

**Development and Initial Testing of a Multimedia Program  
for Computer-assisted Cognitive Therapy**

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## **Abstract**

A multimedia program for computer-assisted psychotherapy has been developed to help patients learn cognitive therapy skills. The program is designed to provide psychoeducation, teach self-help methods, and give information to clinicians on the patient's progress in using the software. Multimedia technology is utilized to engage users in the learning process and to make the program accessible for persons who do not have computer or keyboard skills. A preliminary study with 96 subjects who used the software along with treatment as usual found that 78.1% completed the entire program. Users indicated a high rate of acceptance of this form of computer-assisted therapy, and mean scores on a measure of cognitive therapy knowledge were significantly improved.

## **Introduction**

It has been suggested that computer programs for psychotherapy could have a significant positive impact on the cost and/or availability of mental health services (1,2). However, only a few programs have been tested and made available for clinical use. Early studies examined the possible utility of software that only displayed text, such as a computer program for self-directed exposure therapy (3) and a psychoeducational program for cognitive therapy (4,5). More recently, technological advances such as multimedia (6), interactive voice response (7), hand held computers (8), and virtual reality (9) have been incorporated into computer programs for psychotherapy.

Although concerns have been raised about possible negative effects of having humans interact with a machine as a component of therapy and about the limitations of computer programs in communicating with patients (1,2,10,11), most studies have found

that patients readily accept computer tools for psychotherapy (2,7,12). For example, Colby et al. (2) reported that 79% of 278 users of their text-based program reported a high level of satisfaction, and Griest et al (7) observed that 71% of subjects who used an interactive voice response system for obsessive compulsive disorder noted that the program improved the quality of their lives. A counterpoint to the favorable reports on computer-assisted therapy was registered by Scott and Larue (13) who found that severely depressed inpatients had difficulty using a computer program that attempted to simulate patient-therapist communication.

There has been limited research to date on the efficacy of computer-assisted therapy (14), but available evidence suggests that computer-assisted therapy of different types can be useful for depression (5), anxiety disorders (3,8,9,15), and OCD (7). To date, there have been no reports of patient acceptance or efficacy of multimedia programs for computer-assisted therapy. Demonstration of patient acceptance and tolerance of computer-assisted therapy is a necessary step before initiating randomized, controlled trials. In this report, we describe the development and initial testing of Cognitive Therapy: A Multimedia Learning Program (6), the first multimedia program for computer-assisted psychotherapy. The aims of the research study described here were to: (1) determine acceptance of computer-assisted therapy by patients who used the computer program along with treatment as usual, and (2) pilot outcome measures for learning cognitive therapy skills measuring treatment efficacy to be considered for later randomized, controlled investigations.

### **Program Development and Content:**

Our review of other programs for computerized cognitive therapy suggested that earlier software, such as programs developed by Selmi and colleagues (1990) and Colby and Colby (1990), might not have broad applicability because of a complete reliance on written text to communicate with the patient. Familiarity with computers, keyboard experience, and ability to sustain high levels of concentration appeared to be important factors in the suitability of these programs for clinical use. Another problem with some earlier programs is that they were designed to be substitutes for therapists. A recurring difficulty in designing therapeutic computer programs has been the dilemma of simulating "natural language." Early developers attempted to construct programs that approximated human communication (Weizenbaum, 1966; Colby, Watt, & Gilbert, 1966). However, comments of patients could easily be misunderstood, and feedback from the computer could be stilted or off target (O'Dell & Dickson, 1984). More recently, programmers have moved away from the idea of using "natural language" or artificial intelligence to make computers simulate human therapists (Greist, 1989; Bloom, 1992; Locke & Rezza, 1996).

Cognitive Therapy: A Multimedia Learning Program was developed as an alternative to earlier forms of computerized therapy. Our intent was to provide a computer program that could be used easily by persons with no previous computer experience and those with significant symptoms of depression or anxiety. Thus, a multimedia format was chosen with video, audio, and a variety of interactive exercises designed to engage users in the learning process, stimulate affect, and model procedures for reducing symptoms. A "user friendly" interface is used to minimize requirements for reading text. Typing skills or previous experience with computers are not needed. Text is

written at the ninth grade level. Users navigate their way through the program, respond to multiple choice questions, and complete inventories and ratings by making selections with a mouse. They are given feedback after all responses to assist with learning and to encourage further participation in the program.

The software for Cognitive Therapy: A Multimedia Learning Program does not attempt to substitute for the critical features of clinician-administered therapy such as rapport, empathy, or clinical judgment. Instead, the computer program is designed to socialize the patient to cognitive and behavioral treatment methods, offer psychoeducation, reinforce the utility of self-help exercises, and help free the clinician for interventions that require the sensitivity and expertise of a human therapist.

