Description of datasets

<u>Variable Names</u>

sbj: code of each participant.

group: group name for each participant

age: age of each participant.

sex: gender of each participant. 1=female, 2=male.

cave condition: for Exp. 1-4, 1=o1 in the top cave, 2=o1 in the bottom cave, 3=o1 in the middle cave; for Exp. 5-6, 1=o1 in the top cave, 2=o1 in the bottom cave.

CSmod: conditions of the cue modality. v=visual cues in Phase 1 (& auditive dues in Phase 2), a=auditive cues in Phase 1 (& visual cues in Phase 2). Because Exp. 2, 3 and 6 did not counterbalance the cue's modality, their data did not include this variable.

st2sequence: manipulation of trial types on the first trial (or the first two trials) in Phase 2. For Exp. 2: 1=o1-trial 1, 2=o2-trial, 3=o3-trial (only shown in Group NoShift-3cave and Shift-3cave), 4=no-outcome trial present on Trial 1; For Exp. 4 and 5: 1=o1-trial on Trial 1 and o2-trial on Trial 2, 2=o2-trial on Trial 1 and o1-trial on Trial 2; For Exp. 6: 1=o1-trial, 2=o2-trial present on Trial 1.

trial name: **[cue]_[outcome]_[interval]_[trial number]**. For example: A_o1_CS_tr1 represents proportion of gaze time towards the o1 cave during the cue interval on Trial 1, when Cue A was presented. A_o1_preCS_tr1 represents gaze time towards the o1 cave during the pre-cue interval on Trial 1, when Cue A would be shortly presented.

Data of each experiment includes gaze time towards the correct outcome's area during the cue interval (denoted by CS in trial's name) and the pre-cue interval (denoted by preCS in trial's

name) respectively.

Note that the dependent variables *dwell time* for the main analyses were the difference in gaze time between the cue interval and the pre-cue interval (e.g. dwell time for A-o1 on Trial 1= A_o1_CS_tr1 – A_o1_preCS_tr1). When no interval is mentioned in the variable name, the variable is already the calculated *dwell time*. For instance, Z_o1_tr1 represents dwell time towards the o1 cave on Trial 1, when Z was present; X_o3_tr1 represents dwell time towards the o3 cave on Trial 1, when X was present.

Explanations of experiment-specific variables or blocking of trials:

    Exp. 1: gaze time of A-o1 on Block 1 is the averaged gaze time of A-o1 on Trial 1 and 2, and gaze time of A-o1 on Block 2 is the averaged gaze time of A-o1 on Trial 3 and 4, etc. For analyses of Phase 2 learning, gaze time involving prior less predictable outcomes was averaged within each block. Thus, gaze time with prior less predictable outcomes on Block 1 is the averaged gaze time of X-o2 and Y-o3 on Trial 1, gaze time with prior less predictable outcomes on Block 2 is the averaged gaze time of X-o2 and Y-o3 on Trial 2, etc.

    Further, Exp. 1 contains two additional analyses: 1) *dwell time* toward the three caves during Cue Z which signaled the absence of any outcome in Phase 2, and 2) *dwell time* towards caves o1, o2, and o3 during the cue which did *not* precede them (i.e. looking at the o1 cave with Cue X and Y, looking at the o3 cave with X and at the o2 cave with Y). Thus, we additionally reported *dwell time* (i.e. gaze time during the cue interval minus gaze time during the pre-cue interval) towards each cave during Z- trials and *dwell time* towards the o1 and the o3 cave during X as well as towards the o1 and o2 cave during Y in another worksheet (named

as "dwell time for add. analyses").

Exp. 2: Data of groups with three cave conditions (NoShift-3cave & Shift-3cave) during the cue and the pre-cue interval is reported in the first worksheet (named as "Exp2_ gaze time_3cave") and groups with two cave conditions (NoShift-2cave & Shift-2cave) in the second worksheet (named as "Exp2_ gaze time_2cave").

Notably, in NoShift-2cave and Shift-2cave, gaze time for each trial type on each block of Phase 2 is the averaged gaze time of trials with the same outcome within that block. For instance, gaze time for the prior predictable outcome o1 on Block 1 during the cue interval is the mean gaze time of R_o1_CS_tr1 and W_o1_CS_tr1, gaze time for the prior less predictable outcome o2 on Block 2 during the cue interval is the mean gaze time of S_o2_CS_tr2 and X_o2_CS_tr2, etc.

Exp. 3: See Exp 1.

Exp. 4: gaze time of Group Outcome-absent during the cue and the pre-cue interval respectively was reported in the first worksheet (named as "Exp4_ gaze time _Outcome-absent") and Group Cue-absent in the second worksheet (named as "Exp4_ gaze time_Cue-absent").

Notably, C-Ø trials in Phase 1 for Group Outcome-absent was denoted by C_o2absent in trial's names. For instance, C_o2absent_CS_tr1 represents gaze time towards the o2 cave during the cue interval, when C was presented but o2 would not appear. For analyses of Phase

1 learning, gaze time of trials with o2 on each block was the averaged gaze time of trials C-o2 and C-Ø within that block. In particular, gaze time of o2 trials during the cue interval on Block 1 is the mean gaze time of trial C_o2_CS_tr1 and C_o2absent_CS_tr1.

Further, Ø-o2 trials in Phase 1 for Group Cue-absent was denoted by C-absent_o2 in trial's names (e.g., C-absent_o2_CS_tr1). However, gaze time during Ø-o2 trials was not included in the analyses since participants could not actually perform "responses" without signaling. Moreover, gaze time of A-o1 on Block 1 in Group Cue-absent is the averaged gaze time of A-o1 on Trial 1 and 2, gaze time of A-o1 on Block 2 is the averaged gaze time of A-o1 on Trial 3 and 4, etc.

Exp. 5: see Group Outcome-absent of Exp. 4

Exp. 6: Ø-o2 trials in Phase 1 for Group Cue-absent was denoted by C-absent_o2 in trial's names (e.g., C-absent_o2_CS_tr1). Because A-o1 on Trial 29 and Ø-o2 on Trial 15 belong to the transit block, these two trials were not included in the analyses. Gaze time of A-o1 on Block 1 is the averaged gaze time of A-o1 on Trial 1 and 2, and A-o1 on Block 2 is the mean gaze time of A-o1 on Trial 3 and 4, etc.