Push-Me, Pull-Me: Describing and Designing Technologies for Varying Degrees of Reflection and Invention

Abstract
This poster suggests a terminological continuum from reflection (push) to invention (pull) for describing children’s technologies. Situated as social actors in the zone of proximal development, children’s technologies support diverse developmental processes, from the invention sparked by a blank canvas to the metacognitive reflection suggested by maintaining and revisiting a progress portfolio. It is suggested that affect-neutral terminology for situating specific technologies along this continuum will assist designers in their own processes of invention and reflection.

Keywords
design terminology, reflection, invention

ACM Classification Keywords
H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces – Theory and methods.

Introduction
This poster’s premise is that children’s engagement in the processes of reflection and invention can be motivated or hindered by the affordances of technologies. For researchers who study children’s use of technology and designers who are incorporating the participation of children into their research and design practices, the situation is often complicated by
discussing technology in technologically-mediated contexts. For example, asking a child to respond to a video of a robot will likely elicit a different response than asking a child to draw a picture of a robot with which he or she would like to play. In this poster, we propose that an initial step to more fully understanding those distinctions is an unambiguous and affect-neutral terminology for describing technologies.

**Existing Terminology**

Existing terminology for describing the influence of a technology or medium on its user is insufficient for our purposes due to one of two features: the distinctions made are affectively charged, implying that one end of the terminological spectrum is somehow “better” than the other regardless of context; or, more subtly, the terminology available does not sufficiently describe the opportunities for user interaction with the technology. Falling into the first category, for example, are distinctions such as passive versus active media, or technologies of consumption versus construction (e.g. [2]). These terms imply that some media require the user to actually do something to accomplish some goal, while other media is simply for informational or entertainment purposes. Similarly, in education circles the terms teacher-centered and student-centered are used to describe the ways in which teachers either rely primarily on lectures or actively involve their students in some other learning task. The underlying value judgment, at least in much contemporary conversation, is that a good teacher will strive to offer activity-based, student-centered instruction as much as possible.

While we certainly do not dispute the value of technologies that support interactivity, the implication that visible activity is always better is misleading and not appropriate to all contexts. A television documentary or a lecture, while not requiring an observer to physically move or create in any way, can inspire critical thought and reflection. As noted in a treatise on project portfolios, reflection is as essential a part of the development process as is analysis and application of information. “Like designers, students...must be able to make explicit their reasoning and tradeoffs, to justify the decisions they have made in the course of their project” (627) [6].

In other words, so-called “passive” media or “consumption” technologies can, in the right contexts, promote rich cognitive and meta-cognitive activity and student-constructed knowledge despite no behavioral or human social activity. Some designers of multimedia instructional tools stress this, noting that hands-on activity and social collaboration need not be the only hallmarks of constructivist learning (i.e. depending on the learner’s internal modeling and meaning-making rather than on the aggregation of independent facts) [7]. Other terms are needed here to describe children’s technologies so that the connotations of the terms do not detract from the description of a technology’s learning affordances.

Not all existing terminology suffers from these affective connotations. Marshall McLuhan, for instance, introduced a distinction between hot and cold media. "A hot medium is one that extends one single sense in...the state of being well filled with data” (24-25). He then notes that hot media are low in participation, while cool media are high in audience participation or completion [8]. While this scale is appropriate for describing the information-richness of a medium, as in the first part of McLuhan’s definition, it does not
adequately articulate the possibilities for audience participation and creativity. In other words, a hot medium might encourage audiences to contribute to meaning-making even when they do not contribute to content. McLuhan suggests that a photograph is hot because it is well filled with visual data. Data alone, however, is not enough to construct meaning. In order for the photograph to communicate meaning, the audience must also bring its knowledge of context, its skills of visual interpretation, and its intentions.

**Proposed Terminology**

Learning the skills, knowledge, and intentionality to interpret and act upon the world around us is a social process, as has been noted by both educational theorists and technology designers. In particular, Lev Vygotsky theorized a *zone of proximal development* (ZPD) to describe the difference between what a learner can accomplish alone and what he or she can do with help from a more capable peer or adult [10].

As Clifford Nass and colleagues have noted, people respond to even minimal technological personification (i.e. a voice) with the same social rules as they apply to human actors [9]. In the case of technologically mediated instruction, the technology takes on the role of the more capable party with respect to the ZPD. This transference of instructional agency from the designer(s) to the technology itself implies that we need to understand more than just techniques for imparting information and skills to learners. We also need strategies and vocabulary for describing how a particular design is positioned with respect to the entire spectrum of developmental activities, from knowledge recall and metacognitive reflection to creative synthesis and invention. Famously, Bloom and others have developed a taxonomy of developmental activities [1, 5]. While they categorize and outline cognitive processes, these taxonomies do not describe how technologies stimulate or hinder those processes.

For this purpose, we propose a semantic continuum to describe the ways in which technology inspires invention, reflection, or some combination of the two. Technologies operating in an inventive mode tend to “pull” on the user, encouraging user-generated content. Technologies operating in a reflective mode, by contrast, “push” content toward the user, stimulating the user to generate meaning through a process of analysis and deliberation. This terminology is affect-neutral, allowing designers to use it to plan, execute, describe, and reflect on their own projects without misleading assumptions. Additionally, it is accessible to users, particularly children, and will be helpful for researchers and designers who inquire into user’s relationships with various technologies.

It should be noted that these terms do not replace McLuhan’s hot-cold scale. Rather, they are orthogonal to it, as shown in Figure 1 below. Use of a medium in a particular context might be hot and reflective, as with a downloaded photograph, video, or recording. That same medium takes on a different context and position on the scale when it is modified, rearranged, or otherwise incorporated into a user’s own invention. The use of journals in [3] changed from inventive to reflective and back again at different times as children’s ideas were incorporated into the design process. A lava lamp seems to be the epitome of passive technology, affording little more than a gaze. In the context of a physics classroom, however, it could be highly reflective, inspiring discussion and cognitive growth.
Conclusion

The stimulus for this terminology was a conversation, not about teaching children, but about learning from children. Children’s understanding of abstract concepts like morality or wisdom is often based on concrete images, objects, and people. Helping them to articulate these ideas, therefore, often requires offering them a variety of media with which to express themselves. The child’s choice of medium, however, whether new technology or old, influences his or her response. The availability of vocabulary to describe whether the medium is more reflective or more inventive is helpful for designers as we consider how best to involve children in designing for conceptual development.

Yet participatory design is not the only social-cognitive context in which this distinction will be helpful. For example, in [4] we see that a technology like a robotic pet seems to push or project the active concept (personality, agency, cognition, etc.) upon the child, whereas other technologies (like a stuffed dog) evoke from the child a construction of the active concept. It is expected that others will find additional useful applications of these terms.

References


