Visions in Leisure and Business

Volume 5 | Number 1 Article 9

1986

Computers and the Physically Disabled

Robin Lombardo

Robin Kunstler
City University of New York

COMPUTERS AND THE PHYSICALLY DISABLED

BY

ROBIN LOMBARDO, M.C.T.R.S.

DIRECTOR OF RECREATIONAL THERAPY
BRUNSWICK HOSPITAL CENTER
PHYSICAL MEDICINE AND REHABILITATION DIVISION
366 BROADWAY
AMITYVILLE, N.Y. 11701

DR. ROBIN KUNTSLER, ASSISTANT PROFESSOR

HERBERT H. LEHMAN COLLEGE OF THE CITY UNIVERSITY OF NEW YORK
BEDFORD PARK BLVD. WEST
BRONX, NY 10468

ABSTRACT

The rise of the technological age has opened up doors of mobility and freedom for persons with physical disabilities. Utilization of computer-assisted rehabilitation and daily living aids can often mean the difference between isolation and independence for this population. Although highly beneficial, the psychological impact that this modern machinery has had on the human being cannot be ignored. A study which investigated the effects of the implementation of a computer-assisted art/leisure activity in relationship to a similar, more traditional art program is presented. Analysis of data collected indicated that both groups responded similarly, yet important data was recorded that has pertinent implications for future study in the area of clients' reactions/interactions, program implementation/leadership, and computers.

COMPUTERS AND THE PHYSICALLY DISABLED

AN OVERVIEW

Modern technology and the computer world have opened up doors to independence for persons with physical disabilities. Microcomputer advances have infiltrated every area of life for the physically impaired from diagnosis, evaluation and treatment in rehabilitation medicine, to

independent living, wellness, and just pure enjoyment in everyday life activities. This short paper will only be able to scratch the surface in outlining the advances in computer-based assistance for the physically disabled, but nonetheless, it will attempt to highlight several major innovative uses of the microcomputer for, and by, the disabled.

In the treatment and rehabilitation of persons with physical disabilities, the computer offers tremendous assistance. For the patient who has experienced a brain trauma and/or has evidenced deficits in cognitive functioning, various and numerous software packages are readily available on the market today that can assist in his or her treatment. By involving this client in games, puzzles, and other computer activities, the following cognitive abilities can be addressed and evaluated (resource sheet of names and addresses of software available from the authors upon request):

* attention span and concentration

* perceptual scanning

* organized thought and judgment

* motor response and timing

* planning

* problem solving

* reading/comprehension/word association

* sequencing

* time estimation (patience vs. impulsivity)

* basic speech

* memory (short and long term)

and more.

The computer in the treatment setting provides the patient with consistent, structured, sequential, progressive, and reliable tasks that may not only be challenging, but fun. These micro-programs allow the patient a chance to work independently for the most part, and can be adjusted to meet each patient's individual treatment needs and idiosyncrasies. In addition to providing a new modality for rehabilitation, these computer programs give consistent feedback in the way of scoring (which can often be stored for future reference), and visual and verbal stimuli which allow the patient to see his or her own abilities and improvements quickly and accurately. While the use of the comptuer can be time-efficient for the therapist and can often "free up" the amount of time a therapist needs to spend with a patient, the computer cannot replace the human personal interaction, praise, and visual observation so needed in rehabilitation training.

An area of computer-assisted therapy which also serves a dual purpose of fitness training was designed by Dr. Gideon Ariel and is called the "ArielTek" system. This system is a computerized exercise machine that makes the nautilus equipment obsolete, both in function and cost. It measures, calibrates, compares, and records a patient's muscle strength and range of motion (both active and passive), movement timing, velocity, resistance, speed, fatigue, caloric expenditure, overload (stress), movement direction and duration, energy displacement, and more. The ArielTek responds to each user individually and is experimentally almost 100% reliable. This system could be a vital tool for teaching a client motor skills such as psychomotor control, movement, sequencing, coordination, running, throwing, etc. It also uses continuous audio and/or visual feedback to guide each user through the exercises. In addition, the ArielTek provides an arena for the physically disabled to train <u>independently</u> without assistance once instructed in its use. In an interview, Dr. Ariel highlighted the advantages of this system:

Q. Dr. Ariel, will this ArielTek system replace the therapist?
A. No it will not. It will on the contrary open more jobs as it will give far more information for the therapist to work with and interpret. It will help and not hurt the therapies.

