Leadership Testing in an Electronic Environment

An Interactive Qualifying Project Report
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by

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Abstract

Leadership is an important skill for members of the military, business world, and the global economy. Leadership skills can be instructed and evaluated. In this pilot study, the feasibility of using an electronic environment to instruct and evaluate leadership was investigated. It was found that video game programs could serve as a medium to instruct leadership, and could be tailored to evaluate leadership either subjectively or objectively.

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1. Introduction

1.1 Importance of Leadership in Society

Leadership is an important aspect in a great number of areas in society and in the global economy. Two of the most notable areas are the business world and the military. The military need for leadership is obvious. The entire military structure is based on several tiers of leadership, all used to achieve the military's many goals. At one level, a leader might be required to make split second, life or death decisions for hundreds of troops. At other levels a leader may only require the confidence and obedience of his subordinates in a more office-like, organizational environment. At numerous levels, from Cadet to Colonel, the military instructs its personnel in leadership to make its units more effective. Also, it is economically important for businesses to find and develop skilled leaders. People with leadership potential that can be trained as managers are highly valued, since training a manager in leadership skills can be difficult and costly.

The stress on leadership in the business world is often overlooked because it is frequently confused with management. "Management and leadership are often considered the same activities, but the two concepts differ in the sense that leaders focus on people while managers deal with things.[1]" Field Marshal Sir William Slim once said "…managers are necessary; leaders are essential.[1]" A manager who is also a good leader will not need to resort to demands and use his or her formal authority to attempt to compel people to be more productive. Instead a leader will have people commit to the task at hand and come up with new and innovative ideas because they feel inspired to, not because they were told to as part of their job. An excellent example of this principle is the charismatic leadership exercised by Polaroid founder Edwin Land. He was able to inspire his employees to work above and beyond all expectations for wages below those they could earn elsewhere. His leadership made them want to do it just for the joy of

overcoming the challenge.[2] Thus the key is to find a manager who might also be a good leader, whose authority is "charismatic" rather than "bureaucratic" who people willingly follow due to confidence in their ability and commitment to a common goal or vision imparted by the leader.

Leadership is also important in other areas of society, such as teaching. Students will try harder and perform better for a teacher who is a good leader, and the teacher will not only be able to instruct the students better in school but will also be able to more effectively inspire, enlighten, and influence them as a role model. The better teachers often liken themselves to coaches rather than fountains of knowledge. This type of leadership is also sought among instructors and counselors of youth groups such as Boy Scouts or Girl Scouts, or even generic summer camps. The Boy Scouts are a good example because the have a commitment to service, yet foster leadership in their members by forcing them to organize everything themselves. The Scoutmasters guide in the planning of hikes, events, and meetings as part of the mission of the organization, awarding ranks and recognition to those who rise to the challenge. Those that take this initiative emerge from the ranks as the leaders of the next generation.

Many of the aspects of good leadership can also be found in good parenting skills. A family could be viewed as a team, where each family member plays a role. Here, fostering communication and team building are important skills for the parents as the family leaders. The need for formal discipline is inversely related to the leadership skills and influence of the parents, since leaders inspire obedience to common goals and institutions without the need for overt threats.

1.2 Leadership is a Dynamic Skill

Leadership is not a static skill, definable and applicable in one form for all situations. This is the essence of situational leadership. The Situational Leadership Model defines four basic types of leadership, which coincide with four basic types of followership. Followership

can roughly be defined as the art of following a leader or as the skill level of a follower. There are two types of leadership behavior. The first is "Directive Behavior," which is basically one-way communication; the leader tells the follower what to do. The second type is "Supportive Behavior," which is marked by two-way communication. Here, the leader involves the follower in the decision-making process by listening and providing support and encouragement. Followership is also divided into two basic areas: competence and commitment. Competence is simply how knowledgeable a follower is in dealing with a given task. Commitment is the level of commitment or enthusiasm toward a task.

The situational leadership model defines four styles of leadership based on all the combinations of supportive and directive behavior. A high directive, high supportive style (S1) is known as "Directing," while a low directive, low supportive style (S4) is known as "Delegating." The entire model is laid out in the following chart[1]:

STYLE OF LEADER

(HIGH)		
	High Supportive Low Directive **(S3)** **Supporting**	High Directive High Supportive **(S2)** **Coaching**
	Low Supportive Low Directive **(S4)** **Delegating**	High Directive Low Supportive **(S1)** **Directing**
(LOW)		(HIGH)

Followership is laid out slightly differently than leadership. A "D1" follower would be the beginner with low competency, but relatively high commitment. A "D2" follower would have some competence, but low commitment. All the follower levels are laid out below[1]:

LEVEL OF FOLLOWER

High Competence High Commitment	Moderate/High Competence Variable Commitment	Some Competence Low Commitment	Low Competence High Commitment
D4	D3	D2	D1
(Developed)			(Developing)

A follower at the D1 level would have the drive to get things done, but would not necessarily know how. Here, they would not need much encouragement, but would need to be told how to do a task. This would fit a Directing, or S1, leadership style. Likewise, a follower who at the D4 level would have both the drive and knowledge to complete a task, and the leader would only need to tell them what needs to be done. This would be a Delegating style of leadership.

As one might expect, real life does not follow this model exactly. Different people are at different levels in different situations, and most of the time everyone is somewhere in between the followership levels. A good leader is able to adapt his or her style according to the follower and given situation. This is the essence of situational leadership.

1.3 Importance of Dynamic, Real-Time Instruction and Evaluation of Leadership

We have already established that leadership is very important to society and that several important organizations view it as a skill that can be taught, though some people acquire leadership skills without formal training. In either case it follows that it would be important to be able to teach and test for leadership ability. Leadership can be taught both by academic instruction and by practice with real-life situations. Instructing leadership through books and lectures is more about teaching the aspects of a good leader and the theory behind leadership; the hope is that people will then be able to apply and practice these theories on their own. Anybody could learn the aspects of a good leader and be able to recite them, but to practice good leadership takes instruction and practice in actual leadership situations. This is why the military goes to great lengths to instruct leadership outside of the classroom, in addition to classroom

instruction. A great part of the entire Reserve Officer Training Corps (ROTC) program, for all services, is based on constant practice of leadership skills in a wide range of situations. This concept is not exclusive to the military, as many businesses will hire consultants and hold leadership seminars for employees. This investment aids the people with the organizational authority in becoming more effective leaders. These seminars, like some of the training material in the military, involve Group Leadership Problems, or GLPs. GLPs will be discussed in more detail in section 2.1.

Evaluation of leadership is also important in many situations. Referring again to the military, measuring leadership is another focus, to follow the leadership training. Leadership is so important to the military that people are evaluated partially based on their leadership skills. The business world should have no less emphasis on its significance. The difficult part comes in finding a suitable evaluation metric. Evaluation, like instruction, must be done in a way to mirror real-life. This is why there is the need for dynamic, real-time instruction and evaluation.

1.4 Merits of Electronic Instruction and Evaluation

One of the most effective leadership tools for instruction and evaluation is the Leadership Reaction Course (LRC), which will be explained in detail in section 2.1. The LRC, however, requires a dedicated area for a permanent setup and a significant cost to build. Along with the costs of building such a course, using the course means coordination with the course supervisor, transportation, and enough interest to make the trip worth it. Leadership seminars are also very costly for course registration, transportation, and lodging. These costs could be well into the thousands of dollars per person per course.

Electronic instruction and evaluation is far less expensive than physical courses or large seminars. The costs to build an electronic tool are minimal. Building an electronic course such as the one developed in this study takes only inexpensive software (about $30 for the program

used in this study) and some time to design the test. Professional designers would be able to do this in less than a week. Non-professionals who took the initiative to learn the simple software could design tests at the cost of a little extra time, but with monetary savings. An electronic test would be reasonably portable and would not require any special equipment to run. All that is needed are a few computers capable of running the software, which almost any business or school would have. An electronic test would also eliminate any risk associated with physical tests, if that is an issue.

Due to the brevity of this electronic testing method, it could be used as a preliminary test to the LRC in order to evaluate a team or leader. With the information from this preliminary test, an LRC session could be specifically tailored to address any weaknesses discovered. This would serve to increase the overall efficiency of training.

2. Background

2.1 Precedence for Dynamic/Real-Time Instruction

Many tasks are best taught in a dynamic environment, where physical reality and/or actual time constraints add to the value of the exercise. For example, pilots learn how to fly by actually operating an aircraft, or drivers by driving a car, rather than studying written material alone. There has been a drive, however, to find alternate means of teaching or testing these skills. The result was the development of ever more sophisticated simulators that add a great deal of realism to the training without risking lives and expensive equipment.

Flying and driving are physical tasks, simulation of which requires a great deal more realism than a primarily mental process, like leadership. A leadership simulation must stress certain principles, however, it does not need to simulate a specific situation. In this way, people

are able to learn to be general leaders. Leadership teaching tools range from small puzzles to large obstacle courses, most of which are not specialized for specific fields.

An example of a simple tool used by many organizations is a Group Leadership Problem (GLP.) These usually take the form of a situation that requires a group of people to apply good leadership and followership traits. They stress teamwork, organization and planning, resource management, creative thinking, and other characteristics desirable in leaders. Many of these problems require little or no equipment to solve; yet they allow team members and observers to learn about team dynamics, and their own strengths and weaknesses. The convenience of the GLP has led to its use by ROTC units, executive leadership courses, and a whole range of organizations looking to enhance leadership.

The U.S. military has developed a much more physical teaching tool known as a Leadership Reaction Course (LRC). Like a GLP, the LRC stresses those traits desirable in leaders. It does so, however, in a physical environment. Each obstacle is designed so that only a team that works together will be able to finish. The physical nature of the LRC puts more stress on the participants, forcing them to learn how to operate and cooperate under such stressful conditions. Both the GLP and the LRC always have observers watching the team and evaluating their dynamics, so they can be used to teach the participants how to improve.

