W21C

Innovations – Communication Tools and Education: Implications for Policy

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Purpose

To determine the impact of new communication technologies in the education system; whether it will affect the professional training of teachers and the prospects for disabled students with limited or no speech.

Background

New communication technologies are emerging, reshaping the way we interact with one another. They seem to improve the emotion and quality of life for disabled people[2,9,14].

New communication technologies include:

- Brain-machine interface (BMI) (Fig. 1)
- Sub-vocal speech device (Fig. 2)
- Social Robots (Fig. 3)
- iPad (Fig. 4)
- SmartBoard (Fig. 5)
- Speech generated communication device (Fig. 6)
- AlphaSmart (Fig. 7)

Methods

- Review of **Brain-machine interface (BMI)** and **educational assistant (EA)** in relation to disabled people literature
- Used Knowledge Share (KSv2) v2.1.3, developed by Dean Yergens (http://people.ucalgary.ca/~dyergens/ksv2.htm) to systematically review the literature
- Databases: ScienceDirect, Scopus, OVID(All), EBSCO(All), Web of Science, JSTOR
- As for **BMI**: 1,058 articles were found, however only 71 fulfilled the criteria (include: English, PDF available; exclude: pure technical, conference announcements, books); Kappa factor 0.99
- As for **EA**: 465 of the 840 articles found were included
- Used Atlas.ti 7.0.71 qualitative data analysis software

BCI SYSTEM[15]

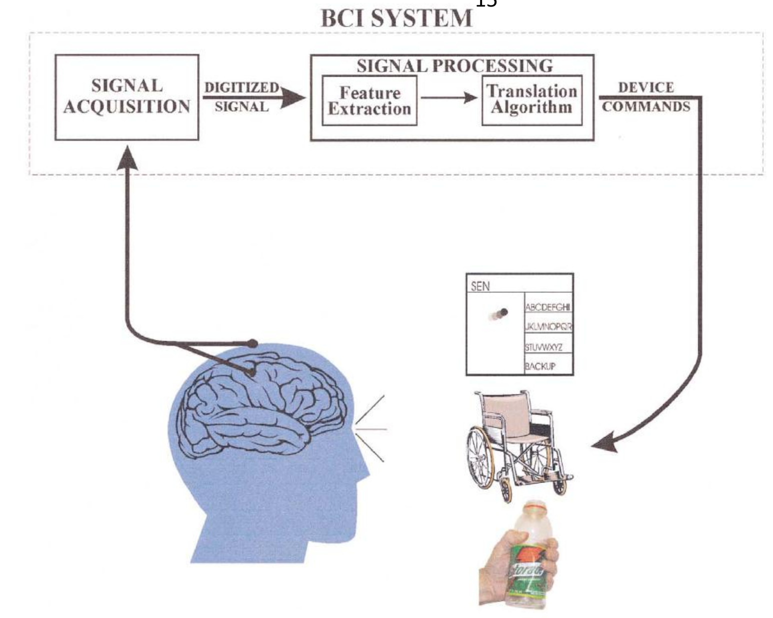

Fig. 1. Basic design and operation of any BCI system. Signals from the brain are acquired by electrodes on the scalp or in the head and processed to extract specific signal features (e.g. amplitudes of evoked potentials or sensorimotor cortex rhythms, firing rates of cortical neurons) that reflect the user's intent. These features are translated into commands that operate a device (e.g. a simple word processing program, a wheelchair, or a neuroprosthesis). Success depends on the interaction of two adaptive controllers, user and system. The user must develop and maintain good correlation between his or her intent and the signal features employed by the BCI; and the BCI must select and extract features that the user can control and must translate those features into device commands correctly and efficiently.

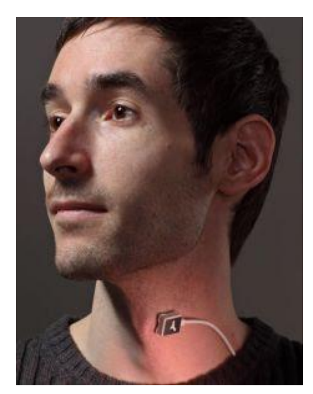

Fig. 2. Sub-vocal speech device [17]

Fig. 4. iPad [18]

Fig. 5. SmartBoard [19]

Fig. 6. Speech generated communication device [20]

Fig. 7. AlphaSmart [21]

Technology & Educational Assistants

- Technology is described to be beneficial for greater success in student learning and an ameliorate for a lack of staff resource in the classroom[1]
- With advancements in communication technology, there is a need for EAs to learn and effectively use the assistive technology[4]
- EAs perceive that they require more formal training when it comes to learning new technology[12]

Social Robotics in the Classroom

- Used as EAs - students receiving instructions[12,15]
- Interacting and socializing with robots[12,15]

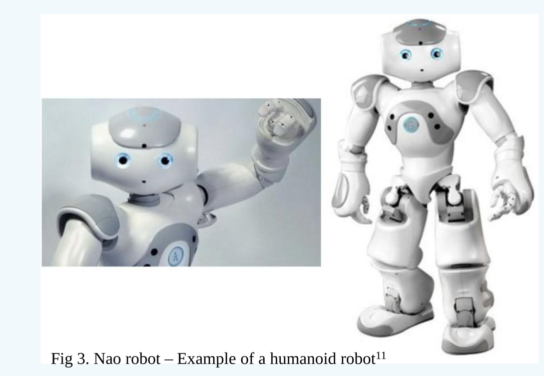

Fig 3. Nao robot – Example of a humanoid robot[11]

Issues: Example of BMI

- Invasive vs. Non-invasive technology and the debate within the scientific community:
  - **Invasive** (based on intracranial implantation)
    - Pro: provides neural signals of the best quality and has high potential for further improvement[7,11,14]
    - Con: carries risk associated with invasive surgical procedures[11]
  - **Non-invasive** (based on recordings of EEGs from the surface of the head)
    - Pro: provides solution for individuals without speech for simple communication with the outside world[11,13]
    - Con: neural signals have a limited bandwidth[11,13]
- Authenticity of the technology and of the individuals using the technology[3,5]
- Safety – medical risks, privacy, data collection[2]
- Enhancements for minors and incompetent individuals[3,5]
- Inequality to accessibility[3]

Future Directions

Research under way:

- Individual face-to-face interviews with a group of special education school teachers
- Online survey of a disability service organization in Saskatchewan

Research to be performed:

- Survey of disability service organization in Calgary
- Interview with: Speech Pathologists, university students from faculties of engineering/education/health sciences, high school students involved with summer research

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