Terminating Information Search

Stefan Appelhoff

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1 Introduction

As agents in different environments, humans often find themselves in situations that require decisions based on limited knowledge about the available choice options. The topic of the present project is the process, how humans selectively sample choice options to arrive at a more refined knowledge about the properties of the options. Specifically, the interest lies in self-directed information search in sequential decision making problems. A short example illustrates the topic further:

> Imagine that your laptop is broken and you want to acquire a new one. In the process, you may sequentially sample several available models and their respective properties such as prices, specifications, and reviews. To avoid indefinite browsing, you will need to terminate your search at some point and select a new laptop - most likely without having obtained full certainty about the best option.

For the project described here, the aforementioned example will be transformed into an experimental paradigm that allows for the examination of behavioral and neural aspects of choice in a controled manner. Similar to the real life example, the experimental paradigm exhibits the following characteristics:

- There is an environment in which several options exist that will yield outcomes upon selection.
- There exists limited knowledge about the options and the frequencies of their associated outcomes.
- There will be the opportunity to obtain information about the options through a sampling of the options.
- The overall goal is to maximize the positive outcomes obtained from the options in the long run.

In the paradigm, participants will make sequential decisions about which option to sample. In these trial to trial decisions, the question of interest to this project lies in how participants set their termination criteria. I.e., when do participants decide to terminate the information search in one option and switch to search another option? When do participants decide to stop sampling altogether and decide for one final option to be optimal based on current knowledge? The remainder of this document will be a concise formulation of the research questions followed by an outline of the experimental paradigm. Finally, the implementation of the experimental paradigm on a computer program will be described.

2 Research Questions

1. How are sampling efforts sequentially allocated to the different options?
2. How do we arrive at a decision to terminate the information search?
3. What is the quantitative link between neural signals obtained by EEG with the behavioral data of participants performing the experimental paradigm.

3 The Experimental Paradigm

The proposed experiment will be based on a combination of two different paradigms that are well known in the literature.

1. The n-armed Bandit Paradigm
2. The Sampling Paradigm

In the following, these two paradigms will be descibed in detail. Figure 1 provides an overview of the paradigms.

3.1 The n-armed Bandit Paradigm

From Hertwig also known as Partial-Feedback-Paradigm [1].

3.2 The Sampling Paradigm

yep, pretty nice.

3.3 Combination of the Two Paradigms

Need a figure here for the 2x2 design

4 Computerized Implementation of the Experiment

describe the computer code here
need a figure for the flow ???

5 References

[1] Ralph Hertwig and Ido Erev. "The description–experience gap in risky choice". In: *Trends in cognitive sciences* 13.12 (Dec. 2009), pp. 517–523. DOI: 10.1016/j.tics.2009.09.004. URL: http://dx.doi.org/10.1016/j.tics.2009.09.004.

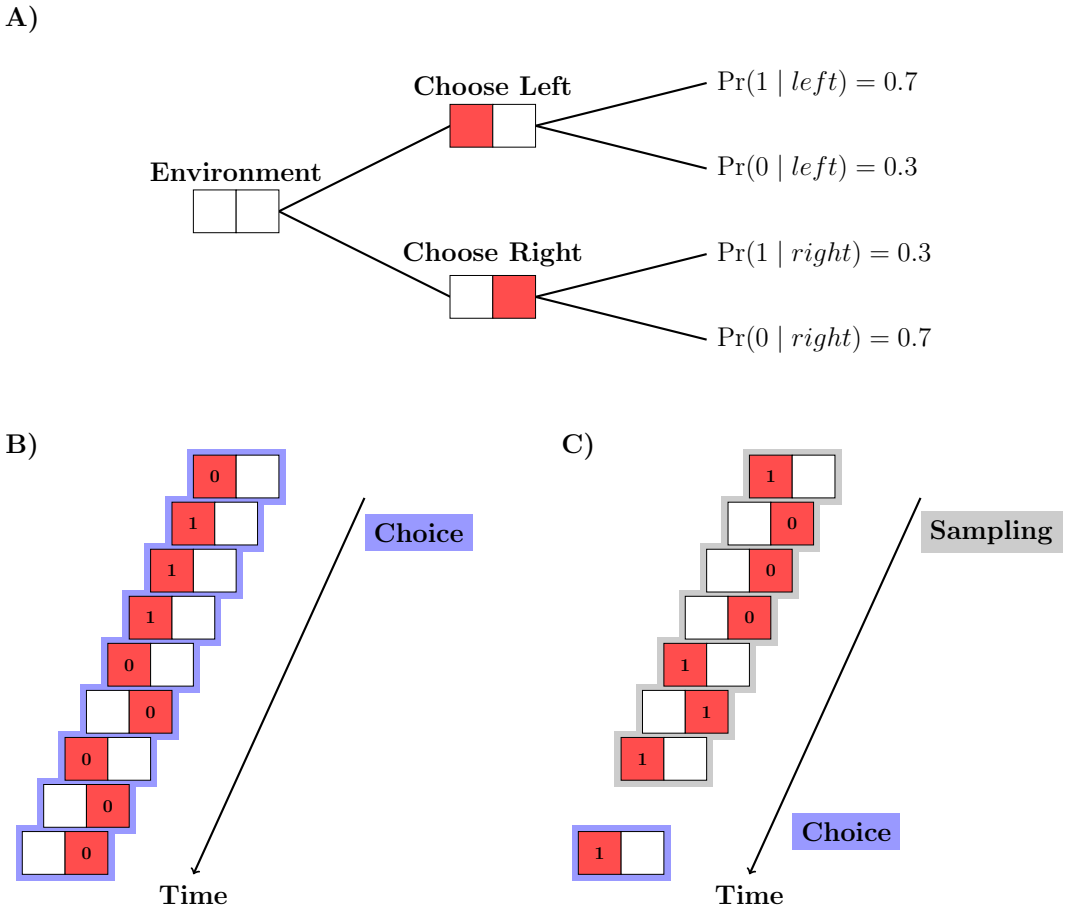
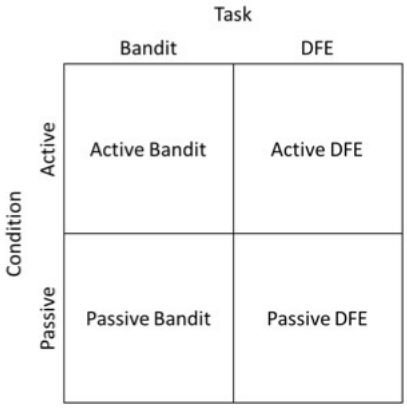


Figure 1: A) Depiction of a two-armed Bandit. Note that the number of options in the environment can be extended arbitrarily to form an n-armed Bandit. Each Option contains its own probability mass function (pmf) of outcomes. These pmfs are unknown to a subject performing the Bandit task. **B)** A typical run of trials in a Bandit task. A subject sequentially chooses among options and is provided with feedback. Each trial represents a exploration-exploitation problem. **C)** A typical run of trials in the Sampling Paradigm. A subject is allowed to sample the available options without an impact of the outcomes on the final payoff. At some point, the subject can decide to terminate sampling and choose one of the options, which will impact the final payoff.


Task
Bandit
DFE
Condition
Active
Passive
Active Bandit
Active DFE
Passive Bandit
Passive DFE