Q. What is this system's present use?
A. We have no marketing. It is basically through word of mouth [that people learn about this system]. There are approximately 312 of these machines being used today in hospitals, athletic clubs, and corporations in the U.S. and Canada.

Q. What is the price of this system?
A. It can be leased for as little as $390.00 a month. It is a very cost-effective system with a repair record that is almost perfect. The benefits of the ArielTek far surpass its cost.

Q. How have the patients reacted to this system? What feedback have you received?
A. They [the users] become addicted to it. They love it and they love the visual and audio feedback this machine gives them . . . . When they work with anything less, they feel they are missing a partner. They feel cheated.

While the ArielTek does not address the gamut of the client's psychological, social, and affective needs, it nonetheless is a safe and sound avenue for the medical rehabilitation and physical well-being of the physically disabled to be technologically addressed in new and more profound ways.

Much in the same way that computers can help the person in need of cognitive retraining, the computer holds vast training and independent living coaching aids for the individual with learning disabilities. The computer can consistently be patient and never tire in assisting the learning impaired. In addition, these micro-systems can be a vital tool if available within the special education setting, and in terms of teaching an individual a skill (be it knitting or even boiling water),

computerized programs can repeat instructions almost indefinitely, without the need for a coffee break!

Finally, for persons with motor/movement impairments, computer assistance can often make the difference between isolation and independence. McWilliams (19) describes how Walt Woltosz (who became physically disabled from Lou Gerhig's Disease) adapted and added peripheral software to a Radio Shack Model Four Computer to create a package to enable persons with severe multiple physical impairments to communicate. This system is called the Words+Living Center [United Technologies Corp., Sunnyvale, California (408) 730-9588]. This system complete costs about $3,500. Simply stated, with barely an eyelid twitch a person can draw, turn on and off electrical appliances, play games, "talk", and more. People can work a microcomputer by any or all of the following methods:

* an eyebrow furrow or blink of an eye

* tapping morse code with a head, tongue or toe switch

* speaking commands

* squeezing a bulb put in the mouth (called a Pneumatic Squeeze Bulb)

* visual scanning or by sight (using light beam and pupil dilation detection)

* inhaling and exhaling (via a breath puff activated system) thus enabling the severely disabled person total environmental control over such things as (model available from the authors upon request)

* talking on the telephone

* doing business from the home

* ordering a book from the library

* going grocery shopping

* turning on and off a T.V., stereo, C.B., or a lamp

* locking or unlocking a door

* "writing" a letter to a friend

* playing a game for pure enjoyment alone, or with others.

Therefore, what can we expect to find in the future for the physically disabled in the way of computerized assistance? When asked this very question, Dr. Ariel replied:

> [with respect to treatment] for the immediate future, now I am talking in one year from now, I can see it that costs of this technology will be considerably lower. Combined with laser technology [and the use of video screen], the doctor or therapist can treat the patient at home by not even leaving his [or her] office. We are working on a prototype right now like this that will be reimbursable by insurance where the therapist can see the patient [at home] from a screen in the office or hospital. With these machines [computerized] in the home, <u>everything</u> can center around the home, including therapy.

When considering all of the advances in microtechnology that have occurred in such a short period of time, one can only imagine what lies ahead for the disabled as well as for persons without physical disabilities. Despite the cost and primitive nature of the systems that are currently offered for the physically impaired, their obvious advantages cannot be denied.

When Dr. Ariel (April 16, 1985) was asked about his advice for fellow colleagues and therapists who wish to learn about this ever-changing computerization, his response seemed quite apropos for the final word of a discourse on computers and the disabled. He remarked:

> My advice is to always keep aligned with the knowledge of the highest technology available. Select your courses and teachers in order to get the best knowledge of modern technology. Be selective and read, read, read! Don't expect to always be taught. You may have to teach yourself . . . I think you may have to . . . [use self-study techniques] learn at home. Get a high tech education. In whatever you do, seek what is the best!

