Evaluating the Emotional Effectiveness of Visual Game Narrative Techniques and Emotional Feedback using the eMotiv Headset

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9/22/2009

A Proposal Presented for a
Masters of Interactive Technology
SMU Guildhall

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Introduction

A large part of what creates a compelling narrative lies in the interaction between characters. In the current incarnation of interactive media, this interaction happens at an emotional distance, with the characters in game acting at you, rather than reacting to the player's feelings about a situation. When a character does react to the player's actions, the character's reactions to the player are preprogrammed and predictable, and happen regardless of what the player is actually feeling and thinking. Because of this, the interaction between player and non-player character (NPC) frequently ends up feeling hollow.

Emotional feedback recently emerged as a topic of interest in games and consists of a system in which programs gather information about the user's mental state, and then use this to modify the actions and reactions of the program. There are several ways to gather information about a player's emotional state, such as Electroencephalography and other Brain Computer Interfaces (BCI), galvanic skin sensors and cameras with facial recognition software, all of these options use currently existing technology. As these technologies become cheaper, and easier to produce, devices that monitor the user's emotional state are becoming commercially viable in the mass-market. All of these advances in technology mean nothing unless there are ways in which to use them, and intelligent approaches to implementing them. Emotional Feedback has a wide range of applications, but this project focuses on the eMotiv Headset, a portable and inexpensive electroencephalograph (EEG), and its use in the construction of effective narratives.

The eMotiv Headset allows for an easily accessible and cost-effective method of information gathering between the player and the program. By monitoring brain waves in certain parts of the brain, the eMotiv Headset determines the emotional state of the player. Games can use this information to create emotionally charged and reactive situations for the player, by having the game's systems and characters react in a realistic or surprising way. This constant dialog between the game's systems and the player has the potential to greatly increase player involvement and engagement in a game. While this new level of interaction has the potential to completely change the ways in which players interact with the games they play, this technology also brings new challenges to the forefront. By changing the way in which the player interacts with the narrative, it stands to reason that the way in which the game delivers the narrative must also change to meet the growing realm of potential player interaction. Narrative techniques that were effective in the past may no longer yield the same results in the face of a highly personalized game experience, where emotions fuel the interactions between the player and the game.

The emergence of the eMotiv Headset signals the start of a new trend in gaming. The gap in human-computer interaction has started to close. By giving the user the ability to turn their emotional states into data that can be read by computers, games have just acquired a powerful tool in creating characters and interactions that can closely emulate empathy and realistic human interaction.

Figure 1: The eMotiv Headset reads emotional states. Taken from: http://eMotiv.com/corporate/1_0/1_1.htm

This technology is of significant interest to the games industry, because the eMotiv Headset has the potential to be so much more than an expensive game controller. This tool allows developers to create something truly novel. The questions asked now will help shape the perception of the technology for years to come.

However, despite all the benefits, there are drawbacks to the technology as well. Keeping up with the costs to develop additional content to allow for a truly believable experience stands as the greatest challenge to the technology's viability. Before embracing the technology fully, the games industry must address a whole host of concerns and questions. The breadth of topics available for study is staggering and ranges from the long-term malleability of the player's emotional states, to finding specific development techniques that allow companies to create enough content for the Headset to be useful, while still keeping costs low enough for their own business models to remain profitable.

This study asks the question: "Which visual storytelling techniques are most effective at eliciting emotional responses?" This is relevant to understanding how effective certain narrative techniques (such as gesture, proximity to the player and specific (as opposed to implicit) imagery, and the system's reaction to player's emotional state) are in relation to one another.

Throughout the conversation the eMotiv Headset takes multiple data readings. In the control group version of the test, the headset simply records data, and the conversation follows the baseline path through the gameplay experience. In the test group, the eMotiv Headset actually takes the data and plugs it back into the system. In this case, at critical points during the test the game takes the eMotiv Headset's data and makes a determination on which emotional response the player has. This data pushes the conversation down one of the branches of the game system. Different emotional responses unlock a different NPC reaction, which changes the overall experience for the player. Ideally, this leads to player-NPC interactions that cause the player to feel like the NPC is a real person that believably responds to the player's emotions.

By placing users in a situation where they experience narration by an NPC and flashbacks within the same scene, this study not only allows for the collection of data through the eMotiv Headset, but creates a scenario in which the headset plays a critical part in maintaining player engagement. The game system accomplishes this through an evolving situation based upon the player's emotional reactions to the game's content.

