University of Utah
UNDERGRADUATE RESEARCH JOURNAL

ANOTHER BIG FOOT STUDY: GAP WIDTH PERCEPTION WITH VIRTUAL FOOT SCALING IN CHILDREN

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The purpose of this study was to explore our understanding of spatial cognitive abilities in children versus adults; investigating how one may use their perceived body sizes to make decisions about what they can do in an environment. Gibson, and his theory of affordance (1979) theorizes that one's perception of the environment is related to one's capability of available action in the specific environment. Action-scaled affordances and our judgments of such may be based off of our understood perceptions of our own body dimensions and the environment itself. Our goal in this study is to replicate the effects of a past study on adults to analyze the effects of virtual body size on children, and specifically investigate the effects of foot size on gap width perception and affordance judgments for stepping.

Methods. We use an HMD Vive, a virtual reality device, to investigate our questions. The environment, an Italian plaza (see Figure 1), was created using a computer generated program called WorldViz. Participants are asked to wear a head mounted display headset, and foot trackers. Our data collection consisted of 36 kids ages ranged from 8 to 12 (mean age 10 years), and 40 adults ages 18 to 48 (mean age 21 years). The participants were placed into two conditions, the big foot condition where the participants' virtual foot was enlarged by 150% but of their actual foot size, or the small foot condition where their virtual foot was scaled to 75% of actual foot size (see Figure 2). The participants were asked to perform two tasks: the first, affordance judgment task where they were presented eight different size gaps which were shown three times each and randomized across 24 trials, and then were asked whether or not they could step over the gaps with a yes or a no response. They did not actually step over these gaps. The second task involved size estimation of four width gaps presented three times each, and also randomized across 12 trials. Lastly, the participants were asked to whether or not they felt shorter or taller, or their actual height. Questionnaires were also taken to collect their perception of their virtual foot, and their perception of ownership, agency, and self-localization of their avatar feet.

Results. Our findings showed a significant interaction of foot condition (e.g. big vs small) and age group (e.g. adult vs children). A replicated effect of big foot condition was seen in the adult population which showed adults overestimated their stepability of gaps with big compared to small feet, however this was not the case for children. With children, there was a significant foot condition effect, but reversed, showing kids overestimated their stepability of gaps with the small foot condition compared to the big foot condition. There was no effect of foot condition in the gap size estimation tasks.

Implications. Thus, our findings suggest a need for further exploration of spatial cognitive abilities in children. Possible explanations for the reversed effect could be the instability in the continuous growth of children, which may affect their ability to judge their action-scaled affordances in accordance to their body dimensions. Another possible explanation could be due to the kids' logic in how their perception of height relates to feet size. For example one may perceive their smaller feet to mean they are taller as an individual because they are farther away from the ground (e.g. longer legs), or big feet to mean they are a shorter individual because they are closer to the ground (e.g. shorter legs). Future work will assess perception of virtual body size across age and different body dimensions.

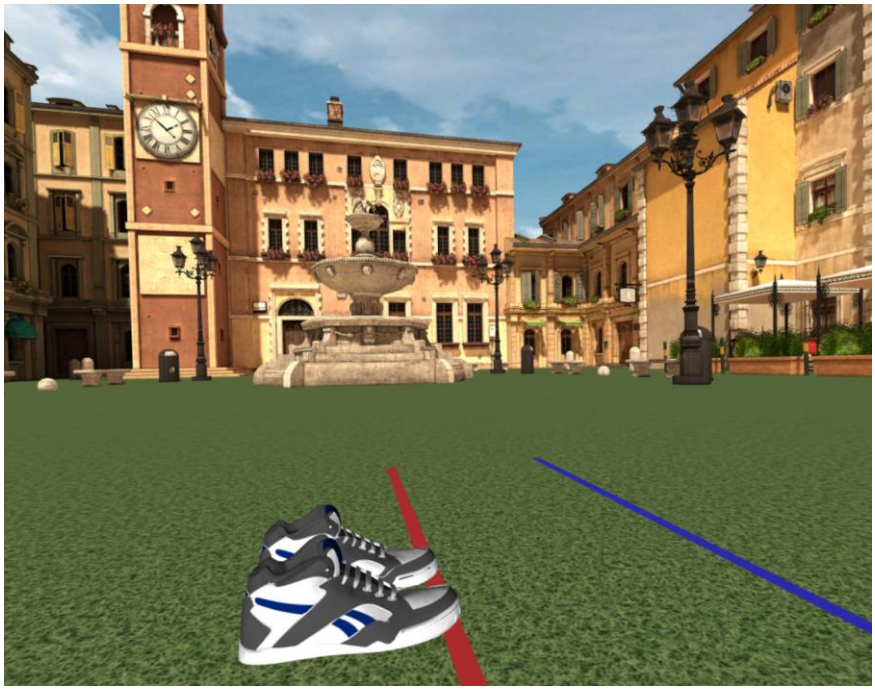

Figure 1. The plaza virtual environment with virtual feet.

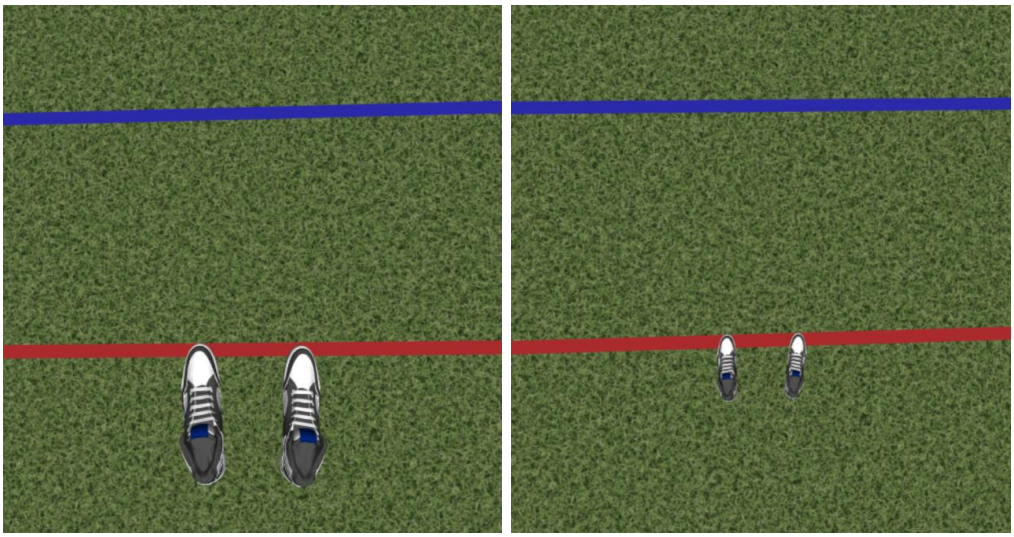

Figure 2. Big (1.5x) and Small (.75x) virtual feet used in the experiment.