The program is divided into six modules (Introduction, Basic Principles, Changing Automatic Thoughts, Taking Action, Changing Schemas, and Continuing Your Progress) which cover the core concepts and procedures of Beck's form of cognitive therapy. The modules contain introductions and guidance from a narrator who is an experienced clinician, videos of individuals (portrayed by professional actors and actresses) who are using cognitive therapy skills to cope with depression or anxiety, interactive learning exercises, and review questions to assess progress in understanding the program content. Gender and ethnicity are presented in a balanced manner. Three of the four characters in the video sequences and stories are female, one is a minority. Patients usually take about four hours to go through the program one time, but may also repeat sections as desired. It is usually recommended that patients use the software in a series of sessions lasting 20-45 minutes each.

Patient responses to computer-generated questions are stored and then reported back to the clinician in a Progress Report. Information is collected on sociodemographic data, self-report of global depression and anxiety scores, subjective reactions to the program, and comprehension of lesson material. A two password access system is used to guard confidentiality of patient data. Because programming of this software began prior to the introduction of DVD and large amounts of video are utilized, the program was originally available only on videodisc. A DVD-ROM version (titled Good Days Ahead: The Multimedia Program for Cognitive Therapy) is scheduled for completion in late 2001.

**Method:**

Subjects were 96 inpatients and outpatients at The Norton Psychiatric Center, an affiliated psychiatric service of The University of Louisville. Inclusion criteria were: (1) DSM-IV diagnosis of major depression, dysthymic disorder, bipolar disorder depressed phase, panic disorder, generalized anxiety disorder, or social phobia; (2) tenth grade education or GED diploma; (3) age 18-75; (4) computer program recommended by treating physician. Referring physicians were supplied with inclusion and exclusion criteria and were asked to refer patients who met study requirements. No other instructions were given to referring physicians about suitability of the computer program for clinical use. Exclusion criteria were: (1) DSM-IV diagnosis of schizophrenia or any other psychotic disorder (including major depression with psychotic features), bipolar disorder manic phase or rapid cycling, dementia or other cognitive disorder, mental retardation, substance induced mood disorder, borderline personality disorder, antisocial personality disorder, or factitious disorder; (2) currently taking an antipsychotic

medication; (3) active substance abuse; (4) inability to read; (5) electroconvulsive therapy within previous 6 months. Informed consent was obtained from all subjects for participation in the study. Diagnoses were made by the referring physicians. No estimates of reliability of diagnoses were performed.

In this uncontrolled, preliminary trial, subjects used Cognitive Therapy: A Multimedia Learning Program along with treatment as usual. The research design was naturalistic. Subjects were permitted to use the computer program at their own pace and to participate in other treatments such as pharmacotherapy and psychotherapy. No attempt was made to control the frequency of use of the computer program, the duration of use of the program, or the amount or frequency of other treatments. Most patients treated at the Norton Psychiatric Center where the study was conducted receive a mixture of treatments including pharmacotherapy and psychotherapy. A variety of methods (eg., supportive therapy, cognitive-behavior therapy, and psychodynamic therapy) are utilized by therapists at this center.

Patient satisfaction was measured by responses to three questions that are part of the assessments that are built in to the computer program and are asked at the program midpoint and end. Subjects responded to three statements (“the program helped me,” “I enjoyed the program,” and “ I would recommend the program to others”) which are each scored on a five point scale (1 = lowest satisfaction rating; 5 = highest satisfaction rating). The scores for responses to the three statements were combined into a total affinity score (range = 3-15). Subjects who dropped out of the study were asked to complete an exit questionnaire that contained the affinity measures, in addition to written comments about their experiences in using the software.

Knowledge of cognitive-behavior therapy (CBT) was measured by self-report in two ways: (1) a question built in to the computer program (1-5 point rating, 5 = highest self-report of knowledge of CBT) that was answered before starting the program, at the midpoint (after the first three modules), and the end of the program; and (2) the Cognitive Therapy Awareness Scale (CTAS), a measure of knowledge of CBT skills designed for this study that was administered pre, midpoint, and post completion of the program. The CTAS was developed for this study because no other instruments for measuring cognitive therapy knowledge were available. The CTAS contains 40 true-false questions about basic CBT concepts and methods (See Appendix)

Self-report measures of cognitive distortion (Automatic Thoughts Questionnaire – ATQ), depression (Beck Depression Inventory - BDI), and anxiety (Beck Anxiety Inventory - BAI) were also included to obtain a preliminary assessment of symptom change in patients who used a multimedia program for psychotherapy along with treatment as usual. Because this was an uncontrolled trial, efficacy of the computer program as a treatment adjunct could not be measured. Subjects completed the ATQ, BDI, and BAI prior to beginning the computer program, at midpoint, and immediately after finishing the program. Data were analyzed with descriptive statistics, repeated measures analysis of variance, and independent samples t tests.