This project aims to prove the viability of the eMotiv Headset, as a device for gathering information on the player's emotional state by examining changes in test subject's reaction to the game experience over time, and weighing them against the corresponding stimuli. In addition to this, the project examines what effect an interactive emotional feedback system has on the player's involuntary responses to the material. There are several questions that this project addresses:

Primary Questions:

- Which visual storytelling techniques are most effective at eliciting specific emotional responses to further enhance an interactive experience using emotional feedback?

Secondary Questions:

- Do players react differently in an interactive emotional feedback system, as opposed to a pre-determined experience?
- Is there a correlation between demographic and reaction to the NPC?
- What challenges does the research present for future developers and researchers of emotional feedback systems, and what can be done to adequately meet these challenges?

The project hypothesizes that flashbacks are the most effective means for eliciting a reaction from the player. Additionally, the project hypothesizes that players react very differently in an interactive system, and that a strong correlation exists between emotional reactions and the demographic of the test subject. Simply put, people of similar age and life experiences react the same way, when exposed to a specific situation.

Field Review

The field of emotional feedback has existed for less than two years, but the idea of a Brain Computer Interface (BCI) has existed since the 1970's. The earliest incarnation of a BCI consisted of teaching a monkey to control the rate at which neurons fired by using a system of rewards and punishments. However, the greatest advances in BCI technology came in the mid-1990's. One of the most notable successes arrived in 1999 when scientists at the University of California, Berkley managed to interpret and reconstruct movies shown to cats who had a BCI implanted in their brain. This study showed that technology has the ability to receive, interpret, and reconstruct brain waves into coherent images.

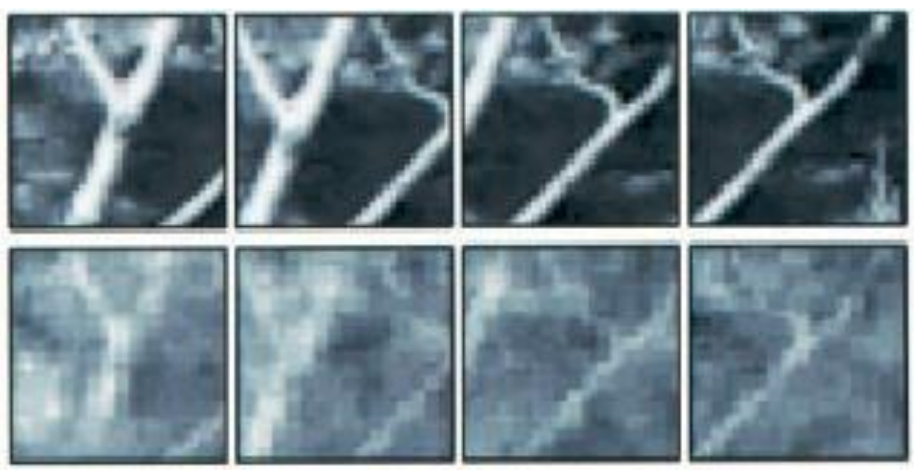


Figure 2: Images from a BCI recording. Taken from: http://en.wikipedia.org/wiki/Brain-computer_interface

Throughout the last decade scientists have conducted numerous studies into BCIs over a wide variety of subjects, from remotely controlling a robot arm to restoring hearing and sight to those who have lost it throughout the course of their life.

Three types of BCI have developed over the years: invasive BCIs, partially-invasive BCIs, and non-invasive BCIs. Invasive BCIs are inserted directly into the grey matter of the brain in order to acquire a signal. Many of the experiments involving restoring lost senses have required an invasive BCI, due to the high quality of the signal. However, Invasive BCIs have the possibility of scarring the brain tissue, which is a significant drawback of the technology.

Figure 3: Jens Neumann uses an Invasive BCI in order to see. Taken from: http://en.wikipedia.org/wiki/Brain-computer_interface

Partially-Invasive BCIs rest outside the grey matter, but inside the skull. They function similarly to an invasive BCI, but the signal strength is somewhat reduced. However, partially-invasive BCIs still allow for a strong signal without the potential for scarring the brain tissue.

Non-invasive BCIs do not require implants of any kind. Many non-invasive BCIs involve the use of Electroencephalography (EEG) Magnetoencephalography (MEG) or Magnetic Resonance Imaging (MRI). While MEG and MRI are prohibitively expensive for commercial distribution, the eMotiv Headset uses EEG to collect data, and is available for commercial purchase as a game controller. The signal quality of non-invasive BCIs is by far the worst of the three, due to interference from the skull, but still allows for the collection of a wide variety of information, such as emotional states, facial twitches and even allows the user to issue simple commands such as “push” or “jump”. Non-invasive BCIs also require the largest amount of training time of all three BCIs.