2.2 Precedence for Leadership Evaluation

There are many positions in all segments of society where some sort of leadership potential is a prerequisite to success. To occupy such a position, a person must display a certain level of potential, in the form of existing skill. In the corporate world, most of this evaluation takes place parallel to the work being done. Those that do well in their current job, and make the right impression, are promoted to higher positions within the organization. It is also becoming increasingly common for corporations to test applicants' aptitudes in various areas during the

hiring process. A brief yet versatile leadership test would allow the company to hire applicants with the most leadership potential.

The military has formalized its leadership evaluation processes within its officer training programs. All of the military services require their ROTC cadets to go through a program of training and evaluation, including at least one period of prolonged evaluation. For example, Air Force ROTC cadets are required to attend four weeks of Field Training between their sophomore and junior years. At the camp, officers are assigned about 25 cadets each, whom they observe and evaluate. The Air Force has a specific set of traits on which all cadets are evaluated during the course of the camp. The Army uses a card with similar ratings to grade cadets' performance on the LRC. This way they are able to identify the cadets with the potential to become good leaders, and therefore, presumably, good officers, before they are placed in a critical situation.

With electronic environments, such as those created in many popular games, identification of many critical leadership skills can be evaluated or improved through complimentary instruction. This would be easier and less costly than current methods.

2.3 Description of Quake

The program used in this study was a computer game called "Quake." Quake is an action game played in the first person perspective, which means the computer monitor displays what the electronic character would be able to see, as though the character was a real person. The object of Quake is to get to the end of a level, fighting your way through various enemies using a selection of weaponry. In the course of each level, the player may need to activate certain buttons and switches to open doors or extend bridges. Quake may be played in multiplayer mode either with the players playing against each other (death match) or playing through the levels as a team. When playing as a team it is still possible to injure other players. Quake was chosen as the experimental medium because of the team play feature, potential for puzzles using

switches and triggers, and the ease of which customized levels can be created using any number of level editing programs available.

3. Methods

3.1 Definition of Terms

Directive Behavior:

"The extent to which a leader engages in one-way communication: spells out the follower(s) role and tells the follower(s) what to do, where to do it, when to do it, how to do it; and closely supervises performance.[1]"

Supportive Behavior:

"The extent to which a leader engages in two way communication, listens, provides support and encouragement, facilitates interaction, and involves the follower in decision making.[1]"

Team member:

One of the four people simultaneously participating in the test, or their corresponding electronic alter ego.

Monster:

Any unbound hostile entity within the electronic environment that is intended to interact with the team member.

Army unit:

A single monster that attacks by firing a shotgun and has a resemblance to a team member's electronic alter ego.

Fish:

A single monster that attacks by biting and has a resemblance to a piranha. This monster is the only monster that can inhabit water.

Dog:

A single monster that attacks by biting and has a resemblance to a real dog.

Enforcer:

A single monster that attacks by firing a laser gun and has a resemblance to a larger army unit.

Shambler:

A single monster that attacks by shooting a bolt of lightening from its hands or by an overhead swing of its two fists. It has a resemblance to a huge bear or sasquatch.

Gold key:

An item in the electronic environment that opens doors that require a gold key. These doors cannot be opened in any other way.

Biosuit:

An item in the electronic environment that allows a team member to swim underwater for an extended period of time without surfacing for air. This item also allows a team member to move through damaging liquids as if they were water. This item has a time limit before expiring.

Spike traps:

An entity in the electronic environment that continuously fires projectiles in a single direction. The projectiles resemble large metal spikes.

Re-spawn:

In the event that a team member died in the elctronic environment the team member would be recreated either where the team member entered the level, or slightly displaced from where they died.

3.2 Design Method

There were two types of decision-making situations that we developed. We differentiated between them based on the amount of time the leader had to make a decision. Thus we had long situations and the short situations. Each decision-making situation forced the leader to demonstrate their current capacity to lead by necessitating communication of a decision and the orderly execution of that decision. The long situations were created to simulate the leader's reaction under low pressure, while the short decisions were created to simulate the leader's reaction under high pressure. Success in either situation depended upon the leader's use of directive and supportive behaviors, which were the primary aspects that we were measuring.

We had eight situations paired up into four levels. Each level had a long situation and a short situation. The teams and their leaders did not know anything about the different types of situations. However, a brief introduction level was created to allow the team to get to know each other and introduce the team to any of the unusual uses of quake, such as floating paths of water. Finally, this introductory level gave the team members that had never played quake before the time to acquaint themselves with Quake's controls, physics, and monsters. This level was comprised of two sections from each of the testing levels. All of the levels used can be found on the included disk.

In the first level that the teams went through, the long situation was encountered first. This situation utilized twelve buttons that were distributed between three rooms. Each button altered the environment in a specific manner. By putting a team member in each of the three rooms and trying each of the buttons, the effects of each button could be determined. When certain buttons were pressed, a safe path to the next situation was available for a short time. At all other times this path was lethal. The rooms were laid out as follows:

The room that the team started in had five buttons. The second room, which was below the first room and filled with water, had six buttons and a gold key. The third room, above the first room, had spikes shooting from three walls, one button, and a door that required a gold key.

In the first room all of the buttons were located on the walls. One button turned lights on or off in the room below. Three of the buttons permanently opened secret doors. One group of three army units was behind each of two of these doors. A biosuit was behind the third door. The final button in this room temporarily opened a panel in the floor.

Beneath this panel was the second room. On the floor of this room were four buttons. One of these buttons triggered a huge wall to move all the way across the third room. Each of the other three buttons on the floor triggered one of three walls to temporarily move into a position in front of the spike traps in the third room. There were two buttons on the walls of the second room. One of these buttons turned the lights on and off in the third room. The other button activated a platform that continuously moved between the first and third room. The gold key was located near the floor in a corner. When the key was acquired one of the nearby walls moved away to reveal fish.

The platform that transported the team members up into the third room was in one of its corners. On a wall in the opposite corner was the only button in this room. This button simultaneously triggered all three of the walls that temporarily moved into a position in front of the spike traps. Next to this button was the door that required a gold key to open. Between the platform's corner and the exit door's corner were enough spike shooters to kill a team member attempting to cross, even with full health.

The second situation in the first level was a short situation. In this situation the team and its leader were deposited in a room with two shamblers that could attack from a fixed location.

There were two paths leaving this room. Down each path were a handful of army units. We determined that extended combat with two shamblers should be recognized as lethal.

In the second level, the short decision was first. This situation started the team in a long hallway with a text message on the screen telling the team to run. Behind the team was a huge moving wall that filled the entire hallway. Further down the hallway were three openings. The first opening was on the left and was inclined to a larger room. In this larger room were three hell knights. The second opening was on the right and was declined to a larger room. In this larger room were two groups of four zombies. The third opening was at the end of the hallway, and only large enough to allow one player through at a time. This opening led to a hallway that would repeatedly split in two and then join back up. This second hallway had four army units and two enforcers. No matter which opening was taken the team would meet in a hallway that would open to the next situation.

The second situation in the second level was a long situation. The team started in a huge room. Along the ceiling there were four columns of water that met towards the far end of the huge room. Also at the far end of the room was an opening into another hallway. In front of the opening were five spike traps to discourage the team members from passing through the opening too frequently.

The hallway was broken up into three segments. In the first segment of the hallway was a button on the floor. This button opened a door at the opposite end of this segment of the hallway that led to the second segment of the hallway. The door would not stay open long enough to allow the team member that triggered it to go through it. In the second segment of the hallway there was the underside of both a second level and the stairs that led up to it. Beneath the stairs was another button. This button activated a door that led into the final segment of the hallway. Again, the team member that pressed the button could not get through the door before

it closed. In the corner of the final segment of the hallway was a button that opened a door in front of the stairs. This button was also placed far enough away from the door so that the team member that pressed it the button could not get through the door before it closed.

At the top of the stairs was a trigger that opened a door that allowed entrance into the shortest of the four water columns. It also triggered three doors that were hanging in each of the longer three columns of water. Each of these three doors was hanging in one of the long stretches of water that went off in a different direction. All four doors would remain open only long enough for a team member to get to the end of one column of water. At the end of each of the hanging columns of water was a room or a series of hallways that housed an aide to completing the stage. At the end of the column that turned left was a room containing twenty-four dogs and a gold key. At the end of the column that went straight was a series of switchback hallways. There were army units and dogs in the hallways. At the end of the hallways was a switch that opened a second set of doors that allowed all of the team members to get to the floating columns of water. At the end of the column that went right was a hallway that ended in a door that required a gold key to open. Behind the door was an extremely long hallway filled with army units. At one end of the hallway was health, guarded by two shamblers. At the other end of the hallway was the level exit.

A long situation started off the third level. In this situation the team had to choose from either going in a tunnel of water or going down a hallway that was filled with monsters. There was a biosuit to allow the team to determine if the tunnel of water was too long for a team member to survive. The tunnel was actually long enough to start drowning a team member, but not long enough to kill them. Both the hallway that was filled with various monsters and the tunnel filled with water met up in a single room, which led to the next situation.

The next situation, a short situation, started when all four team members dropped down a hole found in the corner of the room that ended the first situation. The team was then pushed into a larger room with two possible exits. Both exits were in plain sight as the team was moved into the room. Once the team made it into the room the ceiling began to fall rapidly, forcing the team to evacuate the room. The two exits eventually met in another room that had the level exit.

The final level began with a short situation. The team started off in pairs in two opposite nooks on one end of a wide hallway. On the wall that joined the two nooks was a button. In the hallway were a large number of various monsters. There were also spike traps which were blocked by an interior set of walls to start. The button triggered the interior walls to be lowered permanently, allowing the spike traps to shoot across the hallway. At the end of the hallway was a platform that raised the team members into the final long situation, a huge hedge maze. Within the hedge maze were three large towers, one near the beginning, middle and end of the maze. There were stairs inside the towers that allowed the team members access to the roof of each tower. From the roof, a team member could see the paths of the maze. From any one tower the next tower was just barely visible. Jumping from the top of the tower was fatal. At the end of the maze was the exit from the test.

