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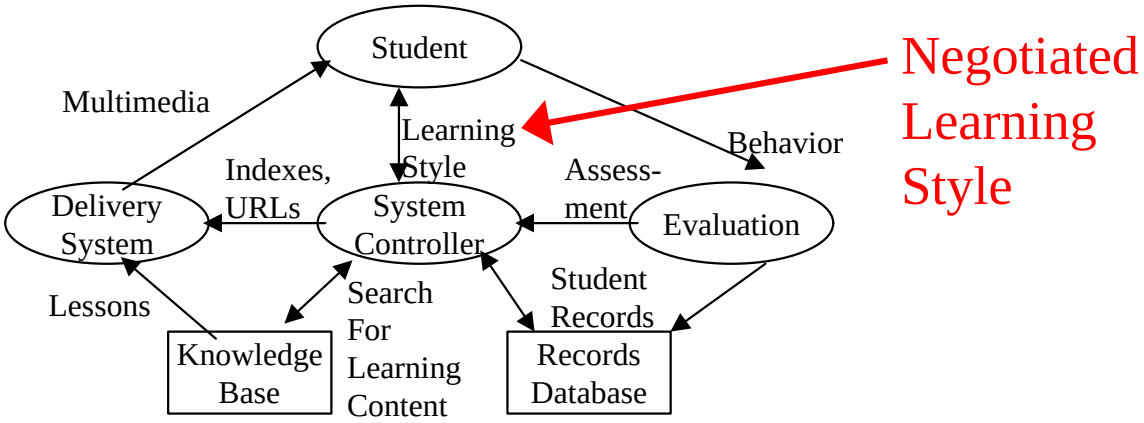
Abstract

A common technical paradigm for cultural adaptation for information technology is: a user interacts with a cash machine (software, document, etc.) and the system determines the appropriate language (French, Japanese, English, etc.) to interact. Generically, this paradigm concerns a one-way communication of user profile information to "the system". Sophisticated learning technology systems involve adaptive learning styles, i.e., some learners respond best to pictures, some learners respond to works, and some learners have physical limitations (e.g., deafness, blindness). Learning style adaptation is an N-way negotiation (student, parent, teacher, institution), i.e., not just a user profile, but group and "institution" profiles, too. The technology required to implement learning style adaptation is identical to cultural adaptation. The learning technology paradigm exposes the nature of the cultural adaptability problem better than the cash machine paradigm.

1. Learning adaptation as a technical paradigm

Sophisticated learning technology systems adapt to the needs of a wide variety of students. The adaptation must be dynamic (changing during a session), user-centered (meeting the needs of the user), and, possibly, institution-centered (e.g., French courses must be taught in French). A common system view of learning technology systems is below (see http://www.edutool.com/architecture).



Learning style adaptation is an N-way negotiation between the student, parent, teacher, institution, and other interested parties.

2. Learning adaptation as a better paradigm

Cultural adaptation is explained, typically, as a customer accessing a cash machine and the cash machine "knows" or adapts to the language spoken by the customer. This technical paradigm of responding to the needs of the user (user profile => language changes) has utility but doesn't expose the problem completely. For example, in a three party electronic commerce transaction (buyer, seller, shipper), which culture does the system adapt to -- one, all, none? Like learning adaptation, electronic commerce requires a complex negotiation of cultural adaptation. However, the "cash machine" paradigm does not capture the complexity of this transaction, nor others such as interacting with users having physical limitations (e.g., deaf, blind, slow movement).

3. N-way negotiation -- technical issues

The following are negotiation issues common in learning adaptation, as applied to cultural adaptation, i.e., *these are the technical issues concerning cultural adaptation*:

- **User input devices.** Which input devices (e.g., keyboard, mouse, voice, sensors) are usable, preferable, or unusable.
- **User output devices.** Which output devices (e.g., video, sound, actuators) are usable, preferable, or unusable.
- **I/O quality of service.** What are the communication attributes (e.g., bandwidth, delay, error rate) necessary for a successful interaction.
- **I/O interaction rate.** What are the expectations for timing of interactions (e.g., for varying hearing, speech, and visual capabilities). For example, a user with poor vision may take a longer to read a message, so the "time out" (for non-interaction) should be longer than normal. Furthermore, the interaction rate might be determined by the capabilities of the underlying communications network.
- **Character codings.** What characters comprise the character set used for coding (not encoding). For example, the set of ISO 10646-1 (32-bit) characters might be used for coding (the conceptual characters), but the encoding used to describe them is ISO 646 characters, e.g., `"??U12345678"` is an ISO 646 character encoding that describes a 32-bit ISO 10646-1 character coding.
- **Character encoding.** What bit/octet representations are used to encode the characters.
- **Characters outside coding.** If there are characters outside of the coding (not encoding), how are these characters handled during process (e.g., translation, conversion). For example, if the character coding (and encoding) is ASCII, what is the appropriate translation and processing of characters with accents and umlauts?
- **I/O outside of device capability.** What happens when the input (output) message exceeds the limitations of the input (output) device? Some examples are: typing a message that is longer than the width of a field or screen (scrolling, word wrap?),

displaying a color image on a monochrome monitor (crosshatch vs. grey scale?), displaying Kanji characters on a 7x9 LED display (translate to kana?).

- **Language and dialect.** Which language should be used? Which dialect (e.g., British English vs. Australian English)?
- **Country, region.** Which country is appropriate for transactions? This feature would be used to determine or infer general cultural and regulatory issues. For example, if the user is from New York, US, a disclaimer might be different than a user from California, US.
- **Translation support.** What interpreters or proxies are necessary to facilitate cultural translation?
- **Age.** What is the age or maturity level of the user?
- **Learning, cognitive, and/or communication style.** Which presentation techniques are best for the user? These techniques may vary, dependent on the user's (nomadic) environment. For example, an aural message is much easier to receive while driving and a visual message may be easier to receive in a noisy or noise-sensitive environment.
- **Content preferences and restrictions.** Which content is acceptable or unacceptable in a culture? For example, certain content is appropriate for the culture of adults (e.g., adult-oriented movies), yet unacceptable for the culture of children.

4. Related web sites

- IEEE 1484 Learning Technology Standards http://www.manta.ieee.org/P1484
- Educom's Instructional Management Systems project http://www.imsproject.org
- Learning Technology System Architecture http://www.edutool.com/architecture