A COMPARATIVE STUDY OF PARTICIPANT SATISFACTION IN COMPUTER-BASED VERSUS TRADITIONAL DRAWING (ART/LEISURE) ACTIVITIES

Introduction

There can be no doubt that microcomputers have infiltrated almost every aspect of human life. The impact that this newer technology has had on mankind is impossible to ignore. How do these microsystems affect us as human beings, and how do individuals perceive this newer form of technology? Knowledge and data need to be gathered using controlled experimental designs, to uncover exactly "how" the human interacts or ignores, responds or rejects, likes or dislikes, this newer form of technology.

Purpose of Study

A preliminary study on the question of whether or not there is a subjective difference between user satisfaction using traditional art materials and using a computer was conducted. Many questions have arisen as to the cost-effectiveness and participant satisfaction of computerized versus the more traditional leisure activities. In short, it is important to collect data on institutionalized client uses with the computer (not just the hand-held computer games), and how this new technology can "fit in" with other aspects of therapeutic recreation programming. This experimental study was designed to explore, compare, and test the significance of user response to, and satisfaction of, computerized "painting" versus the more conventional approach to this basic form of arts and crafts.

This research also intended to provide justification for or against the use of the computer for specific arts and crafts activities at the rehabilitation hospital where the study was conducted. It is essential to determine what elements are enjoyable about using the computer to paint before any program of this nature is to be implemented for recreational/therapeutic purposes. This research was a beginning step towards gaining such information.

Literature Review

The computer and its varied use as an art medium and creative tool also offers a wide avenue for research and investigation. What are the perceived benefits and criticisms of this technological art? Patton and Holoien (24) praised the use of the computer in developing the art field. They suggested that through graphics or computer art, the linear logic and systematic reasoning of computer technology and the humanizing, aesthetic, "feeling", emotive elements can combine to create pictures and images that, without the computer, would not exist. In addition, the authors cautioned against the lack of computer use by artisans and that this form of technology cannot be ignored as a viable craft tool. Meyer (20) likened the use of the computer as an art medium within a historical context as he stated, "Computer artists claim their medium is where photography was 100 years ago computer art should be taken seriously." Linehan (16) complimented computerized art as he stated that, "Picture making by computer is here to stay." Not all reviews of computer-generated art were so favorable. In direct opposition to what previous authors have stated, Squires (27) complained that computers limit, standardize, and alienate the expressive abilities of the artist by only offering one method of artistic production. He also theorized that as mankind's leisure time increases, we will be running from and not to the mechanized computer. Squires (27) further stated that the final products produced by the computer-based art are inferior to ones created by more traditional means. There is some documented, yet non-experimetal, support for this previous statement. Hubbard and Boling

(12) in working with sixth through ninth graders on computer art, recorded that many of the students' art pieces did not turn out "exactly as they had intended". However, this did not mean that the students were dissatisfied with the products created. Helmich (11) directly rebutted Squires philosophies by stating that the predetermination of the art product is the job of the human, not the computer. He also explained that the computer cannot alter the art work based on an aesthetic response, only the human can do that.

In terms of comparing traditional and computerized forms of art, little research is available to shed some light on this topic. Kirkeby (15) stated that both activities require that "same mysterious coordination of eye and hand." Hemlich (11) presented strong similarities between traditional art and computer art as he purported that they both incorporate the creative elements of selectivity and randomness. Flynn (9) documented that as an artist, using the computer affords her "the freedom that I have come to expect with oils or acrylics, but not with my computer." Miller (21), by reproducing the Mona Lisa on her computer, wrote the following; "The existing graphic technology--and a little imagination--are sufficient to produce art as valid and personally satisfying as art produced through traditioal media." Consumer Reports (4) researched one Apple Computer Graphics system and documented one difference between the two art mediums: "The simulated pencil and paint brush [light pen computer options] don't act quite like their real life counterparts. Consequently, it takes a lot of practice to draw as naturally on the screen as with pencil and paper." It appeared as though this area of computer use required further scientific exploration.

