

EXPERIENCES WITH THE AUTOMATION OF DOWNWARD SPIRAL: A CROSS-DISCIPLINARY CIT CAPSTONE PROJECT

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ABSTRACT

The capstone course sequence at Texas Christian University (TCU) is an important concluding element required of all students seeking the Computer Information Technology (CIT) degree. This paper discusses some of the goals and characteristics of the TCU capstone sequence, its requirements and how it is administered, and discusses one of the cross-disciplinary projects, *Downward Spiral*, that has been under development by teams of students for the past three years.

INTRODUCTION

The senior capstone sequence at Texas Christian University is a two-semester sequence that is designed to integrate learning from a student's various courses in the major with information derived from courses outside the major. The intent is to provide students with an experience that closely approximates the software development practices that they will encounter in industry. As such, the TCU Computer Science Department has, for many years, required students to satisfy a research component during their senior year.

A two-course senior capstone sequence is a requirement of all Computer Information Technology students at TCU. The sequence consists of a one-semester course, titled *Issues in Project Management*, which is designed to "equip students with the tools needed for the application of sound software engineering principles and practices" [1]. This course is followed by a one-semester *Senior Development Project* course that emphasizes team collaboration — the objective being for students to design and implement a project that they have chosen in the earlier course.

CITE 40643 – Issues in Project Management

This course is designed to allow students to function in a team environment to develop the skills to design, implement, and maintain large, complex software systems. Included is a study of the various software development life cycles, with emphasis on the analysis and design of software systems. A significant team project is required necessitating students to use and enhance their writing and presentation skills and to learn how to effectively function in a team environment. The project is completed in CITE 40993, *Senior Development Project*.

CITE 40993 - Senior Development Project

The second course of the Department's two-course capstone requirement is, for most students, a continuation of the project begun in the *Issues in Project Management* course from the prior semester. Emphasis is placed primarily on milestone deliverables, presentations, technical papers, and the development of sound teamwork skills.

One project, *Downward Spiral*, developed in cooperation with the TCU Department of Psychology, has been in progress for the past two years - development continues this year. This paper will focus on this project, past and present.

DOWNWARD SPIRAL BACKGROUND

Motivating people to initiate and sustain personal change has long been recognized as an exceedingly difficult task [2][3]. Ultimately an individual must be intrinsically motivated for meaningful personal change to occur and to persist [4]. In other words, change must “come from within.” Still, it has been shown that there are ways to facilitate and foster such change. Motivational Interviewing, for example, is a substance abuse treatment approach that facilitates internal motivation for change through examination of an individual’s ambivalence toward making changes [3]. Another promising approach has been the use of motivational games and activities to facilitate change in treatment [5][6].

Downward Spiral is an example of such a game that was developed by the Psychology Department at Texas Christian University (TCU) for use in the treatment of client substance abuse. In *Downward Spiral*, players take turns rolling a set of dice and then moving a game token some corresponding number of squares around a board; thus, the game is somewhat like the game of Monopoly®, but with the squares laid out in a spiral arrangement (see Figure 1). The premise of the game is to reflect the downward spiral one’s life can take if one continually abuses drugs, violates the law, and, in general, makes poor decisions. Game points are gained (or lost) due to scenario cards dealt during play. When a player’s token lands on certain squares, a card is randomly drawn that describes an immediate or long-term consequence of continuing the lifestyles that brought a player (or players) into treatment (see Figure 2). As such, the game incorporates health, social, financial and legal consequences, as well as facts and quotes that are conceptually linked to these consequences [7]. The game ends when a player loses all game points, goes to jail 4 times, lands on a death square, or is voted (by other players) as the player suffering the most damage. A player wins if all other players have “died” or by being the first to land on a recovery square. The *Downward Spiral* game was designed to be engaging and to reduce the resistance that typically occurs when individuals are directly confronted about substance use [8]. Ideally the game serves to increase the likelihood that a player will become aware that they do, indeed, have a problem [9] and will offer insight into their cause.

