To investigate inferences of controllability and its elasticity to invested resources, we designed a novel task in which participants play a treasure-hunt game, where they can attempt to travel from an initial location (‘desert’ or ‘fountain’) to a treasure (located in either the 'desert' or the 'mountain' and worth 150 coins) by taking one of two actions: boarding the train or the plane each of which travels to a distinct destination (action (vehicle) to state transitions, *AS,* Figure 1A). At the end of the experiment, the total number of coins earned is converted into a bonus payment to participants. To instantiate controllability, we manipulate the probability that the participant would board the vehicle they selected across experimental blocks (= {0-1}). If participants fail to board their selected vehicle, they automatically walk to the closest location (initial state to final state transition, *SS*, Figure 1A), which leads to the treasure in 20% of trials. In high control environments, participants consistently board their preferred vehicle, enabling them to reliably determine their destination. In contrast, in low control environments, participants are frequently forced to walk to their destination due to failed boarding attempts, based on the prescribed SS’ transitions.

To manipulate the elasticity of control, we provide participants with the option to invest varying levels of resources to board their preferred vehicle. Specifically, participants have the choice to purchase a single ticket (40 coins) to board the vehicle if it stopped at the station, and up to two additional tickets (each with an additional cost of 20 coins) to increase their chances of jumping onto the moving vehicle by pressing the spacebar when it passes the middle of their screen (Figure 1B). Inelastic controllability () is reflected in the initial probabilities of the vehicles stopping at the station, independent of additional resources, whereas elastic controllability ( is reflected in the degree to which additional resources (tickets and jumps) increase the likelihood of successfully boarding the participant's preferred transport.

*(1)*

Where is the number of extra tickets purchased, and .

To evaluate participants' ability to infer the presence and elasticity of controllability, we designed three experimental blocks for each participant, each with a different possible combination of and (as illustrated in Figure 1C) such that zero tickets (opting out of any tickets, blue region), a single ticket (red region), and three tickets (green region) are each optimal in one block. To enable participants to learn the controllability of the environment, we have each block consist of 30 trials, and feedback of the destination reached provided every trial.

**A picture containing diagram, text, screenshot, plan

Description automatically generated**

**Figure 1: Experimental Design (A) Transition Rules:** In both controllability tasks, subjects attempt to board the train which travels to the town or the plane which travels to the mountain. If no tickets are purchased or participants failed to catch a ride they walk, either from the desert to the town or from the fountain to the mountain. **(B) Trial Structure:** On each trial, participants select whether they want to purchase either 1, 2, or 3 tickets to attempt to board their vehicle of choice. Purchasing additional tickets allows participants to jump onto the moving vehicle either once (2 tickets) or twice (3 tickets). Alternatively, participants can choose not to attempt to board the vehicle and instead walk to the nearest location for free which gives them a 20% chance of reward. At the end of the trial, participants are shown where they arrived at, allowing them to infer whether they successfully boarded their vehicle. **(C) Block Map:**  Expected value mapping of all possible block. The x-axis represents inelastic controllability within an experimental block, or the probability that one ticket will lead to successfully boarding the transport. The y-axis represents the elastic controllability within an experimental block, or the degree to which an additional two actions improve the probability of successfully boarding the transport (one additional action provides half the benefit of two addition actions). Expected values were calculated based on the ticket cost, probability of winning, and amount rewarded. The color corresponds to the optimal number of actions (blue: 0 actions, red: 1 action, green: 3 actions) while the transparency displays the difference between the optimal EV and the maximum EV of all other choices, thus representing the relative advantage of the optimal ticket strategy. The ambiguous block is designated by the black circle where no strategy is optimal. Every participant will complete three distinct combinations of elastic and inelastic control allowing us to evaluate behavior throughout the entire map across participants.