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VARIETIES OF VIRTUALIZATION

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Natural environments have a content, i.e., the objects in them; a geometry, i.e., a pattern of rules for positioning and displacing the objects; and a dynamics, i.e., a system of rules describing the effects of forces acting on the objects. Human interaction with most common natural environments has been optimized by centuries of evolution. Virtual environments created through the human-computer interface similarly have a content, geometry, and dynamics, but the arbitrary character of the computer simulation creating them does not insure that human interaction with these virtual environments will be natural. The interaction, indeed, could be supernatural but it also could be impossible.

An important determinant of the comprehensibility of a virtual environment is the correspondence between the environmental frames of reference and those associated with the control of environmental objects. The effects of rotation and displacement of control frames of reference with respect to corresponding environmental references differ depending upon whether perceptual judgement or manual tracking performance is measured.

The perceptual effects of frame of reference displacement may be analyzed in terms of distortions in the process or virtualizing the synthetic environmental space. The effects of frame of reference displacement and rotation have been studied by asking subjects to estimate exocentric direction in a virtual space. Exocentric judgements involve the estimation of the orientation of one external object with respect to an external frame of reference. They may be contrasted with egocentric judgements in which objects orientation is judged with respect to the viewer himself. Though alternative models of the errors of exocentric direction may be compared, the most parsimonious explanation may be that viewers misjudge the direction of the view vector used to produce the display. The motor effects of frame of reference misalignment have been studied using a technique of three dimensional tracking in which a target moves irregularly in 3 axes. Pursuit tracking errors may be separated into linearly additive visual and visual-motor components, but the pattern of error as a function of angular misalignment may not generalize to compensatory tracking or to non-holonomic control modes.

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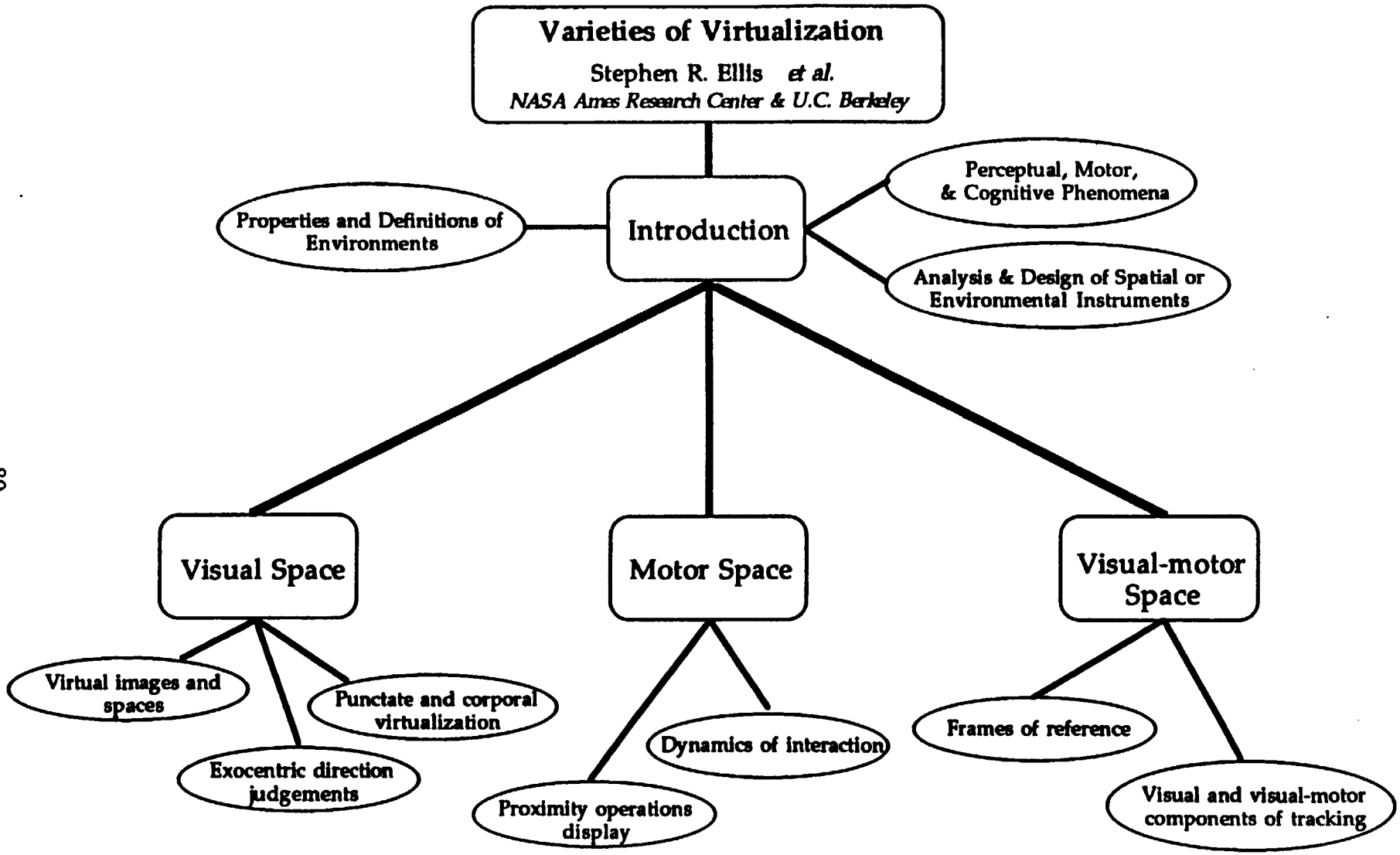
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