While personal reports and theories abound as to some specific uses of computers, investigative research acknowledging the physiological, affective, and psychological influences that computers have had on the human being are also scarce. Shneiderman (26), in doing research regarding computer graphics and users' reactions to it, discovered five problem areas among the participants using the program. They were: boredom, panic, frustration, confusion, and discomfort. He also investigated some psychological factors involved in computer art, such as "desire to control", "closure" or the completion of a task, anxiety, intimidation, and others. In his conclusions, he stated that "More experimental research is needed to refine our understanding of the advantages and environments suitable to graphics interaction [with human beings]."(26)

Mirroring Shneiderman's advice are many authors' pleas for further research in the area of computerized art, its relationship to, and effects on its users, and its place within art education and artistic/leisure pursuits. White (30) exclaimed the need for "a working knowledge of how one interacts with this instrument" of the computer. Linehan (16) asks, "How can man and a non-biological device [such as the computer] communicate?" Madeja (17) pondered th following in his article: "What are the roles of the artist/designer in this creative process? Is there a new and/or different aesthetic criteria which needs to be applied to the new imagery? How can we educate the art student and the public at large about the aesthetic qualities of these new images?"

Finally, Friedman (10) generated these questions through her computer art work with university students, by recording their responses to the program: "Is a line on a computer screen a piece of art? . . . How can any image on a television screen express emotion? . . . Why not draw with pencil and paper instead of a computer?" These curiosities are in need of sound answers.

It appears as though exploring and studying users' responses and reactions to this computer-based art, when compared with more traditional art media is pioneer territory, but nonetheless an area where primary data can pave the way towards an understanding of how microcomputerized art challenges and/or facilitates creativity, pleasure, and satisfaction and engages the human characteristics of man.

Methodology

In the present study, twenty patients from a rehabilitation hospital on Long Island, New York, with various physical disabilities, were employed. The subjects ranged in age from 13 to 71, and all eligible subjects had functional use of both upper extremities and were able to communicate independently. The patients were randomly assigned in equal numbers to one of the two activities (computer or traditional drawing).

The materials available for the computer activity consisted of: one Apple II Plus computer, one Gibson Light Pen* with six color options (black, white, green, red/orange, violet, and blue), one keyboard to stop and start designs, one "Penpainter Program" disk*, one disk drive, a monitor with a white screen, and a printer to produce the final product of the computer art work.

The materials available in the traditional art group consisted of: sheets of white drawing paper equal in size to the computer's monitor screen, and six magic markers with identical color options as the computer group's.

All subjects were tested in the same room, one at a time. The room was soundproof and easily accommodated both activities.

Each activity format was identical for both groups with minor modifications made for tools being used, and was written out and taped verbatim to facilitate control and ease of each session execution. Both drawing activities consisted of five 20-minute sessions, requiring the participant to experiment and draw various lines, shapes, feelings, and ideas, with programmatic themes offered appropriately.**

Data was collected from two sources. Information relating to the implementation of the program specifically was obtained by the facilitator making direct, observational recordings of each participant's responses during each activity session on a Subject Fact Sheet.** A questionnaire (Leisure Evaluation Form or L.E.F.**) was administered at the completion of the activity to each subject. The L.E.F. consisted of ten hypothetical statements relating to the activity, where the patient

had to agree or disagree with each statement, and 11 positive and 11 negative leisure descriptive adjectives/activity characteristics. Here, each patient was required to respond by checking whether (s)he did or did not experience the adjective during the activity.

Results

Each subject's number of overall positive responses to the L.E.F. (refer to Table 1 for responses to first half of L.E.F.) were tallied and each subject was assigned a score appropriately. Table 2 presents the Ns, means, standard errors, and SDs for both groups, and the analysis of the significant differences in terms of the critical t-test. The mean score of the computer group was 72.19 (out of 100) and the mean score of the traditional art group was 70.63. The t-test yielded a value of 0.32, which when compared with the critical t value of 2.101 for 18 degrees of freedom at the .05 level of significance, was not statistically signifcant. This finding suggests that the satisfaction levels of the two groups did not differ significantly.

Verbatim comments revealed that approximately 65% of all of the subjects (60% of the computer subjects and 70% of the traditional art subjects) evidenced some degree of anxiety about drawing or having to create an "artistic" product. The patients' apprehension ranged from a nonemotional "Now what can I draw here?", to an agitated response such as, "You know I can't draw, this looks stupid and awful". Despite the fact that the subjects were informed that they could dispose of their finished products if they wished, they stated concern over whether or not their products would be graded or seen by the psychologist. Some of this "product anxiety" was also due to the fact that a few of the patients stated that they physically could not draw due to a lack of coordination or other associated physical impairments, yet all of the patients employed for the study were able to function independently. The patients appeared to be their own worst critics. On the other hand, the remaining 35% of the subjects referred to themselves (often jokingly) as Rembrandts or Van Goghs during the sessions of the study. These comments may have been emitted to alleviate anxiety or were sincerely stated.