### **Results:**

The primary DSM-IV diagnoses of subjects were major depression 86.4 % (n=83), bipolar depressed 6.3% (n=6), anxiety disorder 5.2% (n=5), and dysthymia 2.1% (n=2). The sample included 67.7% females. Forty (41.7%) of the subjects were

inpatients. The age distribution was: 19 or less (1.0%), 20-29 (27.1%), 30-39 (26.0%), 40-49 (27.1%), 50-59 (16.7%), and 60-69 (2.1%). The levels of education reported by subjects were: some high school (5.2%), high school graduate (16.7%), some college or post high school education (38.5%), college graduate or equivalent (39.6%).

Seventy-five subjects (78.1%) completed the entire computer program, while 21 subjects (21.9%) dropped out of the study before completion. Ninety subjects (93.4 %) reached at least the midpoint of the program. The mean time spent working on the computer program for completers was 224 (+/- 60, range 116 - 460) minutes. Subjects worked on the computer program at their own pace in sessions that usually lasted 20-50 minutes. The median number of days required to complete the computer program was 29 ( $\bar{X}$  = 62.3 +/- 73.3, range = 2 - 307). Thus, the typical program completer worked with the software in 4 to 8 sessions over a 4 week period. Satisfaction scores, self-report of knowledge of CBT, and CTAS scores are displayed in Table 1.

Mean scores on responses to the three statements comprising the affinity score ranged from 4.3 +/- 0.6 to 4.5 +/- 0.6 (five = highest possible rating) and mean affinity scores were 13.2 +/- 1.6 (range 9 - 15, 15 = highest possible rating) after completion of the program. Subjects reported no adverse effects of using the computer software. Self-report of CBT knowledge on the five point scale contained in CTMP increased from 2.2 +/- 0.7 to 4.0 +/- 0.8 after use of the software.

Mean scores on the CTAS increased significantly from 24.2 +/- 4.2 to 32.5 +/- 3.7 ( $p < .0001$ ) after use of the program. Because the CTAS has 40 true-false questions, a score of about 20 would be expected from a subject who knew nothing about CBT. The maximum score on this scale is 40. The individual items from the CTAS were selected to

assess knowledge of a variety of cognitive and behavioral concepts such as automatic thoughts, schemas, and use of common therapy methods. Correlations between test items were computed as a measure of reliability with the Kuder-Richardson formula 20 (KR 20, Anastasi and Urbina, 1997). This statistic is a form of Chronbach's alpha utilized for dichotomous data (i.e, true-false). The KR 20 for data from this study was .58.

When completers were compared with dropouts, an analysis of midpoint satisfaction scores, pre and midpoint CTAS scores, and pre and midpoint CBT knowledge self-ratings of revealed no significant differences. Twelve of the 21 subjects who dropped out of the study complied with a request to complete an exit questionnaire with affinity ratings. The mean affinity score of dropouts on the exit questionnaire (11.7 +/- 2.0) was significantly lower than the mean affinity score of completers at the end of the program (p = .004). Inpatient subjects (n = 40) had somewhat higher initial BDI scores (27.3 +/- 11.2) than outpatients (n=46, 23.7 +/- 9.7), but midpoint satisfaction scores were similar in the two groups (inpatients = 12.7 +/- 1.7, outpatients 12.0 +/- 1.5). The CBT knowledge self-report score increased from 2.2 +/- 0.7 to 4.4 +/- 0.7 in inpatient completers and from 2.3 +/- 0.7 to 3.8 +/- 0.8 in outpatient completers.

Mean scores on measures of depression, anxiety, and automatic thoughts (BDI, BAI, ATQ) were substantially reduced in subjects who used the computer program along with treatment as usual. Significance levels are reported in Table 2.

**Table 1**  
**Patient Responses to Multimedia Computer Program**  
*Total Sample (n = 96)*

<b>Rating</b>	<b>Pre ( n = 96)</b>	<b>Midpoint (n = 90)</b>	<b>Post (n = 75)</b>
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The Program Helped Me*	NA	4.0 +/- 0.6	4.3 +/- 0.6
I Enjoyed the Program*	NA	4.1 +/- 0.6	4.3 +/- 0.6
Would Recommend to Others*	NA	4.2 +/- 0.7	4.5 +/- 0.6
Total Affinity Score**	NA	12.3 +/- 1.6	13.2 +/- 1.6
CBT Knowledge***	2.2 +/- 0.7	3.2 +/- 0.7	4.0 +/- 0.8
CTAS	24.2 +/- 4.2	29.6 +/- 5.0	32.5 +/- 3.7

\* Self-report of satisfaction on 1-5 point scales (5 = highest rating)

\*\* Self-report on 15 point scale (sum of three individual satisfaction scores; 3 = lowest possible score, 15 = highest possible score),

