Peer Commentary on "The Impact of Emerging Technologies on Audiology and Speech-Language Pathology" by Donald Jamieson

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Jamieson has presented a very detailed and thoughtful account of the impact of technology in the communicative disorders (CD) professions. He outlines several major areas of technological advances which are relevant to our professions as well as highlighting a new area of expertise — behavioral technology — the human factors aspect of technology. Jamieson then goes on to discuss important aspects of managing the new technologies. In this commentary I would like to extend Jamieson's discussion of technological advances by providing a vision of the possibilities that further advances could offer the CD professions. I would also like to comment on Jamieson's thoughts regarding the management of the new technologies.

Jamieson's survey of the areas of technology relevant to CD is comprehensive. Advances in such areas as signal processing and sound input/output already have provided the impetus for the development of several new computer-based speech training (CBST) systems (Bernstein, Goldstein, & Mahshie, 1988). These systems capture, analyze, and display portions of the speech signal for speech training. Future CBST systems may allow the provision of prolonged, intensive speech therapy with only minimal intervention from a speech-language pathologist. Such opportunities to extend CD services are vital, given the chronic shortages of CD professionals across Canada and indeed internationally (Ontario Ministry of Health, 1988).

The area with the greatest potential for revolutionizing the profession is speech recognition. I believe, in the not too distant future, children (and adults) will be able to talk to the computer and have the computer talk back. I envisage computer software that can be programmed to listen for either language or speech errors. For example, an utterance could be analyzed for missing morphological markers or deviant /s/ productions. The program would calculate a frequency of occurrence while providing corrective feedback.

Signal processing and enhancement can lead not only to changes in Audiology as outlined by Jamieson, but also to major changes in Speech-Language Pathology diagnostics and augmentative communication. Research is in progress to develop software for modifying the temporal and spectral characteristics of dysarthric speech to improve intelligibility and naturalness (McClean, Gannon, Thomas-Stonell, & Milner, 1990). By selectively altering different speech segments and then evaluating their speech quality, the speech-language pathologist could objectively select speech parameters for training. Taken to its logical conclusion, software of this nature could eventually become a translation device for severely dysarthric speakers whose intelligibility is too poor for oral communication.

Software programs marketed for CD professionals all too often adhere to the drill and practice format rather than to motivational game-like activities and do not use such features as good quality graphics, animation, and auditory output. I am aware of only one study that addresses the issue of intrinsic motivation in computer games (Malone, 1981) As Jamieson points out, use of technology in the CD professions is currently limited more by software design than by hard technology. Much more research is needed in the behavioral technology area.

Expert systems are becoming prevalent in the medical and CD professions to aid the diagnostic process. There is a danger that the judgments of such programs may be seen as more expert than clinical judgments. Expert systems may overlook obvious though less likely explanations for behaviors. An expert program for diagnosing computer failure may suggest that the user check to see if the computer is plugged in but overlooks the possibility that the building may be on fire. Jamieson cites them as examples of possible changes in requisite skill levels. Computer administered tests are also being developed. These tests record only the correct or incorrect responses and do not provide insight into the reasons errors occurred. I believe that diagnostic assessments are more than just a sum of their parts.

Jamieson quotes a survey of former students in Speech-Language Pathology and Audiology that revealed that CD professionals were not availing themselves of the new technologies. I would be interested in the year that the survey was completed. Rapid changes in technology quickly date surveys of this kind. In the past three years, the Hugh MacMillan Rehabilitation Centre has expanded from using one computer

for a department of ten FTE CD professionals to our present complement of six computers. I feel more positive than Jamieson regarding our professions ability to adapt to the new technologies. A major impediment to acquiring equipment is not lack of vision or technological expertise but lack of financial support from the hospital and school board administrations. While I agree that the use of this technology must be supported by research, we cannot afford to wait for such studies to be completed before purchasing and using such equipment.

Jamieson's warnings regarding the dangers of new technology to our professions' scope of practice are valid as he points out, CBST (automated speech training) currently is being used by teachers, preschool teachers, and technicians. These programs look like simple games, but without thorough training in voice disorders, could do actual damage to clients. A calculator should only used by someone who understands enough math to know if he is getting the correct answer.

Our profession is caught in a Catch 22! Research is desperately needed. We must guard against the danger of hopping on the technology bandwagon, yet if we wait for validating research before using these new technologies, we may well be too late. Given the clinical pressures of health care in the 1990's, there is little time to investigate or learn how to implement the new technologies. I agree with Jamieson that the professional associations and the universities must encourage technical competence through revised curricula and continuing education programs. We must become involved with and help shape the direction of new technology. N.T.S.

References

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These comments are written from the perspective of a speech-language pathologist who has been in the field for thirteen years and has specialized in augmentative communication technologies for ten of those years. I was very pleased to see this topic, the impact of emerging technologies, discussed in this publication. I too have perceived what Jamieson describes as a lag in the application of technology by the majority of professionals currently working in speech-language pathology and audiology. It seems that only those professionals who are comfortable with some form of technology have taken up these new tools in an effort to provide more management options for their clients. However, at the present time and in almost every case, the application of these tools requires more time than traditional methods. In the face of budget cuts and increasing caseloads, clinicians are reluctant to take on the work required to learn to apply these technologies, for example, to learn how to program a voice synthesizer and then to actually do it. On the other hand, software is being developed to reduce this investment of time, for example, the COM-BOARD/BOARD MAKER for the MAC Apple computer reduces the gruelling task of creating a portable communication board from twelve hours to only forty-five minutes.

