

# Specific Pavlovian-instrumental transfer: relationship with instrumental reward probabilities

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It has long been known that Pavlovian conditioned stimuli can affect instrumental responses. For example, a tone paired with food can make a rat press more a lever leading to food as well [1]. This effect is called Pavlovian-instrumental transfer (PIT). For its link to both instrumental and Pavlovian processes, PIT represents an important means to understand the specific biological mechanisms underlying goal-directed behaviour and decision making. Recently, it has been shown that there are actually two kinds of PIT: specific PIT and general PIT [2]. In specific PIT, a conditioned stimulus (CS) enhances an instrumental response associated with the same outcome (e.g. the same food), while in general PIT the CS can enhance instrumental responses directed towards other outcomes (e.g. other foods). Specific and general PIT have different properties, in particular it has been shown that general PIT is reduced by outcome devaluation through satiation whereas specific PIT is not [3]. Although there is ongoing progress on the biological mechanisms underlying the two forms of PIT [4, 5], it is still not clear how PIT effects work at the computational level and what adaptive functions they have for animals.

In [6] we put forward an hypothesis on how specific and general PIT might affect instrumental behavior. In particular, we suggested that specific PIT affects the estimates of the probability of the reward associated to the instrumental action: that is, a CS paired with food rises the estimates of reward probability of instrumental responses tied to the same food. In other words, when a CS paired with food is present, the subject believes that its instrumental response will have an higher chance of obtaining that food. If this is correct, then an instrumental response which delivers food with 100% probability when the CS is not present would not benefit of the PIT effect since its reward probability is already at maximum. Thus, an inverse relationship between instrumental reward probabilities and specific PIT should be found. An alternative hypothesis is that CSs paired with food act as “occasion setters”, without altering the estimates of reward delivery. For example, CSs might simply reduce uncertainty about an instrumental response-food contingency being in effect or not, without altering its reward probabilities when in effect. In this case, the prediction switches: specific PIT should be stronger for instrumental responses with high probabilities as reducing the uncertainty on a frequently rewarding response would raise the average expected outcome more than reducing the uncertainty on the presence of a seldom-rewarding one.

To test these alternative hypotheses we are currently running a series of PIT experiments with human participants and multiple instrumental responses having different reward probabilities. Preliminary results from this study will be shown in the poster.

## 1 References

- [1] Estes, W. K. (1943) *Journal of Experimental Psychology* **32**, 150–155.
- [2] Corbit, L. H. and Balleine, B. W. (2005) *The Journal of Neuroscience* **25(4)**, 962–70.
- [3] Corbit, L. H., Janak, P. H., and Balleine, B. W. (2007) *The European journal of neuroscience* **26(11)**, 3141–9.
- [4] Corbit, L. H. and Balleine, B. W. (2011) *The Journal of Neuroscience* **31(33)**, 11786–94.
- [5] Laurent, V., Wong, F. T., and Balleine, B. W. (2014) *British journal of pharmacology*, In press.
- [6] Cartoni, E., Puglisi-Allegra, S., and Baldassarre, G. (2013) *Frontiers in behavioral neuroscience* **7**, 153.