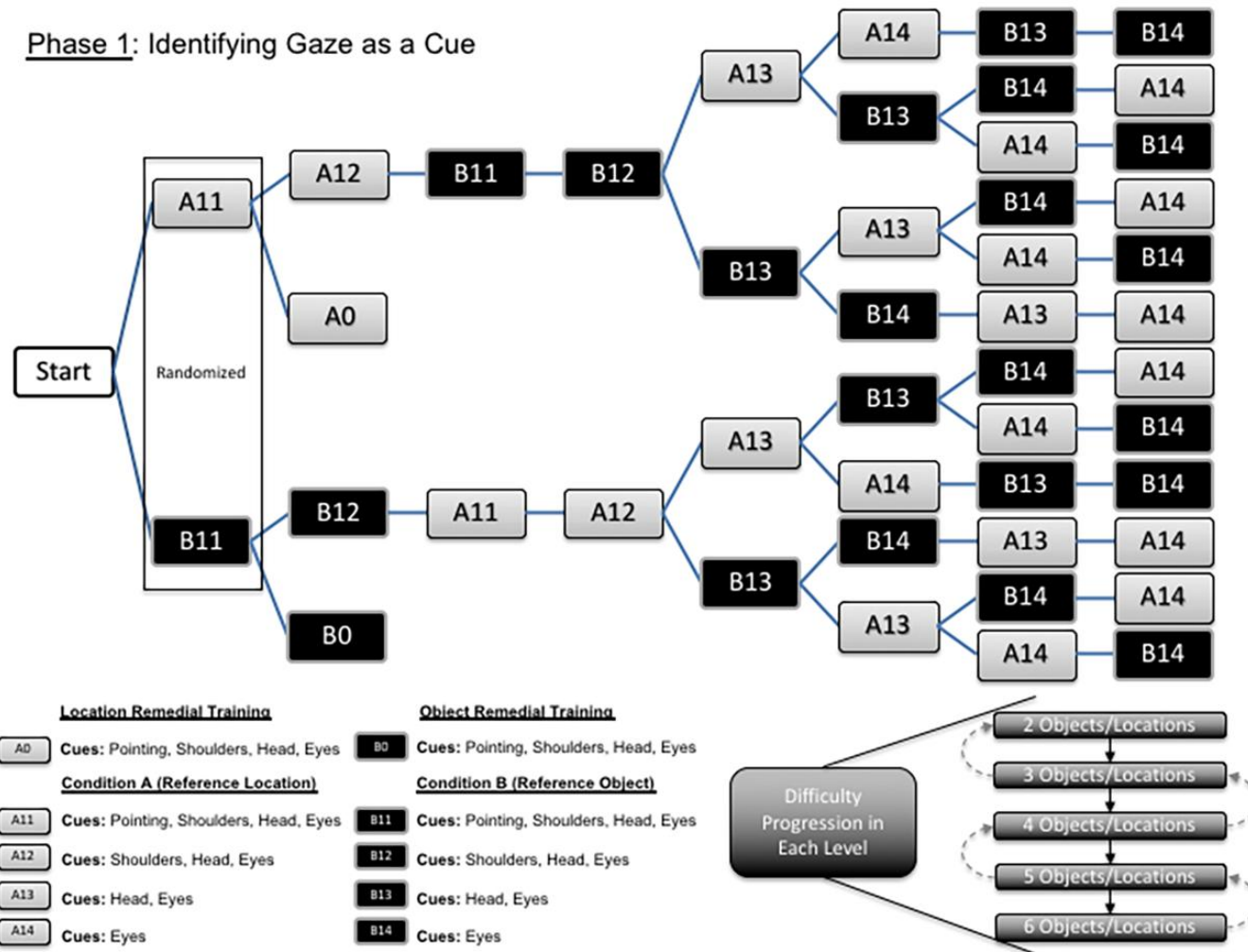


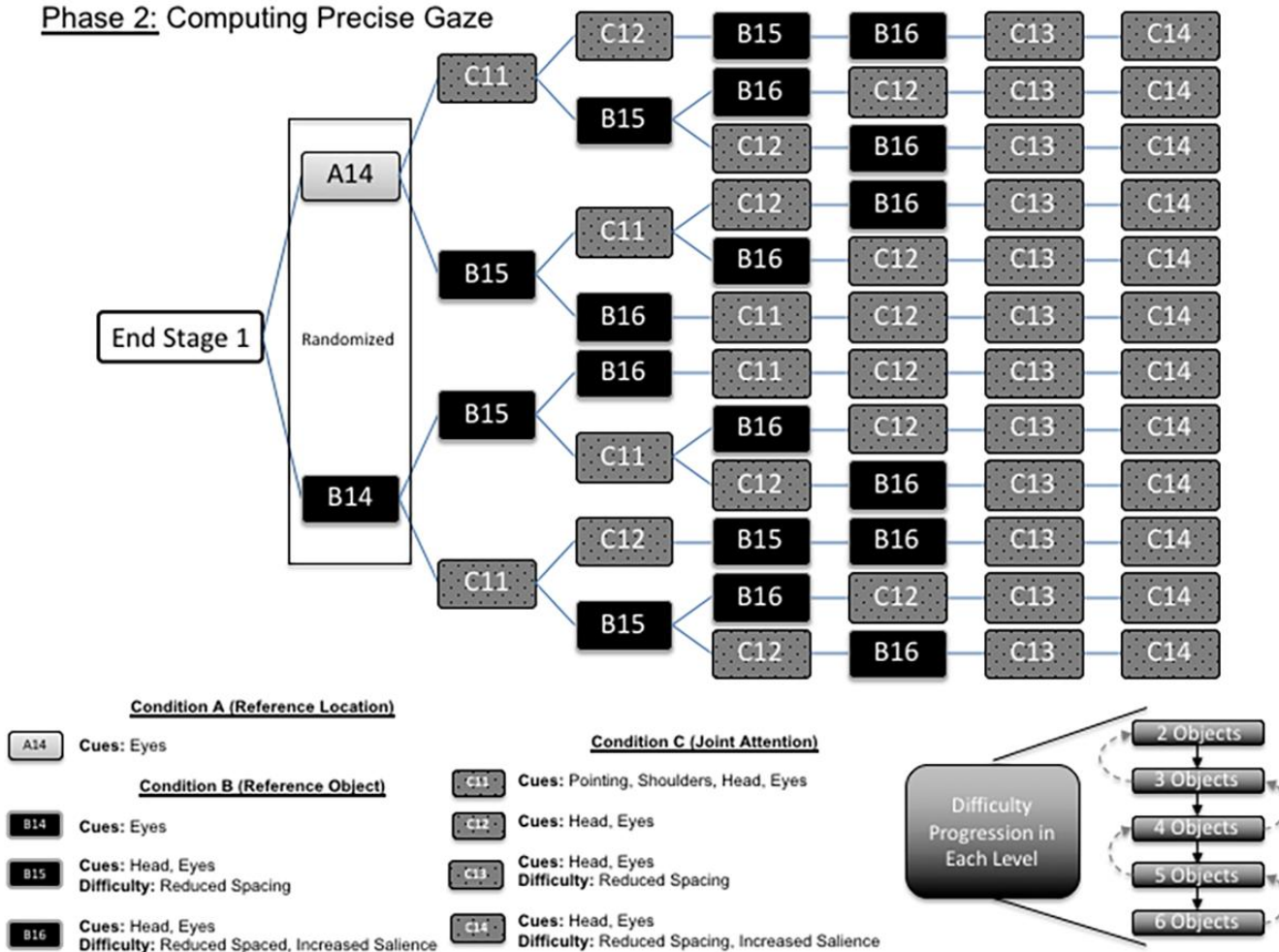
Supplementary Figures



**Supplementary Figure 1. UML Diagram of Phase 1 of Intervention Game.** The tasks in Phase 1 of the game are organized to help participants identify eye gaze as useful information for solving problems in the game and to generalize that knowledge across