Members of the TCU Psychology Department faculty have used the game in combination with a variety of other activities that target motivation and readiness for treatment. When used in combination with these other activities, *Downward Spiral* has been shown to improve ratings of the effectiveness of counselors and counseling sessions [10], improve ratings of the engagement and helpfulness of clients’ peers in treatment [5], and has lead to increased motivation to resist drug use and to avoid unsafe sexual practices [11]. The approach has been shown to be especially effective for females [6], clients with low need for cognition [12], and clients with less education [13]. Evidence also suggests that the game may

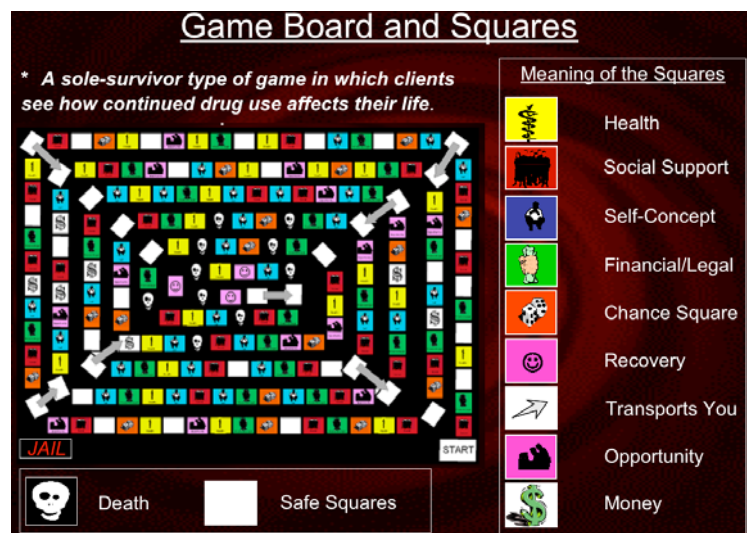


Figure 1. “Downward Spiral”

be particularly beneficial for socially shy individuals who begin to speak up more regularly in group sessions after playing the game

DOWNWARD SPIRAL - PAST CIT PROJECT DEVELOPMENT

For the past several semesters, the TCU Psychology Department, the Institute of Behavioral Research, and the Computer Science Department have collaborated to produce computerized versions of the *Downward Spiral* game [14][15]. The current computerized version allows the game to be played on one or more personal computers with one or more participants at each computer. Automated players, or computer "bots," can be engaged to perform as players in order to increase interest. At present, a server computer is used when game play occurs on multiple computers. The server is used to establish the initial connection between the various client computers and as the intermediary when players at the various computers wish to "chat" interactively. The actual game, however, is conducted on the various client computers via a peer-to-peer connection. The advantages are: (1) overloading the main server and slow response time is reduced and (2) keeping information about a participant's personal information and performance on the local client computer, an important privacy issue when dealing with individuals in treatment programs.