Discussion

While this research evidenced a strong similarity overall between the suggested leisure satisfaction elements as reported by the computer-based and the traditional "artists", a wide range of important data and information was gained through this investigation which carries implications for future research in this area.

Approximately two-thirds of the subjects studied evidenced anxiety about having to produce a professional "work of art" or drawing. No indication was given during the program for the need to analyze or view the paintings, although this would have added a new dimension to the project. Despite the fact that 40% from each group printed ther names on

their finished products, no patient was required to do so. In addition, all of the patients' art work was retained and given to the investigator at the end of the sessions by the subjects themselves. This unexpected outcome of the study might suggest a need to critique and further research the area of process versus product orientation in program planning and participation. It might become necessary to uncover reasons why the patients sensed and expressed this apprehension, and if this anxiety is indicative of our society.

During the execution of this study many situations arose in terms of how the subjects perceived the computer's functioning and problems that came up with the machine, that are important to discuss in light of the purpose of this investigaton. The computer is a machine that functions with input that is exact and consistent. Once adequately instructed and appropriately prompted, many of the computer subjects would either forget to tap the spacebar or leave their finger on the spacebar. Either of these "errors" would create unwanted lines or turn the instructions off so that the drawing would not print. More often than not, the subjects would interpret these events as inconsistent performance and/or oversensitivity on the part of the computer. Interestingly enough, many of the computer participants would often interact with the machine as if it was human. Some of the patients would even use profanity at the computer when it did not respond as they liked, or when the machine emitted auditory signals, the subjects would say something like, "Stop spitting at me!" Some of the conversation aimed at the computer was quite interesting to observe. It might prove valuable to videotape some of these sessions with further replication of this type of research. The computer is new and exciting, even of intimidating, whereas the traditional art activity was very basic and familiar.

This investigative study illustrates the need for additional exploration into the effects of computerization and its relationship to activity participation, as well as its interactive consequences on the human beings who use this newer form of technology for their leisure needs.

*Gibson Light Pen and "Penpainter Program" are products of Koala Technologies LPS II (Light Pen System II), manufactured by Gibson Laboratories, Laguna Hills, California, for Apple II Computers.

**Copies of the Leisure Evaluation Form, Subject Fact Sheet, session format outline, and/or verbatim session content may be requested from the author, Brunswick Hospital Center, P.M.&R. Division, Recreational Therapy Department, 366 Broadway, Amityville, N.Y. 11701.

REFERENCES

1. Bemer, R. W. (ed.), How Computers are Shaping Our Future, Association for Computing Machinery, Inc., New York, New York, 1971.

2. Burton, J. M. Advanced Life Drawing, School Arts, Vol. 83 (November), pp. 32-34, 1983.

3. Clark, G. and Zimmerman, E., Identifying Artistically Talented Students, School Arts, Vol. 83 (November), pp. 26-31, 1983.

4. Consumer Reports, Computers: Apple Macintosh-Is This the Computer You Already Know How to Use?, Vol. 50, January, p. 31, 1984.

5. Consumer Reports, Computers-Part One, Vol. 48, September, pp. 461-488, 1983.

6. Consumer Reports, Computers-Part Two, Vol. 48, October, pp. 531-551, 1983.

7. Consumer Reports, Personal Computers, Vol. 48, December, pp. 73-177, 1983.

8. S. M. Dobbs, Computers: Art Chips In, Art Education, Vol. 36, May, p. 4, 1983.

9. A. C. Flynn, Awaken the Artist in Your Apple, Creative Computing, Vol 8, July, pp. 37-38, 1982.

10. B. Friedman, Art and the Computer, Creative Computing, Vol 8, July, pp. 97-99, 1982.

11. R. Helmich, Enhancing Creativity in Art and Design Through Stochastically Generated Computer Graphics, Art Education, Vol 37, July, pp. 36-39, 1984.

12. G. Hubbard and E. Boling, Computer Graphics and Art Education, School Arts, Vol 83, November, pp. 18-21, 1983.

13. R. A. Kasschau, R. Lachman, and K. R. Laughery, Information Technology and Psychology-Prospects for the Future, Dallas, Praeger Publishers, Dallas, Texas, 1983.