contexts and avatars. Participants are randomly assigned to begin training in one of two conditions that train 1 of 2 functional uses of eye gaze cues. In Condition A they learn to use eye gaze cues to reference locations in the world. In Condition B they learn to use gaze cues to references specific objects in the world. Once in a condition, participants start with the easiest level (e.g., A11), which is defined by the number of non-verbal cues used to signal to the participant about how to solve a puzzle. Within each level, they work through stages of difficulty as the number of objects or locations increases. They have to perform with 80% accuracy within a stage to progress to next stage. When they fail a stage, they regress to the previous stage where they were successful and practice using the cues to solve problems in the game. If participants do not succeed solving the easiest levels (A11, B11), they are temporarily send to remedial training (A0, B0) in which the cues are more exaggerated and slowed down to help participants understand how to interact with the avatars. When they succeed in the remedial training, they come back into the elementary level of the condition they were working on. The lines show the progression of the possible choices through the levels as the game progresses through Phase 1. Note that participants must master comparable levels in both conditions before they can progress to more advanced levels in either condition.

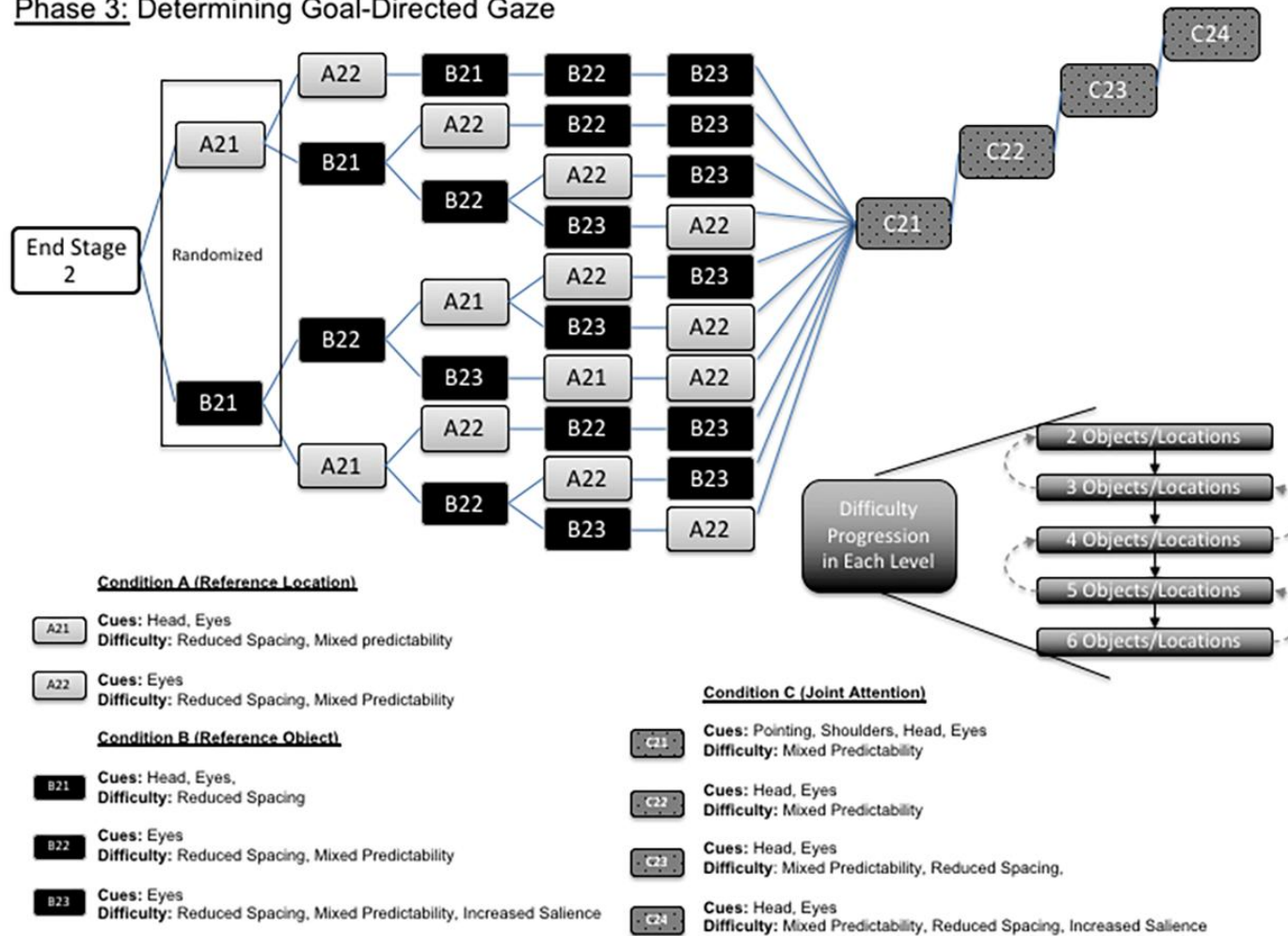
**Phase 2: Computing Precise Gaze**



**Supplementary Figure 2. UML Diagram of Phase 2 of Intervention Game.** The tasks in Phase 2 of the game are organized to help participants use eye gaze in a more fine-grained way. Specifically, as levels increase, the spacing between objects is reduced,

which requires participants to compute more precise trajectories of gaze to identify the correct gazed-at object to solve puzzles. Also, as levels increase, the non-target objects become increasingly more salient to draw attention away from the target gazed-at object. Participants have to learn to ignore the more salient objects and continue to focus on the gaze cues and the gazed-at object to solve the puzzles. Participants also start learning about joint attention on specific objects in this phase of the game (Condition C). As with the other