\*\*\* Self-report of knowledge of CBT on 5 point scale (5 = highest possible score)

**Table 2**  
**Measures of Symptom Change**  
*Total Sample (n = 96)*

Measure	Pre (n = 96)	Midpoint (n = 90)	Post (n = 75)	Significance
BDI	25.2 +/- 10.5	16.4 +/- 8.4	11.6 +/- 10.0	<.0001
BAI	20.7 +/- 12.1	12.6 +/- 10.1	10.5 +/- 10.0	<.0001
ATQ	66.6 +/- 27.3	40.2 +/- 26.6	27.3 +/- 25.3	<.0001

**Discussion:**

The principal goal of this preliminary study was to test the feasibility of using a multimedia computer program for CBT as a treatment adjunct. Prior to initiating controlled research, we sought to determine whether this multimedia program for CBT would be accepted and well tolerated by patients and whether significant numbers of subjects could complete the program material. Additional goals were to pilot measures of CBT knowledge and to assess the potential of this computer program for teaching CBT skills. A naturalistic design was used in order to gain information on reactions of patients

to using computer-assisted therapy in a clinical setting and on duration and time course of software use.

Results of the study indicated that patients with depression and anxiety disorders reported high levels of satisfaction with using this computer software. Over three quarters of the subjects completed the entire computer program, and 93% completed at least the first three modules. There was a wide range of length of use, but most patients who completed the entire program did so within 16 weeks. Patient self-report of knowledge of cognitive therapy skills increased after use of the software. Also, measures of depression, anxiety, and automatic thoughts improved during use of the program.

This study has several limitations. A diverse group of subjects was included and no attempt was made to control for other treatments. Also, subjects were permitted to use the computer program at their own pace and for as long as they wished. Because the study was uncontrolled, it is impossible to determine the role, if any, of the computer program in contributing to changes of self-reported CBT knowledge or symptoms of depression and anxiety. However, the generally favorable subjective responses of patients to using the computer program, the overall increase in report of knowledge of CBT, and the reduction in symptom measures suggest that this form of computer-assisted psychotherapy may have potential as a treatment tool. Randomized, controlled trials will be required to determine the efficacy of this multimedia program for cognitive therapy.

Information on availability of this software for use in clinical practice can be found at <http://mindstreet.com>.

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**Appendix:**

**Cognitive Therapy Awareness Scale**

Patients are instructed to place a check mark beside each answer that they believe is correct. Questions may have more than one correct answer. One point is scored for each correct response. The range of possible scores is 0 - 40. Correct responses are marked with an asterisk (\*).

1. Which of the following are examples of cognitions?

- Anxious or depressed feelings
- Automatic thoughts\*
- Negative behaviors
- Schemas\*

2. Helpful techniques that are taught in cognitive therapy include:

- Directional change
- Examining the evidence\*
- Activity scheduling\*
- Emotional reasoning

3. Automatic thoughts can be described as:

- Out of your control
- Private\*
- Usually rational
- Caused by unhappy feelings

4. Which of the following are examples of emotions?

- Thinking you're not good enough
- Wanting to give up
- Reacting with sadness\*
- Deciding not to show your fear

5. Thought recording exercises may involve writing down the following types of information:

- Outcomes\*

- Emotions\*
- Unconscious thoughts
- Events\*

6. Mr. R., a salesman, was performing about ten percent below his sales target for the year. The problem was largely due to an economic downturn in his region of the country. Although his job wasn't really threatened and his family relationships were in good shape, Mr. R. began to think " Everything is falling apart ---- I'll lose it all." What kind of mistakes in thinking might he be having?

- Overgeneralization\*
- Mind reading
- Ignoring the evidence\*
- Untracking

7. Mr. R., the salesman described in the previous question, decided to start cognitive therapy. Which of these techniques do you think might help him?

- Emotional reasoning
- Programming
- Denying automatic thoughts
- Labeling cognitive errors or distortions\*

8. Ms. T has a number of long standing negative attitudes such as "I'll never succeed" and "I have to be perfect to be accepted." No matter how hard she tries she always seems to think that she is "not measuring up." What cognitive therapy procedures do you think might help her?

- Listing advantages and disadvantages\*
- Breaking out
- Listing schemas\*
- Thought recording\*

9. Mr. G. has been feeling depressed and has withdrawn from most of the activities that he used to enjoy. It seems like nothing gives him pleasure anymore. What would you recommend that he do?

- Use an activity schedule\*
- Stay away from all stressful situations
- Don't push for change until he starts to feel better
- Record levels of mastery and pleasure\*

10. Which of the following statements accurately describe schemas?

- Are upsetting emotions
- Often stimulate automatic thoughts\*
- Act as underlying rules\*
- Can be very helpful\*