3.3 Data Collection

The test subjects were all volunteers from WPI that responded to an open invitation to the entire student body. To eliminate the experience variable we introduced architectures, cause and effect schemes and conditional effects that were abnormal or uncommon for Quake. All of the decision-making situations that we created were unique to this study. Thus, foreknowledge of a situation by a leader or a follower would have restored the experience variable, and furthermore added a preparedness variable. For these reasons we could only test a single person as a leader for every four that participated. During the eight-hour testing period we administered the test six

times. The four team members were all seated in the same room. Two players sat facing a wall, with their backs to the other two. Before any testing began, every person that was going to participate filled out a self-evaluation questionnaire. Next, the test administrators announced the team leader and positioned him/her at the computer reserved for the team leader. The leader was randomly selected through a drawing of straws. The players then had a few minutes to customize the control system to their liking. Once all of the team members were satisfied with their control setup they joined a cooperative game. The cooperative game allowed the team members' weapons to hurt each other.

Before starting, all players were briefed on how the testing was going to be run. They were told that the leader was there to lead the team, but did not necessarily know everything so while the leader had the final say, the team members should give input. They were told that they would see a number of puzzles, such as mazes and multiple button puzzles. All players were allowed to re-spawn, but were told that the goal was to get through the levels alive and they should try to resist the mentality of rushing through just because they could re-spawn and try again. The goal of the levels was to get through, not necessarily to kill everything and push every button, and this was stressed.

Once all of the team members had joined in the cooperative game, the test administrators started the introductory level. Some key points were pointed out during the play of the introductory level to make sure everyone grasped some of the major concepts and other items that were not in normal Quake levels. When all of the team members arrived in the room that had the exit for the level, one would go through and the actual test began.

During the test the administrators recorded the total number of deaths that the team sustained. The administrators also recorded the number of directive and supportive

behaviors/comments that the leader of each team made. These numbers were recorded by the same administrator for each level, eliminating any possible interpretation variable.

After the entire test had been administered, each member of the team was given the "team member debrief" and the team leader was given the "team leader debrief." Both of these forms can be found in appendix A.

4. Results and Analysis

4.1 Specific Leader Performance

All of the quantitative data collected can be found in Appendix C. In addition to the objective measuring tools that we used during the course of the test, a specified administrator made several subjective observations. Further subjective measures were collected through the preliminary player self-evaluation, team member evaluation of the leader, and leader self-evaluation. Each leader displayed certain personality traits that helped or hindered during the process. Some of the tone of each session also depended upon the attitude of the subordinates, however the leader's actions seemed pivotal.

A 20-year-old male, who rated his skill at a 3 out of 11, and didn't play Quake or similar games often, led session 1. The subordinates were all male and were 18, 22 and 21 years of age. They rated their skill at 9, 5, and 6 respectively. None of them often played Quake; however, the 22-year-old played 1-5 hours of similar games a week, while the 18-year-old played 20-40. One of this leader's positive points was that he seemed to defer to those with more knowledge than himself. Sometimes, however, his deferment was detrimental. The situations were built as Quake levels, but not with a quake mentality in mind. The leader sought confrontation with powerful monsters, instead of looking for a way out. Also, control of the subordinates was not very strict, which made resource management difficult. Many of the puzzles required members

of the team to accomplish tasks simultaneously. The team was running around on their own, and solved most of the puzzles accidentally. He asserted himself very little and could have benefited from a more authoritarian approach.

The leader evaluated his own performance harshly, at 3 out of 10. He commented that he felt lost most of the time, and had a lack of skill that made the game more confusing to him than the other players. His reported worst problem was a failure to keep track of all the players. As far as communication went, he felt he did well, giving himself a 7 out of 10, but based that on having listened to everyone when they had suggestions. The experience did not turn him off to leading a team again, but he did comment that he would like to have a better understanding of the situation.

The team members had a much higher opinion of the leader's performance than his opinion of himself, with an average rating of 7.3 out of 10. One of the subordinates stated that team collaboration needed to be fostered by the leader. As far as communication is concerned, the subordinates agreed with the leader, rating him at a 7 on average. They felt that his being open to suggestions was a positive trait that he displayed. Only one of the subordinates stated that they would not follow this leader again, however they did not give a reason.

A 19-year-old male who did not often play Quake or similar games led session 2. He rated his skill level at the minimum of 1 out of 11. The team members where all male, and were 19, 20, and 21 years of age. They rated their skill at 6,2 and 4 respectively. The first participant played games similar to quake 1-5 hours per week, the rest played for fewer hours. The leader initially had problems controlling the team, since there were situations where he would not want them to fire, and they would. He did, however, do well at keeping the lines of communication free of noise. He set the tone by being assertive and vocal right from the start. He also made sure that only one person would speak at a time. He made a real effort to keep the

team together and in his sight. Also, he asked players about their status a few times during the game. He had some trouble with team members running off on their own and getting themselves killed in the first and fourth levels, however most of the time he kept his team under control. One of his greatest strengths was that he thought creatively when trying to solve problems, and asked quite a few questions.

The leader assessed his own performance at a neutral 5 stating that he felt he lost control of the team most of the time. He goes on to state that his lack of knowledge of the game made it harder for him to lead because he was also trying to learn how to play. The more experienced players were not as apt to wait and look at the situation, so they would run off. The leader rated himself as a 7 on communication, saying that he listened when the team members were loud enough to be heard. He solicited information from the more experienced players. He was not discouraged from the idea of leading again, stating that he felt more comfortable as he gained experience in the game.

The team members rated the leader somewhat higher than himself at a 6.2. The main problems pointed out by the subordinates were a lack of competence in the game and a hesitation to implement ideas. They did, however, feel that he gave clear, specific instructions which aided in maintaining order. Their communication rating was, again, somewhat higher than the leader's self rating at an 8.3. All the team members agreed that the leader listened to their suggestions. One felt that there was too much talking all at once, however still rated the leader well. All the team members said they would follow this leader again, praising his communication skills and ability to think on his feet.

Session 3 was led by a 22-year-old male who rated himself at an 8 out of 11 skill level and who plays 1-5 hours of Quake or similar games. The team consisted of a 17-year-old male who plays 1-5 hours of games per week and a 20-year-old male, who plays the same. They rated

themselves at 7 and 3 respectively. The third team member did not fill out an information survey. This leader managed his team very well. He assigned tasks quickly and specifically, kept track of all team members, and sought creative solutions to all problems. In the first level, he quickly designated an orderly system, which allowed them to solve the puzzle quickly. He displayed good fire control, preventing his team from firing on dangerous monsters, thus exciting them. He kept the team in his line of sight almost all of the time, and made sure he stayed safe, while always checking the status of his team members. For example, he turned a corner to face a monster in Level 4, stepped back, and had two better-armed team members quickly step forward and take care of the problem. He was assertive, which caused the subordinates check with him before they went off on their own. He was able to control almost every aspect of the team.

The leader rated his performance high at a 7 out of 10. He stated his biggest problem was that his team members would run off unless he explicitly told them what to do. He gave himself the maximum rating of 10 on communication, stating that he felt he was willing to help and listen to the players. Finally he said he felt comfortable leading again, but would keep even tighter control.

The team members rated this leader a 5.3 on average. The main problems they saw were a lack of adaptability, and not allowing the team members to move more freely. The leader was rated a solid 7.7 on communication by the team. One of the players that rated him the highest simply stated that he seemed attentive. The one that gave the lowest score felt that the team leader was too busy to listen to his suggestions. One of the team members stated that he would not want to follow this leader again, due to a lack of sufficient foresight. The others, however, felt he did a good job and liked that he focused his attention on his team members.

The leader in Session 4 was an 18-year-old male, who reported his skill at 4 out of 11. He does not play Quake, but plays 20-40 hours a week of similar games. The team consisted of

three males, one 21, another 18, and one who did not fill out a sheet. The 21 year old rated his skill at 7, and plays 1-5 hours of first person games a week. The 18 year old also reported a skill level of 7, and plays 5-10 hours of such games each week. The dominating trait this leader displayed was a refusal to lead. Throughout the test, the team members were either off on their own, or they were moving around the level together in spurts of collective will. He made very few decisions, and actually asked the team what to do on many occasions. During a few sections one of the other team members would take charge and solve a problem. Only once did he forcefully direct his team to do something, and it was in a snap decision situation where he had to motivate the team to run out of a room. During the entire exercise, he was not in charge.

The leader rated himself at a neutral 6, and gave clues as to why he acted as he did. He explicitly stated that he hates being the leader in any situation. He did, however, say he was not as intimidated by this situation as others. He felt he had a problem getting the team to stay together and follow him. He felt that he had communicated very well, reporting a 9 out of 10, and stating that he listened and felt it helped the team get through. He did say that he would be comfortable leading again, but put forth the qualifier that he has to feel like everyone is listening to him, or he will lose focus.

The team members gave this leader a low-neutral 4.7 for an evaluation score. The most vehement complaint was that the leader did not act as one. The team saw him refuse to take charge. Every subordinate made some reference to his lack of assertiveness. Some team members felt that they were leading some of the time. They also complained of a lack of initiative and ambition. They rated the leader high on communication, however, with a score of 8.7. They felt he listened very well, but there were comments that he listened so much that it was like other people where leading. Only one team member felt they could not trust this leader

again. That dissenter did not give any input as to why. The others felt that the fact that the team was successful warranted some level of trust in his abilities as a team leader.

Session 5 was led by a 21-year-old male who plays Quake or similar games less than one hour per week. He does, however, rate his level of skill at an 8 out of 11. The team consisted of a 20 year old female, skill level 4, who plays less than an hour per week. Also a 20-year-old male, skill level 8, who plays other first person games 10-20 hours per week. Finally a 21-year-old male, skill level 11, who plays less than an hour per week.

