Can Augmented Reality (AR) immersion and interactivity dispel misconceptions and increase public understanding of science? The interdisciplinary team including USC’s Institute for Creative Technologies, the Rossier School of Education and the La Brea Tar Pits Museum, developed two AR engagements, one miniature “tabletop” and one life-sized “field” experience to investigate the differences in AR across qualitatively distinct designs on interactivity and visual immersion. Participants were able to take part in a “virtual active dig site” and discover fossils preserved in the asphalt seep; they were also able to walk amongst Mammoths in a virtual simulation of Los Angeles from 25,000 years ago. Learning goals for the experiences included: how and what types of plants and animals are entrapped in the tar pits; the similarities/differences between the LA ecosystem in the ice age vs. present; and how we use the scientific method of testing ideas with evidence and revising hypotheses. Design considerations made to evaluate the efficacy of achieving learning objectives, and engagement included: interactivity (selection and manipulation); levels of immersion (smartphone vs head-mounted display), aesthetics (high-fidelity vs low-poly 3D-models). Take-aways from pilot and formal user-studies include the ability to achieve strong interest and consistent learning with lower-fidelity AR; strong reactions to large-scale, life-sized events even with lower fidelity models; mini-experiences, large scale, and even 2D posters (control) can be engaging with the right narrative and framing. Further results from the “Pit-91” tabletop study are being analyzed and data collection on the “Field Experience” is set to investigate a life-sized experience.