Orientation free representations or multiple perspectives in Virtual Environments? A case for increased use of eye-tracking data to differentiate.

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Abstract. As people move through an environment that they may encode spatial information according to a particular frame of reference. These can be egocentric and dependent on individual experience [Easton & Sholl, 1995; Bryant & Tversky, 1999], allocentric and framed by the structural properties of the environment [Coluccia, Mammarella, De Beni, Ittyerah & Cornoldi, 2007] or potentially based on the intrinsic properties of an arrangement of objects within an environment [Mou & McNamara, 2002]. The spatial information utilized or encoded within a preferred frame of reference can be indicated by the presence of a spatial alignment effect.

Spatial alignment effects refer to more efficient recall about an environment and the objects within it from an imagined perspective aligned with a particular source of information. This source of information may suggest a preference for a reference frame. Alignment effects are revealed through judgment of relative direction (JRD) tasks which require the use and application of vectorial learning and measure orientation dependence. One particular type of alignment effect is the First Perspective Alignment Effect (FPA). The First Perspective Alignment effect (FPA) refers to significantly more accurate judgments when participants imagine themselves in alignment with the very first experienced perspective within a novel environment than those that are misaligned or contra-aligned with the first perspective. It can be commonly found in textual environment descriptions [Wilson, Tlauka & Wildbur, 1999], as well as Virtual Environments (VE's)[Wilson and Wildbur, 2004] but less frequently in real world settings [Wilson, Wilson, Griffiths & Fox, 2007].

There appeared to be a discrepancy in the literature despite the occasional presence of the FPA effect in real world experiment designs – with it being more apparent in what some might consider secondary media. Wilson et al. [2007] suggested this may be due to what they termed the salience hypothesis, where the level of available detail could influence the salience of the

initial perspective; real environments have a wealth of available information where VE's in comparison have less increasing the salience and reliance on the first perspective. This was investigated further by Tlauka, Carter, Malhberg and Wilson [2011]. Across several experiments the level of environmental detail was manipulated to test the salience hypothesis, yet no significant difference was found, the FPA effect was present across all levels of detail. Further experiments manipulated the procedure participants experienced. When the procedural experience for the VE groups closely mirrored that which would be found in a real world experimental design (approaching the test area rather than being instantly transported to the start of the route) so did the results. A realistic procedure attenuated the presence of the FPA effect (though this was time limited, the FPA effect returned upon testing a week a later). Tlauka et al. [2011] concluded that the differences in FPA presence found in the literature was a result of differences in procedure; experience of the surrounding environment allows for the encoding and use of multiple perspectives and sources of salient spatial information, attenuating the importance and reliance of the first perspective.

The data from Tlauka et al. [2011] would seem to suggest multiple perspectives were temporarily adopted because of the re-emergence of the FPA after a period of time. However the results from such experiments do not define what these perspectives are, what alternative sources of spatial information were adopted. Without this it is difficult to adequately state if multiple perspectives or a completely orientation free representation have been adopted. JRD's can reveal certain sources of alignment but the judgments presented to participants are pre-set and require the experimenter to have identified possible sources. If appropriate judgments are not investigated or presented in the JRD task then sources of spatial information may be overlooked. There are also further issues concerning the FPA effect. It is relatively unknown what properties of the first perspective are aligned too, and resultantly what spatial properties result in this privileged encoding.

In this poster presentation we present a case for increased involvement of eye-tracking procedures in the standard alignment effect experimental design. Eye-tracking data from a pilot calibration may result in a more appropriate selection of JRD's. Eye-tracking as part of the experimental procedure could result in a greater appreciation of the sources of information being attended to, and in turn lead to the ability to sufficiently differentiate between whether multiple perspectives or orientation free-perspectives are being utilized. We also make the case that such data could allow for the identification of the spatial properties that lead to persistent alignment effects such as the FPA.

Keywords: alignment effects, eye-tracking, First Perspective Alignment (FPA) effect, frames of reference, spatial learning, encoding, Virtual Environments