Semantic Connections
Exploring and Manipulating Connections in Smart Spaces

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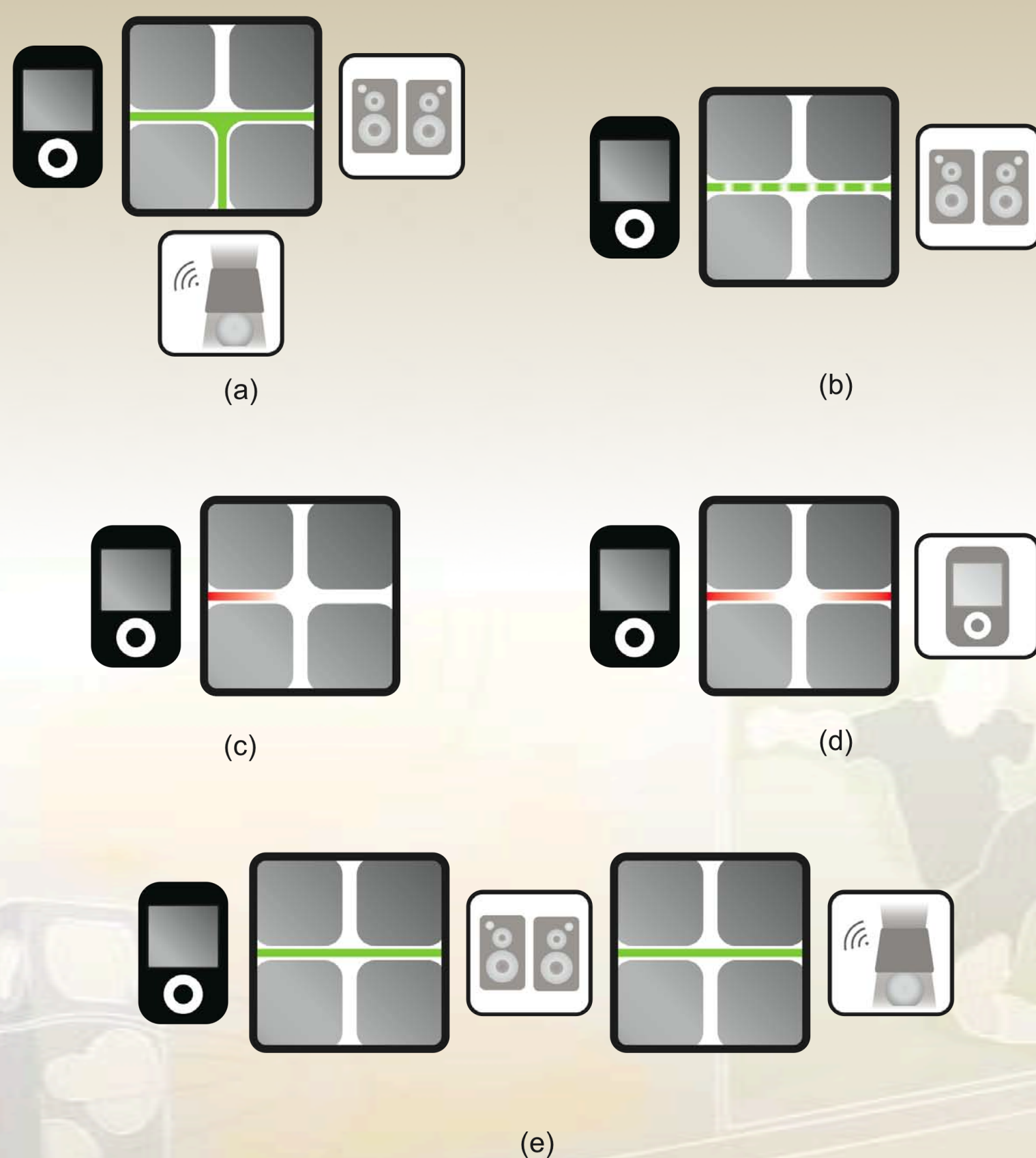
Introduction

In envisioned smart environments, enabled by ubiquitous computing technologies, electronic objects will be able to interconnect and interoperate. How will users of such smart environments make sense of the connections that are made and the information that is exchanged?