Emotional State Estimation Using EEG

The most relevant area of study to this project involves emotional state estimation using EEG. Much of the recent research into emotional state estimation has occurred very recently. **Rutkowski** Cichocki, Ralescu and Mandic **conducted a study in 2007 using EEG.** (Taken from: http://www.springerlink.com/content/x9t83j72457l0574)

> “The notion of emotional empathy, that is the estimation of responses from electrophysiological signals has recently gained attention among the designers of brain computer/machine interfaces (BCI/BMI). This is largely due to the relative simplicity and convenience of electroencephalograph (EEG) recordings. Whereas this problem is not entirely new, engineering approaches connecting the emotional states of humans and the observed EEG recordings are still in their infancy. In this paper we present an initial set of results on the estimation of basic emotional responses generated while watching short videos with dynamic emotional contents. A novel multichannel EEG analysis approach is proposed in order to discover representative components of the emotional responses. This is achieved based on distinct spatial patterns exhibited within the EEG data recorded over frontal lobes, and averaged over a number of trials and subjects. Simulation

results support the proposed approach, and confirm the initial hypothesis." - **Rutkowski** Cichocki, Ralescu and Mandic

Emotional Engagement and Mass Effect

Currently, games have consistently succeeded in evoking emotion from their players. However, in many ways, these emotions lack subtlety. Games like *Gears of War* can affect engagement, aggression, triumph and sometimes fear, but when it comes to tugging the heartstrings of the player, the game falls rather flat. Players typically revere other games like *Final Fantasy VII* for bringing gamers to tears at the death of a party member, but the emotional response stems from the character having a long-standing relationship with the player. However, if that relationship were to exist in other media, it would still affect the user in a similar manner. Simply put, the techniques used and emotions evoked in *Final Fantasy VII* are not unique to games.

However, *Mass Effect* managed to push strongly for emotional engagement by using the game's systems and combining them with cinematic elements in such a way that the player forms emotional attachment to NPCs through their choices in dialogue. Much of what sells the experience comes from the ways in which the characters (both the player's avatar and NPCs) act. Facial expression, tone of voice, proximity to one another, and animations all work well together in order to create a mostly believable experience.

Proximity to the player increases the personal nature of the conversation, and also allows the game to take advantage of nuanced facial expression. However in order for the experience to work, the tone of voice must match not only the facial expression, but the accompanying animations. Things like aggression must show an increase in proximity to the player, even if the NPC does not intend violence.

Admittedly, there are some problems with *Mass Effect*, in that the game makes gestures towards nuanced and subtle emotions but the dialogue and animation still feels stiff, distant and somewhat hollow, at least in part. Real people tend to move and gesture considerably more than characters in *Mass Effect*. The player character's own emotional distance and typically bland dialog choices tend to harm the overall experience.

Mass Effect sells the visual experience very well and manages to achieve its goal of emotionally engaging relationships with NPC more often than not. Techniques from this game directly apply to visual techniques in this project. However, some alteration needs to happen in order to incorporate the techniques into a first-person experience.

Current State of the Art

Emotional feedback recently emerged as a topic of interest in games and consists of a system in which programs gather information about the user's mental state, and then use this to modify the actions and reactions of the program. There are several ways to gather information about a player's emotional state, such as Electroencephalography and other Brain Computer Interfaces (BCI), galvanic skin sensors and cameras with facial recognition software, all of these options use currently existing technology. As these technologies become cheaper, and easier to produce, devices that monitor the user's emotional state are becoming commercially viable in the mass-market.

However, research into emotional states and their applications has only just started find a home with interactive entertainment. Most of this pre-existing research did not use the same tools as this project plans on using, so it is difficult to predict whether or not any issue encountered in previous research will actually have an impact on the present project.

Additionally, most of the research using the eMotiv Headset has revolved around using it as a controller, rather than a device for emotional feedback. The Massachusets Institute of Technology (MIT) has used the headset as a controller for a wheelchair. Carnegie-Mellon University is using the headset as a controller in their pre-existing virtual reality project. The only development that deals with emotional feedback has nothing to do with the eMotiv Headset. Microsoft's newly unveiled Project Natal is capable of reading facial expressions and having an in-game AI react to the player's expressions.

Figure 4: Microsoft's Project Natal reads facial expressions and interprets them as emotions. Taken from: http://www.gamasutra.com/php-bin/news_index.php?story=23863

However, the full capabilities of Project Natal are still unknown. In addition to this, facial expressions do not fully express the user's emotions, as it is entirely possible for the user to make an effort to control their facial expressions in order to affect the way the game interacts with the player. The advantage of using EEG stems from the ability to get accurate emotional data regardless of facial expression, which the program can supplement with data from facial twitches.