conditions, the earliest levels of joint attention episodes include multiple non-verbal cues to facilitate understanding of the object of the joint attention. As the levels of difficulty increase, the cues are focused on the head and eye gaze direction. Also, as in Phase 1, each level has multiple stages that participants have to progress through with 80% accuracy to complete the level. The lines show the progression of the possible choices through the levels as the game progresses through Phase 1. Note that participants must master comparable levels in both conditions before they can progress to more advanced levels in either condition.

Phase 3: Determining Goal-Directed Gaze



**Supplementary Figure 3. UML Diagram of Phase 3 of Intervention Game.** The tasks in Phase 3 of the game are organized to help participants determine the difference between a goal-directed and non-goal-directed gaze cue. Participants learn to do so in

conditions in which they use cues to reference locations (A21, A22), reference objects (B21-B23), and in episodes of joint attention (C21-C24). To learn about goal-directed gaze cues, the easiest levels of this phase of the game reintroduce head direction cues and newly introduce directional gaze information that is not goal-directed. For example, the avatars look up to the ceiling (as if thinking about something), or they scan all the objects with their eyes. These non-goal-directed cues are embedded within the goal-directed cues of looking at a location or an object for specific referential purpose. Participants have to learn to sort out which of the gaze cues are goal-directed and which are not to solve the puzzles in the game. In the most advanced levels of this phase, participants have to contend with all the difficulty, mixed predictability of the goal-directedness of the gaze, reduced spacing of the objects, and increased salience of the non-target objects. Also, as in the earlier phases, each level has multiple stages that participants have to progress through with 80% accuracy to complete the level. The lines show the progression of the possible choices through the levels as the game progresses through Phase 1. Note that participants must master comparable levels in in the object and location conditions before they can progress to practicing these skills in the joint attention condition.