This leader did not effectively control the team. He let them all run off at first, resulting in many losses. He did take some charge after some time in the first level, but lost it again later in the game. He did not instruct the team specifically, and lost control as they explored independently.

The leader gave himself the maximum rating of 10 as a leader. His only problem, according to him, was "dumb group members." He gave himself a neutral 6 on the communication rating, but commented that the team members did not have very good suggestions often. He did feel that he would be comfortable leading again, stating, "I am good!!"

His team saw the situation much differently, rating him at a low 3.7 on leadership. While one member did say he contributed a few good ideas, they all said that he could not plan ahead or assign tasks. Another member stated that he did not distinguish himself as a leader. All stated that he didn't understand the concept of teamwork. His communications rating was also a 3.7. The team was agreed that, while they thought he heard them, he would not answer their questions or use their suggestions in any way. This leader has the dubious distinction that none of the team members trust him enough to follow him again. They where concerned with his ability to assign tasks effectively and with concern for his team members.

The leader of the session 6 team was a 19-year-old female who rated her skill at 4 out of 11. She plays quake and similar games less than one hour per week. The team consisted of three males ages 21, 19, and 19. The three males rate their skill at 11, 5, and 7, respectively. The fist team member plays Quake and other games 10-20 hours per week. The second plays other games 10-20 hours per week. Finally the third plays other games 5-10 hours per week. This leader suffered from a lack of logical organization. She was enthusiastic, but did not systematically solve the problems. Her lack of a system caused her to dismiss the solution to a problem before she could be sure there was nothing to be gained. Her team seemed to sense the lack of direction, so they went out on their own. At certain times during the exercise other member seemed to be leading the team. She seemed to lose the ambition to keep track of her team members once she became frustrated, compounding the control problem.

She rated herself at a 6 for leadership. Her self-reported philosophy was that she tried not to be controlling and simply tried to keep an eye on everyone. She reported her main problems as being her level of competence in the game and losing track of her team members. She gave herself a 7 for communication. She tried to help the team find the secrets to the puzzles, and followed their suggestions. She ended by stating she enjoys leading and would be comfortable leading anyone.

The team went a bit lower, and rated her at a 5 for leadership. Their comments were limited, however the most common complaint was her lack of skill in game play. One subordinate faulted her with it; another stated that he felt it wasn't her fault. The other problem was that she needed to better maintain order. Her team produced an average communication score of 6.7. All team members felt that she listened to their suggestions and asked some of her own, trying to make up for her lack of knowledge. One of the players felt he could not follow

her as a leader again because she should be more familiar with the situation. The other two felt she had earned their trust, and there was no reason not to follow her again.

4.2 General Trends

One trend that stood out was that most people are not able to accurately evaluate their own abilities, leadership or otherwise. This is evident in the vast discrepancies between leader self-evaluation scores and both team member evaluations (of the leader) and evaluations by the test administrators.

The most significant trend gathered from the six sessions was that a more assertive leader was better able to keep track of their team, and was able to conduct coordinated actions more easily. The players would not remain inactive if the leader did not direct them. Instead they would go off on their own, often getting lost. A leader who kept telling their team what to do always knew where each team member was. Inexperience in the game did not seem to be a determining factor in whether or not the team stayed together. For example, the session 2 leader reported an experience level of 1, but was still assertive enough to have his team complete some of the complex puzzles. Leaders that established themselves as "in charge" were perceived as such by the players.

Also, teams where not likely to use solutions that involved not doing something. For example, in the fourth level the players could have made the choice to not lower the walls that held back a series of spike traps. However, someone pushed the button every time. There were two similar buttons that released monsters on the first level. These were also pushed in the course of trying to solve the puzzle. Most of the leaders did not have adequate control of the team to take advantage of situations requiring team restraint.

Also of note was the behavior of all of the participants while taking the test. It seemed that during the course of the test the leaders did not adjust their leadership behavior to enhance

their score, despite the information they received during the pre-test briefing as outlined in section 3.3. Nor did the other team-members change the amount they relied upon their leader for direction. The free nature of the environment allowed the team to separate. If this aspect of the environment had been anticipated we could have examined the leader's ability to coordinate exploration, as well as direct all of the members of the team in the face of an obstacle or puzzle.

It also seemed that after the first situation in the first level the entire team treated every other situation as a puzzle that required solving. In order for the test to be an effective measurement tool the briefing would need to include the basic concept of the level layout; that there are two major decision-making situations of varying length in each level would probably be sufficient. Much of the problem solving that took place during the game was due to trial and error. Data was collected by the team in a haphazard manner. For example, many of the teams figured out that they needed to activate a series of buttons to complete the first level only after several members tried to run through the spikes. This type of reckless action can also be attributed to a lack of leader control. It was difficult to establish a good leader/follower relationship quickly enough to stop the followers from going off on their own in the beginnings of the levels. Many of the team member losses can be attributed to this imprudent form of problem solving.

Finally, the "Quake Mentality" can explain several of the shortcomings of the teams. In the game a player usually plays alone, or if they do play with other people it is competitive. Very few quake levels are built to require teamwork. Due to this construction, people who have played quake or other first person games come into it with a certain mentality. It usually manifests itself in a "shoot everything, push all the buttons" attitude. The levels built for this study concentrated on a very different situation. Players were told that their mission was to reach the end of the level. A successful team leader was able to stay focused on that goal. In

every session, however, there were points where the team would stop and start fighting very powerful monsters, with inadequate weapons, when there were multiple exit routes. The existence of this "Quake Mentality" makes the test somewhat sensitive to the players' ability to "Think Outside the Box" to solve problems creatively.

4.3 MBTI Comparisons

Myers-Briggs Type Indicator test results where used to make a preliminary evaluation of a leader's personality type as an indicator of performance. Of the six leaders tested, four of the sixteen personality types were encountered. A description of each type encountered follows[3]:

INFP

Imaginative, independent HELPERS; reflective, inquisitive, empathic, loyal to ideals: more tuned to possibilities than practicalities. Having introverted FEELING as their strongest mental process, they are at their best when their inner ideals find expression in their helping of people. They value:

- Harmony in the inner life of ideas
- Harmonious work settings; working individually
- Seeing the big picture possibilities
- Creativity; curiosity, exploring
- Helping people find their potential
- Giving ample time to reflect on decisions
- Adaptability and openness
- Compassion and caring; attention to feelings
- Work that lets them express their idealism
- Gentle, respectful interactions
- An inner compass; being unique
- Showing appreciation and being appreciated
- Ideas, language and writing
- A close, loyal friend
- Perfecting what is important

INTJ

Logical, critical, decisive INOVATORS of ideas; serious, intent, very independent, concerned with organization, often stubborn. With introverted INTUITION as their strongest mental process, they are at their best when inspiration turns insights into ideas and plans for improving human knowledge and systems. They value:

- A restrained, organized outer life; a spontaneous, intuitive inner life.
- Conceptual skills, theorizing
- Planful, independent, academic learning

- Skepticism; critical analysis; objective principles
- Originality, independence of mind
- Intellectual quickness, ingenuity
- Non-emotional tough-mindedness
- Freedom from interference in projects
- Working to a plan and schedule
- Seeing complexities, hidden meanings
- Improving things by finding flaws
- Probing new possibilities; taking the long view
- Pursuing a vision; foresight; conceptualizing
- Getting insights to reframe problems

ENTJ

Intuitive, innovative ORGANIZERS; analytical, systematic, confident; push to action on new ideas and challenges. Having extroverted THINKING as their strongest mental process, ENTJ's are at their best when they can take charge and set things in logical order. They value:

- Analyzing abstract problems, complex situations
- Foresight; pursuing a vision
- Changing, organizing things to fit their vision
- Putting theory into practice, ideas into action
- Working to a plan and schedule
- Initiating, then delegating
- Efficiency; removing obstacles and confusion
- Probing new possibilities
- Holding self and others to high standards
- Having things settled and closed
- Tough-mindedness, directness, task focus
- Objective principles; fairness, justice
- Assertive, direct action
- Intellectual resourcefulness
- Driving toward broad goals along a logical path
- Designing structures and strategies
- Seeking out logical flaws

INTP

Inquisitive ANALYZERS; reflective, independent, curious; more interested in organizing ideas than situations or people. Having introverted THINKING as their strongest mental process, they are at their best when following their intellectual curiosity, analyzing complexities to find the underlying logical principles. They value:

- A reserved outer life: inner life of logical inquiry
- Pursuing interests in depth, with concentration
- Work and play that is intriguing, not routine
- Being free of emotional issues while working
- Working on problems that respond to detached intuitive analysis and theorizing
- Approaching problems by reframing the obvious

- Complex intellectual mysteries
- Being absorbed in abstract, mental work
- Freedom from organizational constraints
- Independence and non-conformance
- Intellectual quickness, ingenuity, invention
- Competence in a world of ideas
- Spontaneous learning by following curiosity and inspiration

The two most successful leaders in the study were both found to be INTJ personality types. They may have benefited form the INTJ's tendency to think a problem through before initiating action. They also solve problems systematically, a vital skill for the levels in the study. Finally, their stubbornness motivated them to assure that they, and not the team members, made the vast majority of decisions.

The representative of the ENTJ group fell in the mid range, as one of the mediocre leaders in the study. While an ENTJ and an INTJ will both attempt to solve a problem systematically, the extrovert will try to initiate all actions before assigning a subordinate to complete them. In the situation presented in the study, the leader had to manage their subordinates while they conduced a wide range of tasks. If the leader tried everything out before having a subordinate do it, they took themselves away from a simple but vital task elsewhere. The leader then had trouble finding all the pieces of a complex puzzle.

