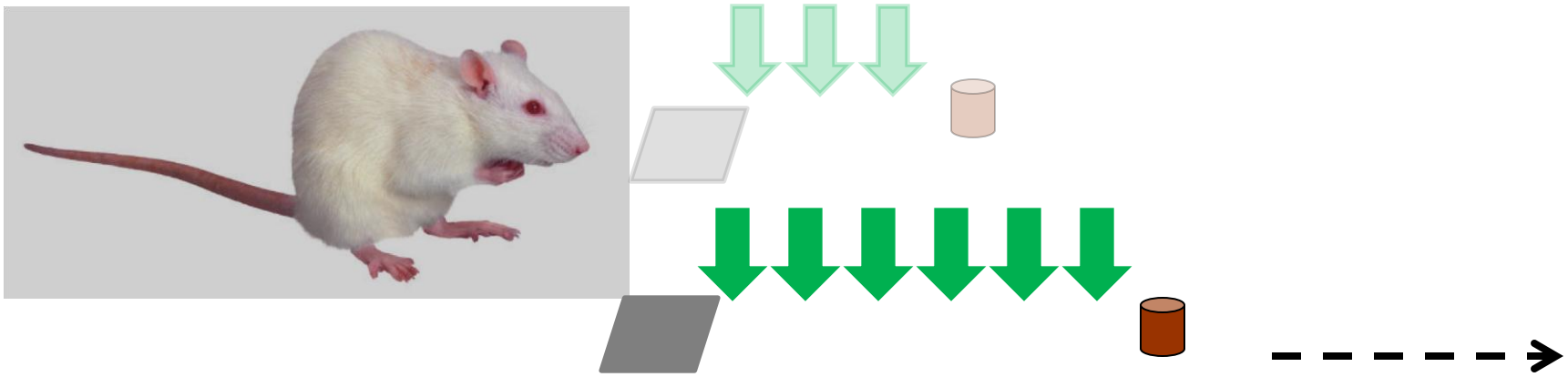
Incentive motivation to work for increasing reward: Progressive ratio (PR)

PR3 1 pellet compared to PR3 4 pellet

Predicting choice behavior

Incentive motivation to work for increasing reward: PR

PR3 1 pellet compared to PR3 4 pellet



Predicting choice behavior

Incentive motivation to work for increasing reward: PR

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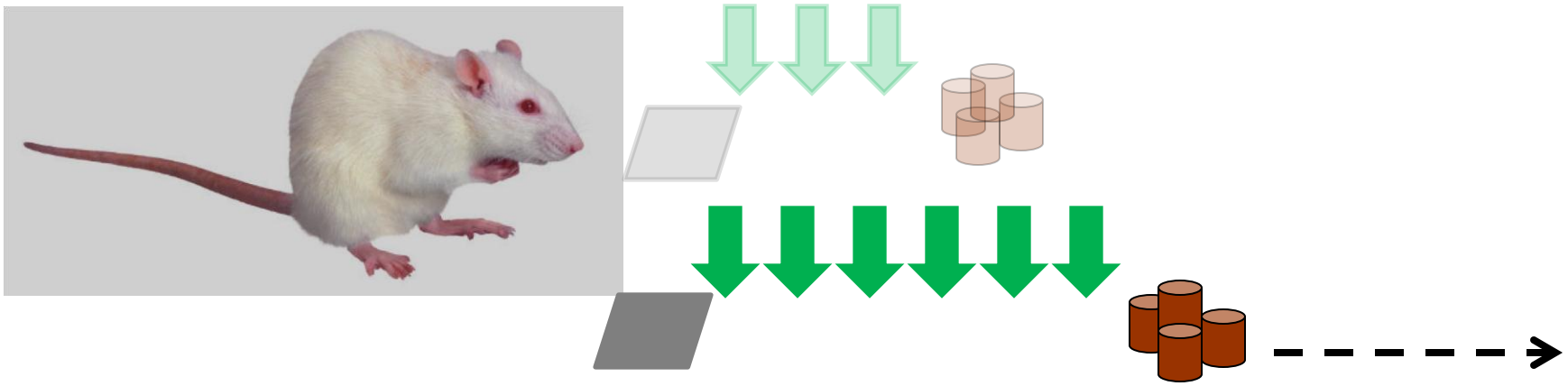