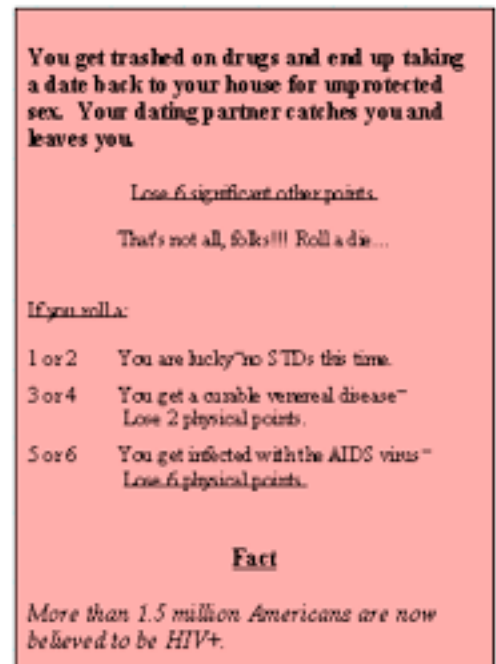


Figure 2. Typical scenario card

An even more important benefit of the automated version of *Downward Spiral* is its expected increase in effectiveness. Foremost among these is the expansion of the set of individuals who can derive the benefits of playing the game. The original version of *Downward Spiral* involved at least two players in fairly close proximity (i.e., they must share a common board, dice, etc). This frequently proved daunting to one or more of the players, particularly when loud or overbearing individuals were participating. The situation was further exacerbated if a player had poor communications skills, was a foreign national (their first language not being English) or if they suffered from some form of learning disability, a common problem in substance abuse treatment programs. The automated version reduces the level of threat to these individuals in a number of ways. A less assertive player may be reluctant to object to the cheating of a more domineering individual; the computer version prevents many such forms of cheating. The mere fact that an individual can play the game in relative isolation with a high degree of anonymity at a PC away from the other players can offer a degree of reassurance. If this is still insufficient to overcome an individual's qualms, a player can make use of bots rather than play with other humans. In addition, an extensive training and help capability has been recently added. This information, as well as the text of the scenario cards, can, at present, be read aloud by the computer, thereby aiding those individuals with reading and learning difficulties.

DOWNWARD SPIRAL - THE CURRENT CIT PROJECT

Previous Senior Design Project teams have worked to transform *Downward Spiral* into an effective computer game. As such, the current team's primary goal is focused on making improvements to the overall functionality of the game. Additional automated board games implemented using the engine

designed for *Downward Spiral* are in the planning stages. The Psychology Department faculty has determined that a desirable feature would support the creation of different versions of the game to increase its agility and to make it more customizable. Two versions, one for alcohol abuse oriented towards college students, and an anti-drug campaign program aimed at middle school and high school students are in development. A college alcohol abuse version of the game has also been shown to be more effective than educational videos on the dangers of alcohol in increasing behavioral intentions to more carefully monitor alcohol consumption at parties [16].

Any of the automated board games could be translated into other languages, *Spanish being the most likely candidate for Texas and other parts of the Southwest*. To this end, the present team of students is working to make the game cover these new topics and others such as child development and parenting, and an adolescent friendly D.A.R.E version for public schools. In order to accommodate this retargeting of the game, an ability to import new cards from external sources is needed, and different colored game boards are desirable to help distinguish between games. These are currently in development.

It has also been determined that the game, as it currently stands, lacks some important elements of the original game. With the original, patients rarely ever completed the game; instead, a proctor/counselor would stop the game at some point and the players would discuss the various scenario cards they had been dealt and any thoughts they might have about the downward spiral their life might be taking. While the computerized version may also be proctored, it is desirable to have built-in “*stopping points*” in the game to facilitate discussion amongst the players and councilors.

Another management aspect, which is still in the process of being implemented, is the automated gathering of performance statistics. Since many of the players are enrolled in court ordered treatment programs, the counselors and organizations that administer the programs are required by law to ensure that individuals complete the various aspects of the treatment in a legitimate and timely fashion. In the past this has required a comparatively large number of counselors just to monitor the game to ensure a player or players do not just claim to have played it. The automated version greatly reduces the potential to cheat by such means as claiming a different position of a player's board piece or the value rolled on the dice. In the near future we hope to have a record of who played the automated version, how many turns each player had, what square they landed on, etc. This should substantially reduce the time and effort spent by a counselor in monitoring the mechanics of the game.

SUMMARY

The development of a computerized version of *Downward Spiral* has resulted in a significant management benefit for the distribution and maintenance of the game. No longer must an individual or organization contact TCU to obtain the board version of the game. The automated version can now be freely downloaded and installed on other machines. Software updates can be handled similarly.