I must take exception to some of the comments by Jamieson. The survey by Leeper of "some of our former students" noted that the only item identified as "being in routine clinical use was the stopwatch." I think this statement is misleading in that it does not represent the state of current technology used in Canada. I am aware of and in regular contact with many clinicians who made regular use of augmentative and computer technology in Vancouver, Calgary, Edmonton, Red Deer, Regina, Winnipeg, Toronto, Sudbury, Ottawa, Hamilton, London, Montreal, Halifax, Charlottetown, Fredericton, and St. John. I have also interviewed a number of students from the Toronto and Dalhousie programs who are current in their knowledge about a wide range of technologies in voice analysis, speech analysis, and other computer applications. I cannot comment on the training programs in the United States, but the fact that there are more Canadian students training in the US than in all of Canada may indicate that this technology lag in training may be more than a Canadian problem.

Another point I would like to make is that although the description of the cost of technologies provided by Jamieson (CD systems from $400 to $4000) is accurate, this is only the hardware cost. Each clinic or department also must budget for the software and related programs that are needed to run this equipment. These costs can be prohibitive, and often the needed software is not commercially available or the programs are designed for research applications in a university setting and have little application to one's population of clients.

A third point I would like to raise relates to the poor quality of synthesized voice available in portable communication devices. This situation is explained in terms of the difference between high cost/large size/good quality and low cost/small size/poor quality systems. The technology is there (as in DecTalk, for example), but it is just too expensive for

the average family ($6000 or more). Consequently, the lower cost technologies that are available are frequently rejected by potential users, their families, and even their therapists because of the inferior speech output.

My final point supports Jamieson's observation that behavioral technologies related to human factors need to be studied carefully. A great deal of this work is being done, at least in the field of augmentative communication, by such respected researchers as Beukleman, Yorkston, Culp, and VanderHeiden. These are in university research centres in the US. Less money is available to Canadian centres, but some very good work is being done at the university and clinical centres in Toronto, Edmonton, Calgary, Hamilton, London, Montreal, and perhaps other places that are unknown to me.

But all this is not enough. I cannot emphasize too strongly the significant role that could be played by communication disorders specialists in reporting the application of technologies in single subject studies. When well thought out and followed through to verifiable conclusions, this information is in- valuable to practising professionals. For more information on this topic, I refer the reader to the 1989 issue of *Augmentative and Alternative Communication*, vol.5, no. 1, the Guest Editorial by Sarah Blackstone, and the 1988 issue, vol. 4, no. 2, of the same publication, the article, "Augmentative and Alternative Communication: A Field in Transition," by Zagari, Kangas, and Lloyd.

Perhaps there is a supporting role that the professional associations can play in providing continuing education programs to working professionals on the applications of new technologies.

Communicative disorders professionals now working also should apply some creativity to the tools they are already using. For example, Jamieson cites the Visipitch as the most widely used speech analysis device. It is marketed for a single purpose, that of estimating voice fundamental frequency, which makes it expensive when it is used only with voice clients. However, we had no difficulty broadening its applications, for example, to indicate voice on/off with hearing impaired children, to indicate articulation of final plosives with dysarthric clients, and to indicate rate of speech with voice clients and with language and neurologically impaired clients. Commercially available graphic software can be used in literally hundreds of treatment models with children and adults. Our methods are the same, but the materials are more interesting, flexible, and effective. Only by keeping up with the literature, by inservice training, and by continuing education will we be able to learn about the use of these approaches.

I agree with Jamieson that we must be confident in our skills and be able to apply our special expertise to the relevant technologies. The purpose is not to define our area of owner-

ship, but rather to see ways of interacting with other disciplines and professionals in creating new solutions to common problems. I have frequently come across computer hacks who are trying to apply their unique programs to help handicapped children and adults to overcome communication, speech reading, and writing limitations. Their volunteered efforts are to be commended, but they usually need guidance in making subtle alterations for the client's benefit. More than a few of the readers will have dealt with family members who, in an effort to improve the speech of a post-stroke aphasic adult, are asked to provide software for practice on the ATARI home computer or a speech reading program to get reading skills back to normal. On the other hand, I am pleased that special education teachers, psychologists, occupational therapists, and others increasingly are requesting our input into the selection of appropriate software and related computer technologies for their clients.

Most students entering university today already have had ample exposure to and training in computer use and related technologies in their elementary and secondary education. But the suggestion by Jamieson to look for more technical competence in the backgrounds of those students applying to communicative disorders programs is valid. A twofold approach that includes both the training of new students and the continuing education of working professionals will do much to bring our professions into the twenty-first century with confidence and strength.
M.J.S.

Reply to Thomas-Stonell and Saya

Five points (at least) seem agreed: recent technological developments have astonishing potential to help those with communication difficulties; there is a sizeable gap between this potential and the reality of conventional clinical practice; a significant research and development effort is required to reduce this gap; and more needs to be done both to ensure that graduating audiologists and speech-language pathologists are prepared to deal with these technologies and to assist those who are already practising to use the technologies appropriately.

None of this reduces the importance of the contributions already being made by clinicians and researchers. In their professional lives Thomas-Stonell and Saya have demonstrated that they are part of the solution to the problems identified in the target article; by joining the debate and offering their views they have helped raise the level of awareness of these matters among their professional colleagues. What is needed now is a set of coordinated, specific actions to address the problems which I, and they, have identified. The CD professionals must work to ensure that that effort is forthcoming.