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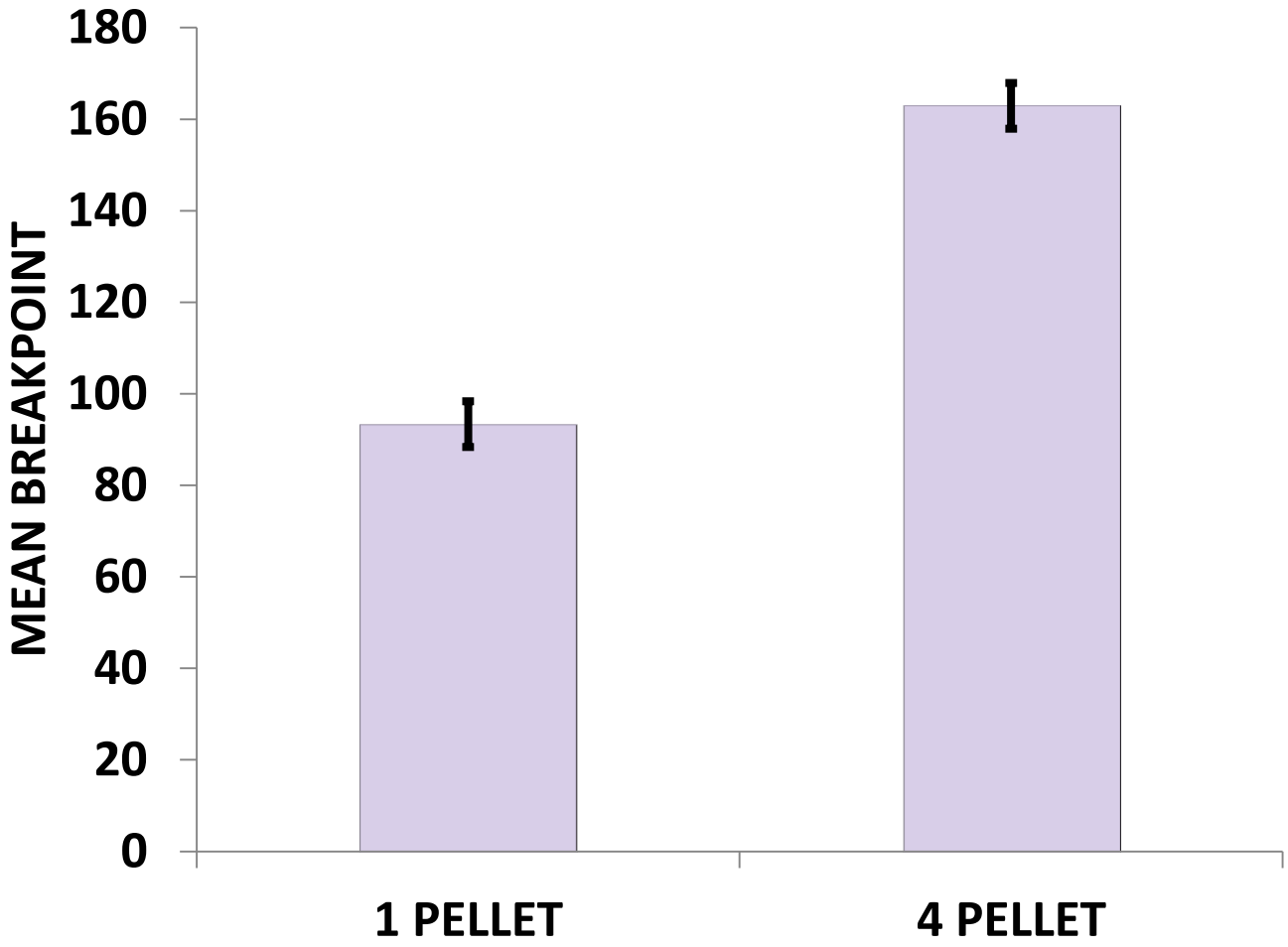
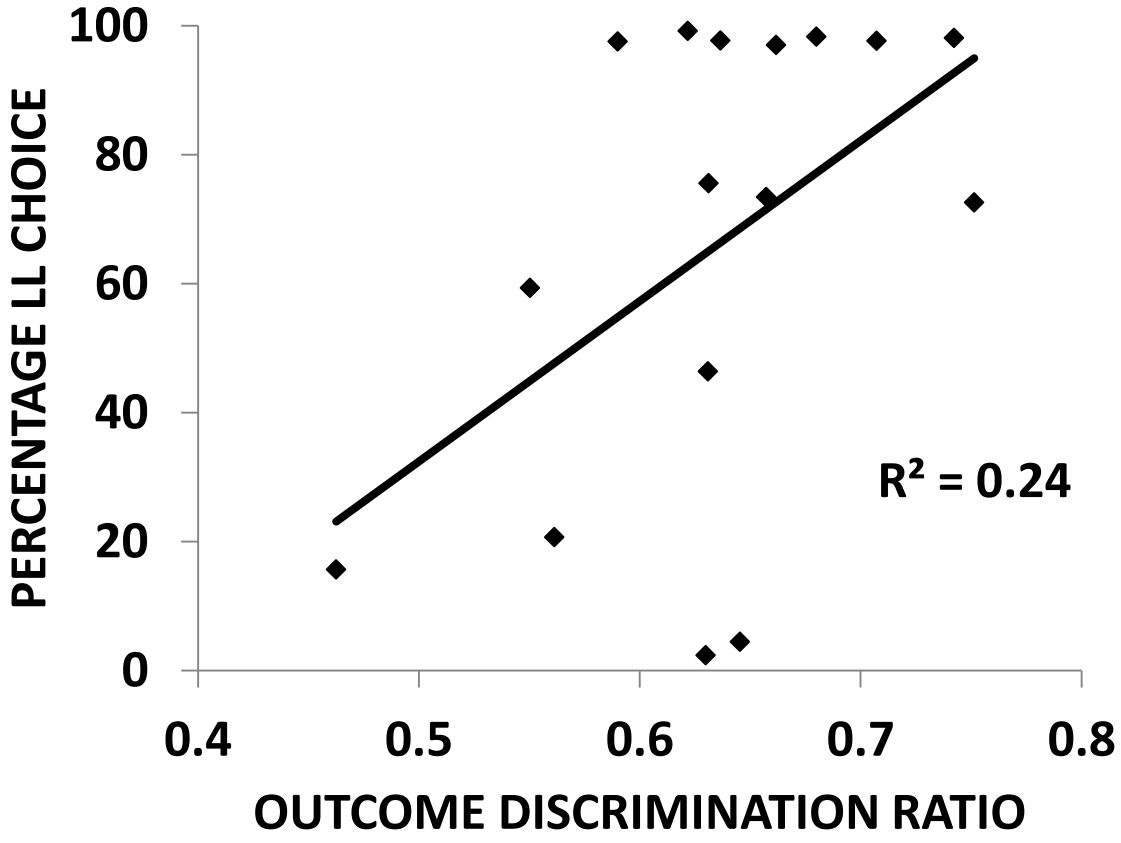
Incentive motivation to work for increasing reward: PR



Predicting choice behavior

Incentive motivation to work for increasing reward: Correlation with choice

Greater increase of work rate for larger outcomes predicts molar maximizing



Applications of a rat model

Rats can be given similar choice situations that people face (see also previous talk).

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Develop behavioral screening and interventions based on work with rats.

Explore neurobiological areas that are currently unavailable in human research.

Thanks go to:

Behavioral testing:

Aaron Smith

The rats

Members of the KK behavioral neuroscience lab

THE ROANOKE TIMES
Monday, September 20, 2004

STEPHANIE KLEIN-DAVIS | The Roanoke Times

Mellisa Williamson, 35, a Bullitt Avenue resident, worries about the effect on her unborn child from the sound of jackhammers.