By far the leader rated worst by their team members was of the INTP personality type. This leader rated himself very high, but expressed great frustration with the team. A person of this type values competence, an asset some of the team members where lacking. Also, they do not enjoy being constrained by organizational boundaries, a trait that may have prevented this leader from forming an organization himself. Finally, they have a tendency to prefer detached analysis of problems. The immediacy of the situation comes in conflict with their preferred problem solving style.

5. Discussion

5.1 General Conclusions

The intent of the study was to evaluate leadership, using an electronic environment, based on the Situational Leadership Model. To accomplish this we attempted to quantitatively measure directive and supportive behaviors as well as general team success. Success was measured by the number of deaths within each situation encountered in the video game.

We found that it was difficult to measure general leadership in this manner. However, drawing upon our ten years of combined experience with the LRC we found a striking similarity in the team dynamics displayed in both the LRC and our test. This similarity is evidence of the great potential of our test as an instructional tool. Also, with some modifications to the manner of evaluation, or some minor adjustments to the test itself, it could be effectively used as a leadership evaluation.

5.2 Use as an Objective Measure of Leadership

In order to make an objective measure of something, it needs to be broken down into measurable components. The components of leadership are still in debate, and many of them are not even objective, let alone quantifiable. In the first prototype of our tool for leadership measurement and instruction we only examined a few aspects of leadership. The primary aspect of leading that we attempted to measure was communication skills. Every time the leader communicated with their subordinates, the communication was recorded and categorized as either directive behavior or supportive behavior. We also measured the amount of time it took the leader to direct their team through each situation. In this way we attempted to quantify the leader's ability to solve problems. Finally we tried to evaluate each leader's general success. This complicated and crucial aspect of leadership was simplified to the frequency of team

member death because the leader was responsible for the well being of his team members. The investigation of the test's viability to objectively quantify these three aspects of leadership was inconclusive. In order to acquire statistically significant data we would have required at least five times the number of people that participated.

While our sample size and diversity was insufficient to support statistical analysis of the data, we were able to see distinct differences in each team leader's current competency in leading. However, a refined or entirely different set of objectively quantifiable aspects of leadership could be examined to improve sensitivity and accuracy. We have proposed four new aspects of leadership that could work in section 5.5.

5.3 Use as a Measure of Problem Solving Ability

Again, the data are inconclusive due to an insufficient number of data points. There were two major flaws in the method used to determine the leader's problem solving ability. The first major flaw was the varying problem solving ability of the other team members. Some team leaders never directed the team towards solving the puzzle. This behavior did not influence the length of time that the team took to solve the puzzle.

The second major flaw in the method used to determine the leaders problem solving ability was the points at which the decision was determined to start and finish. For simplicity the timer started when the level started, and the first puzzle was considered solved when all of the team members were entering the second puzzle. While initially this looks to be a valid method of measuring the time spent on the problem this is not the case.

The first of the two problems with this method is that there were situations, or puzzles, that required little or no thought, and were supposed to be solved in a matter of seconds. For example, in a short situation, once the decision was made as to where the team should go, and if they should break up or not, the puzzle was over. On the other end of the coin is a long situation

like the maze. The solution of how to navigate the maze almost had to be solved long before the team got near the exit from the maze.

The second of the two problems with this method of determining when to start and stop timing the puzzle was the intermediary sections. In almost all of the levels there was a section either before, in between, after, or a combination thereof, the decision making situations. These "intermission" sections were included in the time that the team took to solve a puzzle.

To solve the first problem would require the team members to be plants that behave in a standard way and "discover" or "realize" aspects of the puzzle at specific intervals. To eliminate the second problem would require a subjective estimate as to when the leader conceptually solved the puzzle. Having the planted team members know how to best implement all of the different successful strategies that the leader may decide upon could also eliminate the second problem. This would standardize the situations' completion times from the point at which the leader organized the other team members into a solution to the problem.

5.4 Use as a Leadership/Teambuilding Instructional Tool

It was evident from our experiment that Quake, used in this way, could be a very good leadership and teambuilding instructional tool. Based on the personal experience of Bill McLaughlin and Tristan Ainsworth with the Leadership Reaction Course through ROTC, the running of teams through the custom designed Quake levels was very similar to running a team through the LRC. All the situations presented in the experiment required coordinated problem solving, and therefore leadership, for a quick solution with minimal team member loss. A debriefing similar to the one used for the LRC could be used (but was not used during our experiment) to help all team members (including the leader) improve their teamwork and leadership skills. Debriefings mainly involve discussions about what went right and wrong and any problems that were experienced in the course of the task. Aspects of leadership,

followership, and problem solving are all discussed in the debriefing, leading to increasingly more effective teams.

5.5 Limitations

This test shows great potential in its present form as an instructional tool, however has some limitations as a measure to evaluate leadership ability. First, it is still a primarily subjective test despite the use of metrics and specific measurements. Behavior must still be recorded by an observer; therefore inconsistencies will exist, especially when using different evaluators. Also, the use of a game has some disadvantages when it comes to using it as an evaluation. A game is meant to be enjoyable, which is desirable in a teaching tool, but if a formal evaluation were based on the results of these exercises it would be difficult for those tested to take the test seriously. Subjects being evaluated might frequently object to the results of this test. The consequences of bad decision-making are not as high in the game as they would be in real life. During the experiment some leaders sent their subordinates out on suicide raids or used them as human shields. Actions such as these would condemn a leader to failure, however people took on the status of a renewable resource during the game. The use of a rewards system for successful completion of levels could be used to counter disconcern on the part of the leader and the team. Finally, while this test eliminated the inherent required cultural knowledge of many standardized tests, it introduced a certain amount of required technical knowledge.

5.6 Possible Extensions

Quake, as used in this study, could be used as a tool for evaluation despite its shortcomings. Because the electronic environment is simulating a location and the basic resources and obstacles at that location, the ability to apply this type of test to all aspects of leadership, objective or subjective, is possible. By having the team members play a specific role

at a set point in the game, a leader's ability to handle certain personality types or other fine aspects of the leader's interpersonal skills could be assessed. Having a team member supply specific information at a pre-determined point in the test would allow a very sensitive measurement of the leader's ability to solve problems or otherwise mentally perform. In this sense, the wide range of customization of the test provides the administrator with nearly infinite flexibility.

Since it could be used in a manner similar to an LRC, it could be used to evaluate just as Army ROTC uses the LRC to evaluate various attributes of its cadets, such as initiative, judgment, interpersonal skills, communication, and planning and decision making, among several others. It could also be tailored to focus on any one or two specific traits or skills. See the attached copy of CDT CMD FORM 156-4A-R in appendix B for more detailed information.

The following definitions of terms, which are based loosely on the Army evaluation form, could be applied in the use of Quake (as used in the manner of this study) as an evaluation tool:

Decision Making – Decision-making is measured by the leader's reaction to a series of situations which could be evaluated in a yes or no manner. Two types of decisions are assessed. The first type is the ability to make a decision under the stress of time. Situations that test this decision type are created by supplying two options and some form of pressure (imminent death) that forces a quick decision. The second decision type measured is the ability to make an informed decision based on information that can be gathered. Situations that test this aspect are created by making a simple puzzle that requires the gathering of information to solve. Four situations for each aspect of decision-making are made. If the leader makes the right type of decision, one point is added to the total score for that decision type. Therefore, each time a leader makes a quick decision when there is an immediate threat, he or she gets an additional

point for the quick decision type. After all of the situations are completed, a score from 0 to 4 for each type of decision is assigned to the leader's decision-making ability.

Communication – Communication, the method by which information is passed between players, is in the case of this study measured by verbal statements, orders, or questions. Measure the number of statements the leader makes, then the number of repetitions of that same instruction that need to be made for the subordinate to comply. The hypothesis is that leaders who communicate more effectively will not have to repeat themselves. On the other hand, a leader who does not communicate enough will not solve the problem.

Subordinate Management – There are three management types that come into play in this study. First is specialization – the leader pools certain capabilities in certain members of the unit. Next is generalization – the leader equips all members fairly and evenly. Finally is disconcern – the leader ignores the subordinates, leaving them to their own discretion.

Execution – Execution is the ability to succeed with the decision that has been made. The number of players that survive each of the eight situations measures execution. A score of 0 means that no players survive the situation, a score of 1 means that one of the players survives the situation, and so on.

When used as an evaluation tool, Quake could also be used in a long-term study. In one way, it could be used to measure the progress of an individual or team in building leadership and team skills. An example of this would be to run a team of ROTC students through the game at the beginning of their first year, then again near the end of the ROTC program, to see how they have progressed. This could evaluate the students' progress, or the effectiveness of the leadership training they have received.

There are several games that are very similar to Quake and might actually be better suited to this style of leadership instruction and evaluation. Counter-Strike is currently a very popular

game in which two teams go head to head as a terrorist force and a counter-terrorist force, where the goal (for the Counter-Terrorist force) is either to rescue hostages, escort a VIP, or defuse a bomb. The goal for the Terrorist force would be to guard the hostages, kill the VIP, or plant the bomb. Either side may also win by completely eliminating the other team. By the simple nature of how team-based the game is, along with very good graphics, this game would be very well suited. It may also offer the option of having the leader be a spectator rather than a participating member of the team.

A future long-term study could focus on the hypothesis that simply by playing first-person team games, such as Counter-Strike, people are gaining leadership experience. This would in a way correlate to a chance finding at pilot training that playing certain simulation games actually had improved flying students aptitude in pilot training.

Lastly, this type of study could be used to evaluate the leadership characteristics of a specified group of people by selecting the test subjects rather than using random sampling. This could, for example, be applied to studying leadership qualities in different personality types. The MBTI could be used to identify subjects' personality types for selection, and the results of the study could be compared with the characteristics laid out by the MBTI data.

