Communication + Dynamic Interface = Better User Experience

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INTRODUCTION

Traditionally, programming code that is used to construct software user interfaces has been intertwined with the code used to construct the logic of that application's processing operations (e.g., the business logic involved in transferring funds in a banking application). This tight coupling of user-interface code with processing code has meant that there is a static link between the result of logic operations (e.g., a number produced as the result of an addition operation) and the physical form chosen to present the result of the operation to the user (e.g., how the resulting number is displayed on the screen). This static linkage is, however, not found in instances of natural human-to-human communication.

Humans naturally separate the content and meaning that is to be communicated from how it is to be physically expressed. This creates the ability to choose dynamically the most appropriate encoding system for expressing the content and meaning in the form most suitable for a given situation. This concept of interchangeable physical output can be recreated in software through the use of contemporary design techniques and implementation styles, resulting in interfaces that improve accessibility and usability for the user.

BACKGROUND

This section accordingly reviews certain theories of communication from different disciplines and how they relate to separating the meaning being communicated from the physical form used to convey the meaning.

Claude Shannon (1948), a prominent researcher in the field of communication theory during the 20th century, put forward the idea that meaning is not transmitted in its raw form, but encoded prior to transmission. Although Shannon was primarily working in the field of communication systems and networks such as those used in telephony, his theory has been adopted by those working in the field of human communications. Shannon proposed a five-stage model describing a communication system. Beginning with the first stage of this model, the sender of the communication creates some content and its intended meaning. In the second stage, this content is then encoded into a physical form by the sender and, in the third stage, transmitted to the receiver. Once the communication has been received by the receiver from the sender, it is then at its fourth stage, whereby it is decoded by the receiver. At the fifth and final stage, the content and meaning communicated by the sender become available to the receiver.

An example of how Shannon's (1948) model can be applied to human communication is speech-based communication between two parties. First, the sender of the communication develops some thoughts he or she wishes to transmit to the intended receiver of the communication. Following on from the thought-generation process, the thoughts are then encoded into sound by the vocal cords, and further encoded into a particular language and ontology (i.e., a set of mappings between words and meaning) according to the sender's background. This sound is subsequently transmitted through the air, reaching the receiver's ears where it is decoded by the receiver's auditory system and brain, resulting in the thoughts of the sender finally being available to the receiver.

This split between meaning, its encoding, and the physical transmission of the meaning is recognised in psychology. Psychology considers that there are three stages to receiving data: (a) the receiving of sensory stimuli by a person, (b) the perception of these stimuli into groups and patterns, and (c) the cognitive processing of the groups and patterns to associate cognitively the meaning with the data (Bruno, 2002). Thus, for example, a receiver may see a shape with four sides (the data) and associate the name *square* (the meaning) with it. There is accordingly a split between the input a person receives and the meaning he or she cognitively associates with that input.

Consider, for example, the words on this page as an example of the psychological process through which meaning is transmitted. The first stage of the process is where the reader receives sensory stimuli in the form of black and white dots transmitted to the eyes using light waves of varying wavelength. Upon the stimuli reaching the reader, the brain will perceptually group the different dots contained within the received stimuli into shapes and, ultimately, the reader will cognitively associate the names of letters with these shapes and extract the meaning conveyed by the words.

Semiotics, which is the study of signs and their meanings (French, Polovina, Vile, & Park, 2003; Liu, Clarke, Anderson, Stamper, & Abou-Zeid, 2002), also indicates a split between meaning and its physical presentation. Within semiotics, the way something is presented, known as a sign, is considered to be separate from the meaning it conveys. Accordingly, in semiotics there are three main categories of signs: icons, indexes, and symbols. This delineation is, however, not mutually exclusive as a particular sign may contain elements of all categories. Vile and Polovina (2000) define an icon as representative of the physical object it is meant to represent; a symbol as being a set of stimuli, that by agreed convention, have a specific meaning; and indexes as having a direct link to a cause, for example, the change of a mouse pointer from an arrow shape to an hourglass to reflect the busy state of a system.

This classification of the physical representation according to its relationship with the content and meaning it conveys provides further opportunities to distinguish content and meaning from its physical presentation, and to classify the different elements of presentation. For example, a shop selling shoes may have a sign outside with a picture of a shoe on it. The image of the shoe is the sign, or the physical presence of the meaning, which in this case is an icon, while the fact that it is a shoe shop is the intended meaning. Equally, this could be represented using the words *shoe shop* as the physical sign, in this case a symbol of the English language, while the meaning is again that of a shoe shop.

This split of content and meaning from its physical presentation, which occurs naturally in human communication, allows for the same content and meaning to be encoded in a variety of different forms and encoding methods. For example, the meaning of "no dogs allowed" can be encoded in a variety of visual images. For instance, there might be (a) an image of a dog with a cross through it, (b) the words "no dogs allowed," (c) an auditory sequence of sounds forming the words "no dogs allowed," or (d) the use of tactile alphabets such as Braille, which is used to encode printed writing into a form for the blind. However the content and meaning is conveyed, it remains the same regardless of how it is physically presented.

SOFTWARE ARCHITECTURES FOR CONTENT SEPARATION

For the true separation of presentation from content to occur therefore in software, the content (namely the data or information itself as well as the application's operations, i.e., its business logic as indicated earlier) is stored in a neutral format. This neutrality is achieved when the content is untainted by presentation considerations. This allows any given content to be translated and displayed in any desired presentation format (e.g., through an HTML [hypertext markup language] Web browser such as Microsoft's Internet Explorer, as an Adobe Acrobat PDF [Portable Document Format], as an e-book, on a mobile phone, on a personal digital assistant [PDA], or indeed on any other device not mentioned or yet to be invented). The theories of detaching content and meaning from its physical presentation thus give a framework to separate content from presentation. Once that conceptual separation can be made, or at least continually realisable ways toward it are achieved, then this approach can actually be de-