14. H. Katzan, Microcomputer Graphics and Programming Techniques, Van Nostrand Reinhold, Co., New York, New York, 1982.

15. M. Kirkeby, Computer Graphics-Is There Life After Tron? , American Film, Vol. 8, January/February, pp. 42-45, 1983.

16. T. E. Linehan, Computer Graphics: Opportunity for Artistic Vision, Art Education, Vol. 36, May, pp. 11-14, 1983.

17. S. S. Madeja, Computer Graphics: The New Subject for the Art Curriculum, Art Education, Vol. 36, May, pp. 15-17, 1983.

18. E. L. Mattil and B. Marzan, Meaning in Children's Art, Prentice-Hall, Inc., Engle Cliffs, New Jersey, 1981.

19. P. A. McWilliams, Personal Computers and the Disabled, Quantum Press, New York, New York, 1984.

20. J. Meyer, Computer Art, Arts Magazine, Vol 56, April, p. 13,

1982.

21. C. M. Miller, Computer Graphics: An Art Medium in Lights, Creative Computing, Vol 8, July, pp. 86-90, 1982.

22. J. L. Mitchell (ed.), Computers in the Humanities, Edenburgh University Press, Edenburgh, Minnesota, 1974.

23. S. Nelson, The Gibson Light Pen-A Review, Home Computer Magazine, Vol 5, pp. 32:34, 1985.

24. P. C. Patton and R. A. Holoien, Computing in the Humanities, Lexington Books, Concord, Massachusetts, 1981.

25. R. J. Rossman, Evaluate Programs by Measuring Participant Satisfactions, Parks and Recreation, Vol. 17, June, pp. 33-35, 1982.

26. B. Shneiderman, Software Psychology-Human Factors in Computer and Information Systems, Winthrop Publishers, Boston, Massachusetts, 1980.

27. W. Squires, Creative Computers: Premises and Promises, Art Education, Vol 36, May, pp. 21-23, 1983.

28. S. J. Voigh (ed.), Computer Science Research at Langley, Hampton, Virginia, Proceedings of a workshop held at Langley Research Center, sponsored by the National Aeronautics and Space Administration, Washington, D. C., November, pp. 2-5, 1981.

29. M. Waite, Computer Graphics Primer, Howard W. Sams and Company, Indianspolis, Indiana, 1981.

30. D. W. White, Advanced Technology, Art, and Art Education: Reaching the Third Millennium, Art Education, Vol 36, May, pp. 8-10, 1983.

TABLE 1

Frequency of Positive Responses to 10
Suggested Leisure Satisfaction Elements

Frequency of Positive Responses		1	2	3	4	5	6	7	8	9	10
	1. "gave me an opportunity to be on my own"	I+++++I I**********I									
	2. "my skills and abilities developed"	I++++++++++I *I									
SUGGESTED LEISURE SATISFACTION	3. "felt comfortable working with tools and materials"	I++++++++++++++++++++I I**********I									
	4. (enjoyment of experience as nongroup activity)	I++++++++++++++I I**********I									
	5. "pleased with the setting and area"	I++++++++++++++++++++++++I I**********I									
	6. "had control over what happened"	I++++++++++++++++++I I**********I									
	7. "gave me a chance to escape from my daily routine"	I++++++++++++++++++I I**********I									
	8. "was a new and different experience"	I++++++++++++++++++++++++++++I I**********I									
	9. "discovered more about myself"	I++++++++I I*****I									
	10. "learned more about the activity"	I++++++++++++++++++++++I I**********I									

Key
+ = computer group responses
* = traditional art group responses

TABLE 2

Statistical Findings and Results of
the Comparison of Scores of the Two Groups

Computer group				Traditional group			
N	Mean	Standard error of the Mean	SD	N	Mean	Standard error of the Mean	SD
10	72.19	3.47	10.97	10	70.63	3.40	10.75

N = number of subjects in group
Mean = Mean of group scores
SD = Standard Deviation

$Sx_c - x_t$ = estimated standard of error of the difference = 4.86

Degrees of freedom = 18
Level of significance = .05

t = 0.32

t of 0.32 < 2.101 critical t value for 18 df
at .05 level of significance.

Therefore estimating no statistical
significance between the two groups.