6. Conclusions

The electronic test that we developed could still be tailored for use as an objective measure of aspects of leadership. First, the levels we created for the study were rather large and complicated. To reduce evaluation time the levels could be made more simple and direct. The levels also needed to be more balanced between the resources available to the players, such as health and weapons, and the dangers presented to the players, such as traps and monsters. This would reduce the lethality of the levels and allow a better measure of success. Team members

could also be selected according to certain skills or traits, such as specific MBTI personality types, or planted to perform in a specific manner at pre-determined points of the game.

Since we began this study, other games have become available that are even more suited for a study of this nature. The games are based solely on team play and can be manipulated at least as well as Quake. Some even offer the option of being a non-participating spectator.

This experiment was a pilot study for the use of video games as a leadership teaching and evaluation tool. The intent of the study was to objectively measure leadership skills. To this end we selected certain traits or behaviors that could be identified with leadership skills and could be objectively measured. The time it took to solve the puzzles, and the number of deaths, were expected to decrease as the number of useful communications increased. Although we could measure aspects of communication, we could not establish a trend for leadership ability. In the course of this study, we learned that video games can be used to instruct leadership in a similar manner to the Leadership Reaction Course, which the military and several other leadership training organization use. Video games could be used in the same manner as Army ROTC uses the LRC to evaluate cadets' leadership and teambuilding skills, based on criteria laid out in the form found in appendix B.

7. References

[1] Sellers, Capt Hardy and Capt Robert Shindel, eds. *Air Force Leadership Studies*. U.S. Government Printing Office.

[2] McElheny, Victor K., Insisting on the impossible : the life of Edwin Land, Reading, Mass.: Perseus Books, c1998.

[3] Lawrence, Gordon D., Ph.D. *Descriptions of the Sixteen Types.* Gainesville, FL: Center for Applications of Psychological Type, Inc.,1995.

Appendix A: Data Collection Forms

Name: #

Player Info #

Age:

Sex:

How would you rate your skill at Quake? What's Quake? 1 2 3 4 5 6 7 8 9 10 11 Can't Touch This

About how many hours of Quake (on average) do you play per week?

a. <1
b. 1-5

c. 5-10

d. 10-20

e. 20-40

f. >40

About how many hours of other first-person games (on average) do you play per week?

a. <1

b. 1-5

c. 5-10

d. 10-20

e. 20-40

f. >40

Leader Name: #

Data Sheet #

Success:

Directive Behavior

Supportive Behavior

Indecision/Frustration

Berating

Follower Comments:

Leader Name: #

Debrief – Leader #

How well do you feel you led the team? Very Poorly 1 2 3 4 5 6 7 8 9 10 Extremely well
explain:

What problems did you have as the leader?

How well do you feel you listened to team members? Poorly 1 2 3 4 5 6 7 8 9 10 Very Well

explain: (for example, did you listen to/implement their suggestions, give help when asked, etc.)

Would you be comfortable leading a team again (not necessarily in the same situation)? Y N
explain:

Leader Name: #

Debrief – Team Member #

How well do you feel the leader led the team? Very Poorly 1 2 3 4 5 6 7 8 9 10 Extremely well
explain:

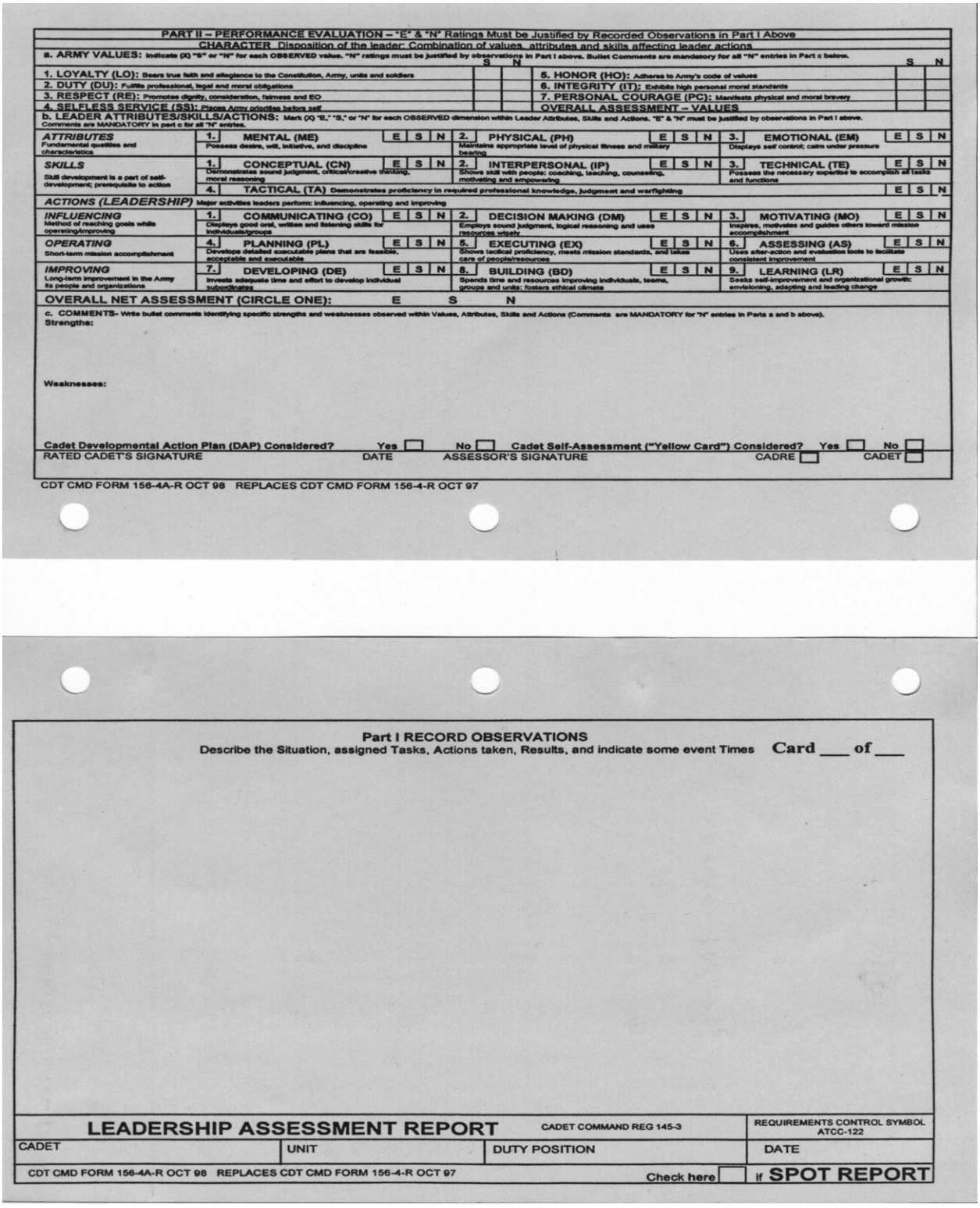
What problems do you feel the leader had?

How well do you feel the leader listened to the team members? Very Well 1 2 3 4 5 6 7 8 9 10 Poorly

explain: (for example, did the leader listen to/implement your suggestions, give help when asked, etc.)

Would you be comfortable following the same leader again (not necessarily in the same situation)? Y N
explain:

Appendix B: CDT CMD FORM 156-4A-R OCT 98



PART II – PERFORMANCE EVALUATION – "E" & "N" Ratings Must be Justified by Recorded Observations in Part I Above

CHARACTER Disposition of the leader: Combination of values, attributes and skills affecting leader actions

a. ARMY VALUES: Indicate (X) "S" or "N" for each OBSERVED value. "N" ratings must be justified by observations in Part I above. Bullet Comments are mandatory for all "N" entries in Part c below.

	S	N		S	N
1. LOYALTY (LO): Bears true faith and allegiance to the Constitution, Army, units and soldiers			5. HONOR (HO): Adheres to Army's code of values		
2. DUTY (DU): Fulfills professional, legal and moral obligations			6. INTEGRITY (IT): Exhibits high personal moral standards		
3. RESPECT (RE): Promotes dignity, consideration, fairness and EO			7. PERSONAL COURAGE (PC): Manifests physical and moral bravery		
4. SELFLESS SERVICE (SS): Places Army priorities before self			OVERALL ASSESSMENT – VALUES		

b. LEADER ATTRIBUTES/SKILLS/ACTIONS: Mark (X) "E," "S," or "N" for each OBSERVED dimension within Leader Attributes, Skills and Actions. "E" & "N" must be justified by observations in Part I above. Comments are MANDATORY in part c for all "N" entries.

ATTRIBUTES Fundamental qualities and characteristics	1. MENTAL (ME) E S N Possess desire, will, initiative, and discipline	2. PHYSICAL (PH) E S N Maintains appropriate level of physical fitness and military bearing	3. EMOTIONAL (EM) E S N Displays self control; calm under pressure
SKILLS Skill development is a part of self-development; prerequisite to action	1. CONCEPTUAL (CN) E S N Demonstrates sound judgment, critical/creative thinking, moral reasoning	2. INTERPERSONAL (IP) E S N Shows skill with people: coaching, teaching, counseling, motivating and empowering	3. TECHNICAL (TE) E S N Possess the necessary expertise to accomplish all tasks and functions
	4. TACTICAL (TA) Demonstrates proficiency in required professional knowledge, judgment and warfighting E S N		
ACTIONS (LEADERSHIP) Major activities leaders perform: influencing, operating and improving			
INFLUENCING Method of reaching goals while operating/improving	1. COMMUNICATING (CO) E S N Displays good oral, written and listening skills for individuals/groups	2. DECISION MAKING (DM) E S N Employs sound judgment, logical reasoning and uses resources wisely	3. MOTIVATING (MO) E S N Inspires, motivates and guides others toward mission accomplishment
OPERATING Short-term mission accomplishment	4. PLANNING (PL) E S N Develops detailed executable plans that are feasible, acceptable and executable	5. EXECUTING (EX) E S N Shows tactical proficiency, meets mission standards, and takes care of people/resources	6. ASSESSING (AS) E S N Uses after-action and evaluation tools to facilitate consistent improvement
IMPROVING Long-term improvement in the Army its people and organizations	7. DEVELOPING (DE) E S N Invests adequate time and effort to develop individual subordinates	8. BUILDING (BD) E S N Spends time and resources improving individuals, teams, groups and units; fosters ethical climate	9. LEARNING (LR) E S N Seeks self-improvement and organizational growth: envisioning, adapting and leading change

OVERALL NET ASSESSMENT (CIRCLE ONE): E S N

c. COMMENTS- Write bullet comments identifying specific strengths and weaknesses observed within Values, Attributes, Skills and Actions (Comments are MANDATORY for "N" entries in Parts a and b above).

