Related Work

Cognitive theory has been extensively studied in the field of instructional interface design. The majority of work is based on Baddeley's canonical model of working memory as a limited buffer for visual and auditory information [a]. When the buffer is overloaded, possibly by performing complex tasks that involve an ordered series of physical and mental activities, new information can fail to be processed [a, b]. Mayer (2005) expands Baddeley's model to form a cognitive theory of multimedia learning [c, d]. In his model, information processing is divided into a verbal (not necessarily auditory) channel and a visual channel. Again, each channel has a fixed information-processing capacity and can be overloaded. Mayer presents a series of principles for designing instructional multimedia aimed to reduce cognitive effort required from the learner for one or more channels [c].

Over the last decade, similar principles have often been used in the design of multimedia systems for academic or conceptual instruction, e.g., Moons and De Backer (2011), or Wong et al., (2012). However, unlike academics, most activities, cooking included, require less intellectual effort but require coordination of motion and sensation. The requirements on the channels of information processing thus differ. Paas and Sweller (2011) argue that "biologically primary" skills passed through evolution require less cognitive effort than explicitly learned, often culturally driven "secondary" skills. Based on time of historical emergence, movement-based activities like sports and cooking should be more primary than many fields of academics. On the other hand, Post et al. (2013) find that gesturing while watching grammar-instruction animations interferes with learning, and grammar could arguably be a primary skill. Moreover, interference from over loading could be bidirectional, for it is well established that secondary in-vehicle activities such as phoning or texting compromises drivers' ability to react to road conditions, leading to injuries and fatalities [f].

Several questions arise, yet few studies have directly investigated the cognitive load effects of teaching tools in non-academic situations. In a rare study, Khacharem et al. (2014) investigate the cognitive load effects of animations used for soccer instruction and find that novice players process both static images better than animations and slow animations better than fast ones, whereas expert players learn more effectively with fast animations. Their results suggest that speed and motion from instruction alone can add additional tolls on cognitive load, but these instructions were conveyed offline, as opposed to during gameplay.

The body of literature on cooking is similarly patchy. Recipe recommendation and generation are well documented in the literature [y, u, o]; many such systems have been built (e.g., gg) but do not assist users in making the recipe. Meanwhile, little or no research investigates the cognitive load of cooking, and few systems seek to address the possible overload. Kraft's iFood Assistant [q] and Quasar Computing's Cook

Assistant Lite [j] seem to share our goals, but their design choices and user test results, if any, are not documented.

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