# Introduction

In visual search tasks, participants report the presence or absence of a target stimulus among distractor stimuli. In most cases, ‘target present’ responses are executed as soon as a target is found (*self-termination* assumption)*.* In contrast, making a target-absent response is not triggered by the detection of target absence, but is instead equivalent to deciding to terminate a search for target presence (implicitly concluding that such a target does not exist). This fact makes target-absent responses amenable to cognitive and metacognitive beliefs and expectations, for example about target prevalence, or about the sharpness of one’s vision.

Such beliefs can draw on previous experience in the task. Indeed, search time in target-absent responses decreases following successful target-present responses, and sharply increases following target misses (Chun & Wolfe, 1996). This heuristic is however limited to repetitive searches of the same target in similar displays, as is often the case in visual search experiments. However, in everyday life many visual searches are usually performed only once, such that relying on previous repetitions of the same search is impossible. For example, immediately concluding that a specific person is absent from a photo is rarely motivated by the distribution of time taken to find this person in other photos in the past. Only the first trials of a visual search experiment, where participants meet the stimuli for the first time, are a good model of this one-shot search behaviour. In these trials, beliefs about expected search efficiency are not yet informed by direct experience with the task, and are thus limited to more abstract intuitive theories of attention and visual search. Furthermore, participants’ ability to learn from positive examples (target-present trials), and their ability to generalize their knowledge across stimulus types and displays, offers an opportunity to study how these schema are built and the inductive biases that guide their acquisition.

In this study, we measure the time participants take to make target-absent (search termination) decisions to quantify their metacognitive beliefs about visual search performance, how this knowledge is built and expanded based on experience, and how it affects objective search performance.

Specifically, we focus on the pop-out effect for color search: When searching for a deviant color, search time is nearly unaffected by the number of distractors for target-present and target-absent responses alike (Treisman & Gelade, 1980; Wolfe, 1998). Our research question is whether and how the color pop-out effect for target-absent trials is dependent on prior experience with the task and stimuli.

In the following experimental design, target-present trials are used as learning samples (where subjects observe how efficiently they can find a target), and target-absent trials are used as test trials (where subjects terminate the search when they believe a target would have been found)*.* Thus, search time in the first target-absent trials correspond to prior beliefs about search asymmetry, before observing any learning samples. The presence of a pop-out effect in target-absent trials prior to any target-present trials would indicate that knowledge about the salience of a divergent color is available to participants in some form, and that this knowledge can flexibly be used for counterfactual reasoning in the process of inference about absence. In other words, an immediate ‘target-absent’ response in these first color searches would indicate that participants intuitively know that a deviant color *would have* popped out, and that they flexibly rely on this knowledge to guide their behaviour. Conversely, the absence of a pop-out effect would either mean that positive experience is necessary for this knowledge to be acquired (such that participants go into the experiment having no intuitive knowledge about color pop-out), or to be expressed (such that metacognitive beliefs about search efficiency don’t immediately translate into decision policy). In Fig. 2 we provide possible patterns of results, and our corresponding theoretical interpretations.