Strengths:

Weaknesses:

Cadet Developmental Action Plan (DAP) Considered? Yes ☐ No ☐ Cadet Self-Assessment ("Yellow Card") Considered? Yes ☐ No ☐

RATED CADET'S SIGNATURE DATE ASSESSOR'S SIGNATURE CADRE ☐ CADET ☐

CDT CMD FORM 156-4A-R OCT 98 REPLACES CDT CMD FORM 156-4-R OCT 97

Part I RECORD OBSERVATIONS

Describe the Situation, assigned Tasks, Actions taken, Results, and indicate some event Times Card ___ of ___

LEADERSHIP ASSESSMENT REPORT CADET COMMAND REG 145-3 REQUIREMENTS CONTROL SYMBOL ATCC-122

CADET	UNIT	DUTY POSITION	DATE

CDT CMD FORM 156-4A-R OCT 98 REPLACES CDT CMD FORM 156-4-R OCT 97 Check here ☐ if SPOT REPORT

Appendix C: Summary of Data

Group 1	Leader Type:	I-23 N-15 F-13 P-1			
	Lev 1	Lev 2	Lev 3	Lev 4	Total
Directive	16	No Data	10	12	38
Supportive	12	No Data	3	2	17
Indecision/Frustration	1	No Data	4	5	10
Berating	0	No Data	0	0	0
Total	29	0	17	19	65
Success(Deaths)	15	No Data	14	5	34

Player Info	Skill	Quake	Other	Sex	Age
Leader (#1)	3	<1	<1	M	20
Player (#2)	9	<1	20-40	M	18
Player (#3)	5	<1	1 to 5	M	22
Player (#4)	6	<1	<1	M	21

Evaluation	Leadership	Listening	Again
Leader Self	3	7	Y
Player (#2)	9	9	Y
Player (#3)	6	5	N
Player (#4)	7	8	Y

Level	Section	Time
Intro	Whole Level	No Data
IQP1	Whole Level	No Data
	1st Situation	No Data
	2nd Situation	No Data
IQP2	Whole Level	12.5
	1st Situation	1
	2nd Situation	11.5
IQP3	Whole Level	1.5
	1st Situation	1.25
	2nd Situation	0.25
IQP4	Whole Level	13
	1st Situation	3
	2nd Situation	See Below
	Total	10
	Before Map	7
	After Map	3
Time after level start at which leader received map		10
*All times are given in decimal minutes		

Group 2	Leader Type I-3 N-33 T-27 J-27				
	Lev 1	Lev 2	Lev 3	Lev 4	Total
Directive	14	9	3	17	43
Supportive	3	0	0	0	3
Indecision/Frustration	1	0	0	0	1
Berating	1	0	0	0	1
Total	19	9	3	17	48
Success(Deaths)	13	6	3	10	32

Player Info	Skill	Quake	Other	Sex	Age
Leader (#5)	1	<1	<1	M	19
Player (#6)	6	<1	1 to 5	M	19
Player (#7)	2	<1	<1	M	20
Player (#8)	4	<1	<1	M	21

Evaluation	Leadership	Listening	Again
Leader Self	5	7	Y
Player (#6)	5	9	Y
Player (#7)	6.5	7	Y
Player (#8)	7	9	Y

Level	Section	Time
Intro	Whole Level	12.25
IQP1	Whole Level	10.75
	1st Situation	8.75
	2nd Situation	2
IQP2	Whole Level	14.5
	1st Situation	1.5
	2nd Situation	13
IQP3	Whole Level	2.25
	1st Situation	2
	2nd Situation	0.25
IQP4	Whole Level	20
	1st Situation	3.5
	2nd Situation	See Below
	Total	16.5
	Before Map	13
	After Map	3.5
Time after level start at which leader received map		16.5
*All times are given in decimal minutes		

Group 3	Leader Type: I-39 N-17 T-17 J-13				
	Lev 1	Lev 2	Lev 3	Lev 4	Total
Directive	22	No Data	3	20	45
Supportive	2	No Data	1	0	3
Indecision/Frustration	1	No Data	2	0	3
Berating	0	No Data	0	0	0
Total	25	0	6	20	51
Success(Deaths)	14	No Data	0	2	16

Player Info	Skill	Quake	Other	Sex	Age
Leader (#9)	No Data	No Data	No Data	No Data	No Data
Player (#10)	7	1 to 5	1 to 5	M	17
Player (#11)	3	<1	1 to 5	M	20
Player (#12)	No Data	No Data	No Data	No Data	No Data

Evaluation	Leadership	Listening	Again
Leader Self	7	10	Y
Player (#10)	6	9	Y
Player (#11)	7	8	N
Player (#12)	3	6	Y

Level	Section	Time
Intro	Whole Level	11.5
IQP1	Whole Level	13
	1st Situation	12
	2nd Situation	1
IQP2	Whole Level	No Data
	1st Situation	No Data
	2nd Situation	No Data
IQP3	Whole Level	1.75
	1st Situation	1.5
	2nd Situation	0.25
IQP4	Whole Level	19.5
	1st Situation	5.25
	2nd Situation	See Below
	Total	14.25
	Before Map	10.25
	After Map	4
Time after level start at which leader received map		15.5
*All times are given in decimal minutes		

Group 4	Leader Type:				
	Lev 1	Lev 2	Lev 3	Lev 4	Total
Directive	4	No Data	3	1	8
Supportive	0	No Data	0	0	0
Indecision/Frustration	4	No Data	0	0	4
Berating	0	No Data	0	0	0
Total	8	0	3	1	12
Success(Deaths)	13	No Data	0	6	19

Player Info	Skill	Quake	Other	Sex	Age
Leader (#13)	4	<1	20-40	M	18
Player (#14)	7	<1	1 to 5	M	21
Player (#15)	7	<1	5 to 10	M	18
Player (#16)	No Data	No Data	No Data	No Data	No Data

Evaluation	Leadership	Listening	Again
Leader Self	6	9	Y
Player (#14)	4	10	Y
Player (#15)	7	9	Y
Player (#16)	3	7	N

Level	Section	Time
Intro	Whole Level	7.75
IQP1	Whole Level	15.25
	1st Situation	12.5
	2nd Situation	2.75
IQP2	Whole Level	No Data
	1st Situation	No Data
	2nd Situation	No Data
IQP3	Whole Level	1.75
	1st Situation	1.25
	2nd Situation	0.5
IQP4	Whole Level	9.5
	1st Situation	2.25
	2nd Situation	See Below
	Total	7.25
	Before Map	No Map
	After Map	No Map
Time after level start at which leader received map		No Map
*All times are given in decimal minutes		

Group 5	Leader Type: I-31 N-39 T-29 P-43				
	Lev 1	Lev 2	Lev 3	Lev 4	Total
Directive	9	No Data	1	6	16
Supportive	0	No Data	0	0	0
Indecision/Frustration	1	No Data	0	0	1
Berating	1	No Data	0	0	1
Total	11	0	1	6	18
Success(Deaths)	12	No Data	4	10	26

Player Info	Skill	Quake	Other	Sex	Age
Leader (#17)	8	<1	<1	M	21
Player (#18)	4	<1	<1	F	20
Player (#19)	8	<1	10 to 20	M	20
Player (#20)	11	<1	<1	M	21

Evaluation	Leadership	Listening	Again
Leader Self	10	6	Y
Player (#18)	6	3	N
Player (#19)	2	5	N
Player (#20)	3	3	N

Level	Section	Time
Intro	Whole Level	7.25
IQP1	Whole Level	14
	1st Situation	11.5
	2nd Situation	2.5
IQP2	Whole Level	No Data
	1st Situation	No Data
	2nd Situation	No Data
IQP3	Whole Level	2.25
	1st Situation	1.5
	2nd Situation	0.75
IQP4	Whole Level	20
	1st Situation	2.25
	2nd Situation	See Below
	Total	17.75
	Before Map	17.25
	After Map	0.5
Time after level start at which leader received map		19.5
*All times are given in decimal minutes		

Group 6	Leader Type: E-31 N-41 T-13 J-7				
	Lev 1	Lev 2	Lev 3	Lev 4	Total
Directive	7	No Data	6	0	13
Supportive	1	No Data	0	0	1
Indecision/Frustration	8	No Data	2	0	10
Berating	0	No Data	0	0	0
Total	16	0	8	0	24
Success(Deaths)	21	No Data	12	0	33

