Learning mechanism of biased action or inaction in operant conditioning

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Introduction:

Known as the Pavlovian effect the hypothesis that when we face a menace, we tend to avoid it, where when we see a reward, we urge to seek for it. This bias is told as a hard-wired effect (Swart & all) involving the striatum, the reward system (Guitar-Massip & all). However adaptive rational choices result of instrumental learning who is sustained by another stream in the striatum and the prefrontal cortex (Guitar-Massip & all). In an action/inaction task based on reward and punishment (table 1), an instrumental task, this Pavlovian bias seems to be easier to learn, fewer errors in less time. However, this advantage seems to be minimized after numerous trial, after the training procedure happened.

Table 1: Instrumental output

action/reaction	GO	NO-GO
+Reward	**Go to win**	**No go to win**
-Punishment	**No go to avoid**	**Go to avoid**
	Pavlovian cues	Anti-Pavolvian cues

In this experiment, we assess the effect of learning on this bias. Our experiment has the goal to verify if this bias exists and to assess if this effect can be influence or cause by learning or as suggested in the literature is hardwired in an evolution process, the Pavlovian reward system. We have the goal to train people on this task and see if the training has an impact on the response in the task. We also want to perform the same study on some children to verify is this bias is not encode from numerous previous conditioning, so to verify that this bias is evolutionarily grounded.

Methods:

We will perform repeated measure on a Go/No-Go task using two key (space/return) to simulate go for win and go for avoid, two keys are set to avoid pressing bias (Fig1). Cues are the only thing that change but it is the same principle. Participants learn during the tasks using trial and errors with a feedback message. As presented previously there is 4 desire output (table1) where we add 2 distractors, participants need to find out the desired output the fastest and most accurately as they can. The first measure is used as a training.

Two version (VO & VF) of this task were build using psychopy3 then update on Pavlovia. We will recruit online English participant using Prolific, we will also self-recruit French and English participants. For adults we use a double condition cue for the first one it is moving dots cued by direction and color, the second one is a Stroop task cued by congruence state and word orientation.
At the moment the experiment is made for adults, however we are in the process to get the approval to test this bias on children. The task will be a bit simpler, keeping the same initial idea.
We hope to recruit 60 to 100 adults from 18 to 70 years old and a smaller sample of childs above 10 from 8 to 17 years old.

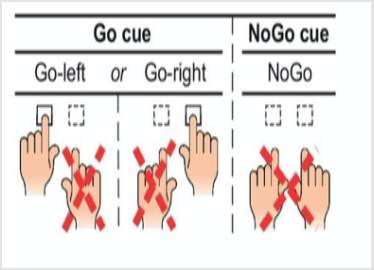
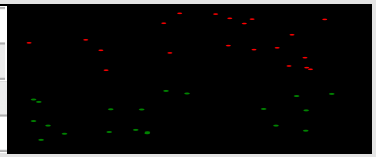


Fig1: Outcome responses

Fig 2: Types of cues used in the tasks

Black	Blue	Orange	Purple	Green
Black	Blue	Orange	Purple	Green
Green	Purple	Orange	Blue	Black
Green	Purple	Orange	Blue	Black



ANALYSIS:

The main outputs we are going to look for are the feedback scores, the reaction time, and the frequencies of go response across the trials.
The tasks are actually two different tasks due to the different cues, we might need to Zscore some of the output of the two tasks eliminating the difference in cues.
In the first task the cues are all of the same nature, but in the second one we need to identify a word in the normal side and upside down. This might influence our reaction time output, a separated Zscoring might be applied.
We will compare the mean of the two-sample and the four cues two by two using t-tests.
To compare the child result a one-way ANOVA will be performed to assess a difference between the adult group and the child group.

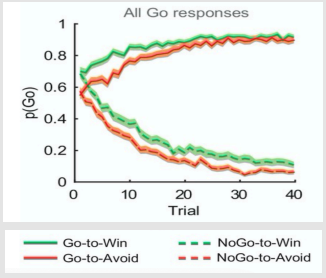


Fig3: Pavlovian bias in instrumental task (from Swart & all)

Tested hypothesis:

In this experiment we assess three null hypothesis:
The first one is that there is no difference between the Pavlovian and the anti-Pavlovian learning time, this is just a verification however this step is needed to validate the further hypothesis. Figure 3 is showing the desired result (those result are coming from Swart & all).
The second one is that there is no difference between the first and the second task for both populations.
The third is that there is no learning difference between children and adults population.

Opinion & Weakness:

My feeling is that learning and hardwired decision are working together the existence of a Pavlovian process is difficult to be sceptic about it. Considering previous studies I am waiting to see a translation due to learning however if we push a bit more I think it will be hard to make the anti-Pavlovian better than the Pavlovian due to a contribution of Pavlovian reward system. Also I think that we will find that children have the same or stronger Pavlovian effect compare to an adult.

Limited generalization of the research.
Finding results won't fully invalidate the Pavlovian bias.

Bonus:

I believe that some part of an experiment can be written by an automated program so I will try for the most part of the report to be self-written (automatically).

References:

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