We developed a tile-like interactive object that allows for both exploration of a smart space in terms of connections, and manipulation of these connections and information/data streams through direct manipulation. This is done by making simple spatial arrangements. The interaction tile visualises the various connections by enabling users to explore which objects are connected to one another and what can be connected to what.
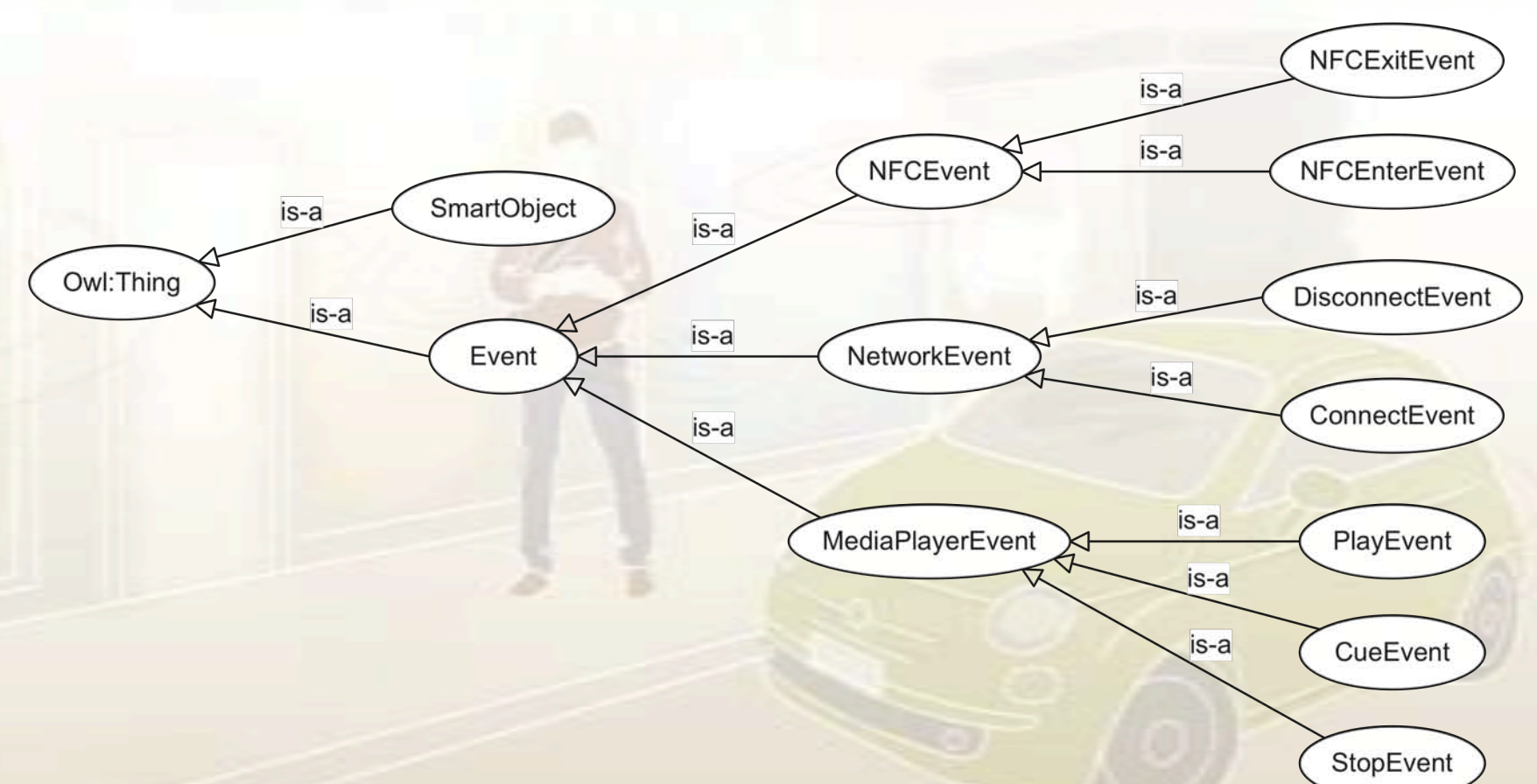

(a)   (b)

(c)   (d)

(e)

Meanings of lighting colour and dynamics: (a) Green solid light means the devices present are connected; (b) Green, pulsing light means the devices are currently not connected, but can be connected; (c) Red solid light means device recognised, a second device is necessary to show connections or connection possibilities; (d) Red solid light means the devices are recognised, but no connections or connection possibilities exist; (e) Shows the possibility to use multiple interaction tiles to look into connections in a more detailed manner, however both (a) and (e) have the same meaning.

Implementation Details

The interaction tile inserts events and data into a triple store and queries it when it needs information. The different types of events and the connections between smart objects and their related properties are described in an ontology. The ontology with "is-a" relationships indicated is shown in the figure below. Every interaction with either the music players or the interaction tile results in an interaction event. A reasoner is used to reason about these low-level events in order to infer higher-level results.

When a user establishes a connection, two `NFCEnterEvent` events generated by two different devices not currently connected, will result in a new symmetric `connectedTo` relationship between the two devices. Since `connectedTo` is also an irreflexive property, it is not possible for a device to be connected to itself. A `generatedBy` relationship is also created between the event and the smart device that generated it, along with a timestamp and other event metadata.