Although the computerized version of *Downward Spiral* has good “face” validity in terms of its correspondence to the original version, empirical tests of its effectiveness have yet to be conducted. However, the faculty and students are optimistic that the computerized versions will maintain their effectiveness while facilitating transfer, distribution, and actual use of the intervention in treatment programs. Experimentation on the computerized version will be initiated with college students in some future semester. We expect that the computerized version will be rated as very engaging, and similar to earlier research with the board version of *Downward Spiral*, that it will lead to improved behavioral

intentions of college students to better monitor drinking behavior at parties, and increase internal motivation for change of clients receiving substance abuse treatment.

REFERENCES

- [1] Farmer, B., Comer, J., Nute, T., & Ball, L. A Two-Semester Capstone Sequence – Preparing Students for the Real World. WDSI 2007, Denver, CO. April 5, 2007.
- [2] Ryan, R. M., & Deci, E. L., (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78.
- [3] Miller, W. R., & Rollnick, S. (1991). *Motivational interviewing: Preparing people to change addictive behavior*. New York, NY, US. Guilford Press, 1991.
- [4] Farabee, D., & Leukefeld, C. G. (2001). *Recovery and the criminal justice system. Relapse and recovery in addictions*. Tims, F. M. (Ed); Leukefeld, Carl G. (Ed); Platt, Jerome J. (Ed); New Haven, CT, USA. Yale University Press, 2001; 40-59.
- [5] Czuchry, M., & Dansereau, D. F. (2000). Drug abuse treatment in criminal justice settings: Enhancing community engagement and helpfulness. *The American Journal of Drug and Alcohol Abuse*, 26(4), 537-552.
- [6] Czuchry, M., Sia, T. L., & Dansereau, D. F. (2006). Improving Early Engagement and Treatment Readiness of Probationers - Gender Differences. *The Prison Journal*, 86, 56-74.
- [7] Czuchry, M., Sia, T. L., Dansereau, D. F., & Dees, S. M. (1997). Downward Spiral: A pedagogical game depicting the dangers of substance abuse. *Journal of Drug Education*, 27, 373-387.
- [8] Bensley, L., & Wu, R. (1991). The Role of psychological reactance in drinking following alcohol prevention messages. *Journal of Applied Social Psychology*, 21, 1111-1124.
- [9] Prochaska, B. J., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist*, 47, 1102-1114.
- [10] Sia, T. L., Dansereau, D. F., & Czuchry, M. (2000). Treatment readiness training and probationers' evaluation of substance abuse treatment in a criminal justice setting. *Journal of Substance Abuse Treatment*, 19, 459-467.
- [11] Czuchry, M., & Dansereau, D. F. (2005). Using Motivational Activities to Facilitate Treatment Involvement and Reduce Risk. *Journal of Psychoactive Drugs*, 37(1), 7-13.
- [12] Czuchry, M., & Dansereau, D. F. (2004). The importance of need for cognition and educational experience in enhanced and standard substance abuse treatment. *Journal of Psychoactive Drugs*, 36, 243-251.
- [13] Blankenship, J., Dansereau, D. F., & Simpson, D. D. (1999). Cognitive enhancements of readiness for corrections-based treatment for drug abuse. *The Prison Journal*, 79, 431-445.
- [14] Nute, T., Farmer, B., Comer, J. & Czuchry, M. Preliminary Analysis of the Automation of *Downward Spiral*, a Drug Abuse Treatment Program, Proceedings of the Fifth Hawaii International Conference on Social Sciences, Honolulu, Hawaii, May 31 – June 3, ISBN #1539-7300.
- [15] [Downward Spiral – a Comprehensive Project Overview \(P6.doc\)](http://frogware.mytcu.com/project/P6/P6.doc), Senior Design Team, Texas Christian University, Spring, 2006, <http://frogware.mytcu.com/project/P6/P6.doc>
- [16] Czuchry, M., Sia, T. L., & Dansereau, D. F. (1999). Preventing alcohol abuse: An examination of the “Downward Spiral” game and educational videos. *Journal of Drug Education*, 29, 323-335.