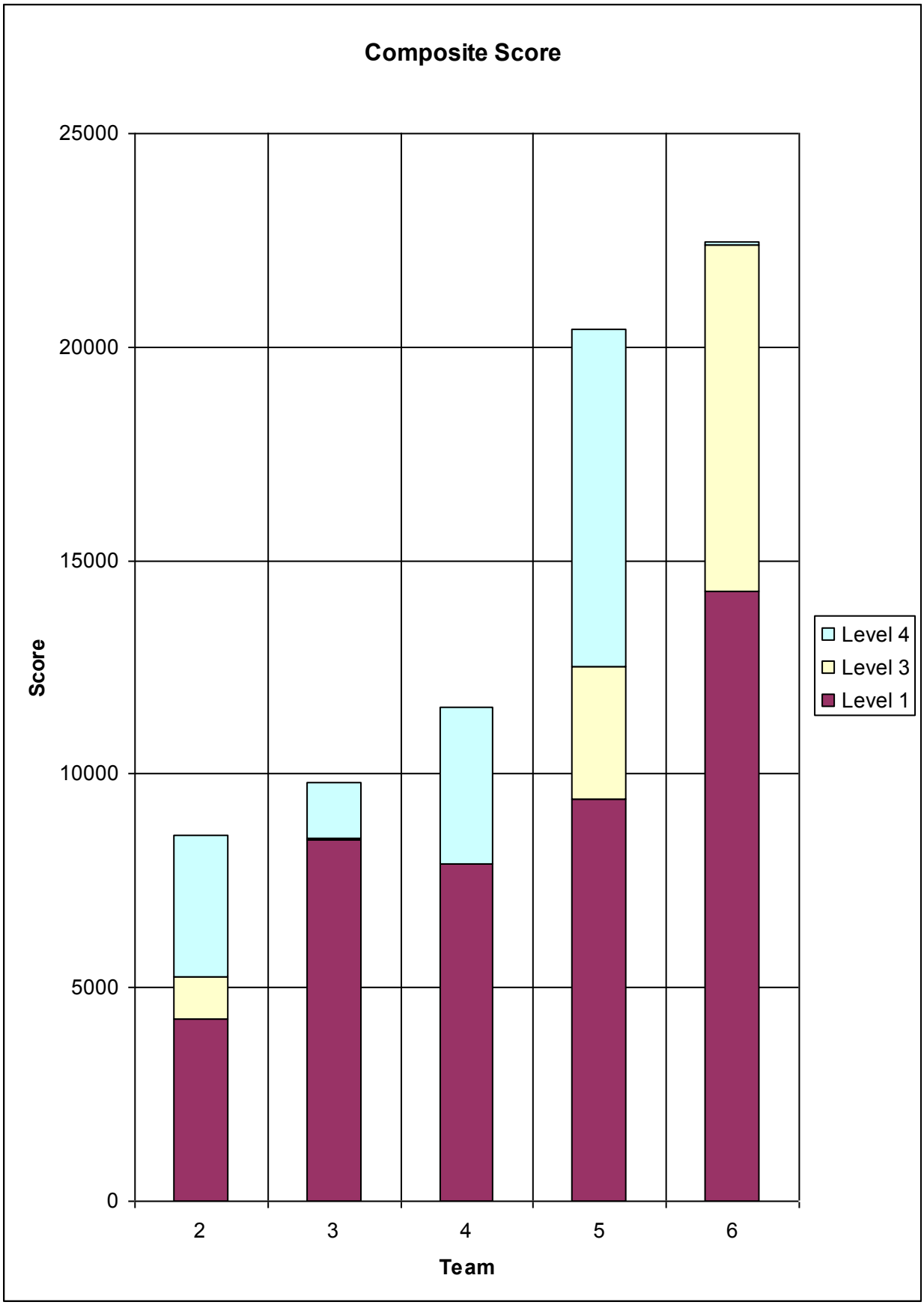
Player Info	Skill	Quake	Other	Sex	Age
Leader (#21)	4	<1	<1	F	19
Player (#22)	11	10 to 20	10 to 20	M	21
Player (#23)	5	<1	10 to 20	M	19
Player (#24)	7	<1	5 to 10	M	19

Evaluation	Leadership	Listening	Again
Leader Self	6	7	Y
Player (#22)	2	6	N
Player (#23)	6	6	Y
Player (#24)	7	8	Y

Level	Section	Time
Intro	Whole Level	No Data
IQP1	Whole Level	13.75
	1st Situation	12
	2nd Situation	1.75
IQP2	Whole Level	No Data
	1st Situation	No Data
	2nd Situation	No Data
IQP3	Whole Level	1
	1st Situation	No Data
	2nd Situation	No Data
IQP4	Whole Level	12
	1st Situation	4
	2nd Situation	See Below
	Total	8
	Before Map	No Map
	After Map	No Map
Time after level start at which leader received map		No Map
*All times are given in decimal minutes		

	Level 1	Level 3	Level 4	Total
Team 2	Average Skill: 3.25			
Deaths	13	3	10	26
Time	10.75	2.25	20	33
Life=100	1310.75	302.25	1020	2633
Composite	4259.938	982.3125	3315	8557.25
Team 3	Average Skill: 6			
Deaths	14	0	2	16
Time	13	1.75	19.5	34.25
Life=100	1413	1.75	219.5	1634.25
Composite	8478	10.5	1317	9805.5
Team 4	Average Skill: 6			
Deaths	13	0	6	19
Time	15.25	1.75	9.5	26.5
Life=100	1315.25	1.75	609.5	1926.5
Composite	7891.5	10.5	3657	11559
Team 5	Average Skill: 7.75			
Deaths	12	4	10	26
Time	14	2.25	20	36.25
Life=100	1214	402.25	1020	2636.25
Composite	9408.5	3117.438	7905	20430.94
Team 6	Average Skill: 6.75			
Deaths	21	12	0	33
Time	13.75	1	12	26.75
Life=100	2113.75	1201	12	3326.75
Composite	14267.81	8106.75	81	22455.56

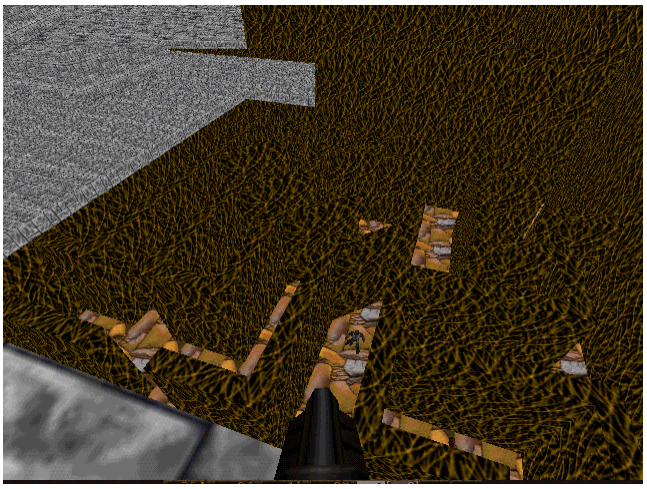
To obtain a composite score for this leadership test, the number of deaths, skill level, and time taken to complete each level was taken into account. During the test, it was stressed that each team member's life was more valuable than any amount of time. Thus, each death was given a value of one hundred points. Each minute counted as one point. Higher skill levels are assumed to naturally produce fewer deaths. To normalize the scores in regard to skill, the total points from time and deaths were multiplied by average skill level. Lower scores are viewed as being indicative of better performance. A graphical representation of the composite scores is included on the following page.


Composite Score
25000
20000
15000
10000
5000
0
Score
2
3
4
5
6
Team
Level 4
Level 3
Level 1

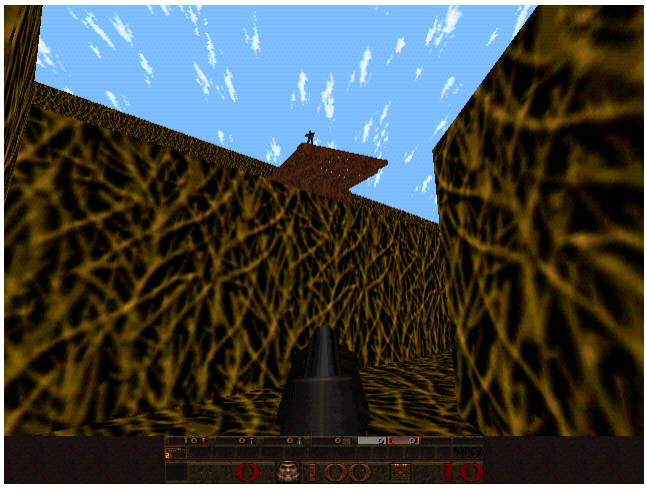
Appendix D: Selected Screen Shots

IQP1 – First room (with twelve buttons)

IQP1 – Third room (spike room, facing exit corner)



Intro – Looking down on the maze



IQP4 – Looking up from the maze at a tower

Appendix E: Contents of Included Disk

File Name	Size	Description
Contents.txt	3 KB	Contents of the CD as well as some documentation on the levels
IQPfinal.doc	3,037 KB	Final paper
IQP results.xls	45 KB	Spreadsheets and chart of data collected
CD Contents.xls	17 KB	This list
glq8_27.zip	271 KB	Freeware version of Glide Quake
wq100.zip	337 KB	Shareware version of WinQuake
qoole250.exe	1,679 KB	Shareware version of Qoole
intro.bsp	886 KB	Compiled intro level
iqp1.bsp	782 KB	Compiled level IQP1
iqp2.bsp	1,197 KB	Compiled level IQP2
iqp3.bsp	249 KB	Compiled level IQP3
iqp4.bsp	1,573 KB	Compiled level IQP4
iqpend.bsp	84 KB	Compiled level IQPend - used at the end of IQP4 as an ending point
mazemap.bmp	901 KB	Map of the hedge maze in IQP4
intro.qle	241 KB	Qoole save file for intro level
iqp1.qle	315 KB	Qoole save file for level IQP1
iqp2.qle	282 KB	Qoole save file for level IQP2
iqp3.qle	146 KB	Qoole save file for level IQP3
iqp4.qle	460 KB	Qoole save file for level IQP4
iqpend.qle	46 KB	Qoole save file for level IQPend
button room.bmp	1,036 KB	Button Room (from IQP1) screen shot
intro maze.bmp	1,036 KB	Maze in intro level screen shot
intro maze2.bmp	1,036 KB	Maze in intro level screen shot
maze tower.bmp	1,036 KB	Maze in IQP4 (hedge maze) screen shot - looking up at tower
spike room.bmp	1,036 KB	Spike Room (from IQP1) screen shot - facing the exit door corner