Methodology

Introduction

This project focuses on determining which graphical techniques are most effective at evoking an emotional response from the player. Specifically, this project phrases the question as: "How do you incorporate emotional feedback into a highly emotional experience using graphics?" By using the eMotiv Headset to collect data on the user's experience, this project investigates which graphical techniques, such as lighting, non-player character (NPC) aggression, and flashbacks are the most effective at eliciting an emotional response from the user.

The primary methodology revolves around a scripted scene titled "Snakebite", which depicts a psychologically damaged soldier carrying out a conversation with a hallucinatory version of another soldier, which is in fact a manifestation of his subconscious. Snakebite consists of a two to three minute interactive video of the conversation. Throughout the conversation the eMotiv Headset gathers feedback from the player's emotional state. At pre-determined points throughout the conversation, the engine collects feedback from the eMotiv Headset and determines which path to take the player down. Throughout the conversation, the game exposes players to situations that should elicit an emotional response. Based upon the player's response, the game reacts to the player in a believable way. This should increase the player's emotional involvement in the conversation.

In order to get an accurate gauge of the subject's reactions, the subject must undergo a three stage test. The first test involves the player watching the video with the headset. The second stage of the test requires the subject to view the conversation after a short break, in which they fill out a survey detailing their response to the video. After the second viewing, subjects fill out a second survey comparing their first experience to their last.

This project compiles and analyzes data from all three tests and compares them against each other. This allows the chance to understand the changes in the user's reaction to the scene. Additionally, this study analyzes the data in relation to other user's reactions, and draws conclusions based upon comparisons between users, including breakdowns based upon access of dialog branches, and their changes over time.

The approximate development timeline is as follows: one month after project start, this project has completed a working application with placeholder assets and final quality dialog, using the eMotiv Headset. The project still includes bugs, and Alpha-quality detection functionality. The project has a strong focus on functionality testing and bug fixes.

At two months after project start, the project has Beta-quality dialog tree/detection functionality, alpha-quality animations for soldier. Significant portions of the work consist of continued refinement of functionality and bug fixes.

At four Months after project start the project has final quality dialog/detection functionality, and final quality assets. At this point, data gathering/ research testing begins.

At five months after project start the data gathering and analysis is complete. Present the project and conclusion analyses to committee for final review.

The Product

Quick Summary

Snakebite consists of an interactive scripted sequence using the eMotiv Headset for a single player. The level guides the player through a conversation with a psychologically damaged soldier after a firefight. The events of the conversation elicit an emotional response from the player. The headset then records the player's emotional responses and plugs them back into the game system, creating a believable player-NPC reaction.

Gameplay Overview

Game Flow

1. Get out of truck, move over to the clearing barrels.
2. Clear weapon.
3. NPC accosts player, and starts a conversation.
4. Player and NPC travel over to a barrel fire, and begin to talk in earnest.
5. Headset gathers information on player's emotional responses, and guides player down conversation paths based upon collected data.
6. Based upon player responses, the level ends at different times.

Major Elements

- Introduction to NPC
- Conversation with NPC (body of gameplay experience)
- Resolution of conversation (player either dies, or wakes up from hallucination)

Major Objectives

This level does not have an specific objective, as the level is more of an experience than an actual game.

Technical Overview

Campaign/Act

"Snakebite" is a stand-alone experience.

Mission Location

- Setting: Undisclosed U.S. Military Forward Operating Base (FOB) in Iraq, 2007
- Time: Night
- Season: Summer
- Weather: Clear

Mission Difficulty

Not applicable, as the level does not include actual gameplay.

Mission Metrics

- Play Time: 3-5 minutes
- Physical Length/Area: 200x200 feet
- New Characters/Vehicles:
    - 4 new characters:
        - Player
        - NPC Soldier

        - Little Girl
        - Insurgent Father

- Visual Themes: 2
    - FOB
    - Small Iraqi town

Details

Theme/Mood

The level evokes a desolate feeling. The barren landscape and pre-fabricated military structures remind the player of just how far from home they really are. A single barrel fire lights the scene. There is activity in the distance, but for the most part the two people are alone, and locked into a dangerous and disturbing situation. The darkness and isolation, as well as the inability to flee the conversation cause the player to feel trapped and claustrophobic. The mood evolves from curiosity into tension and fear, throughout the interactions with the NPC soldier.

The content of the level follows a theme of psychological torment and despair, a questioning of what one knows is true is actually there, or whether or not the memories stand as more of a torture than a source of comfort. The NPC soldier embodies that broken view of reality, and throughout the game he tries to convince the player that there is no other reality outside the war, that all the memories only serve to remind the player of things that he never had or could have.

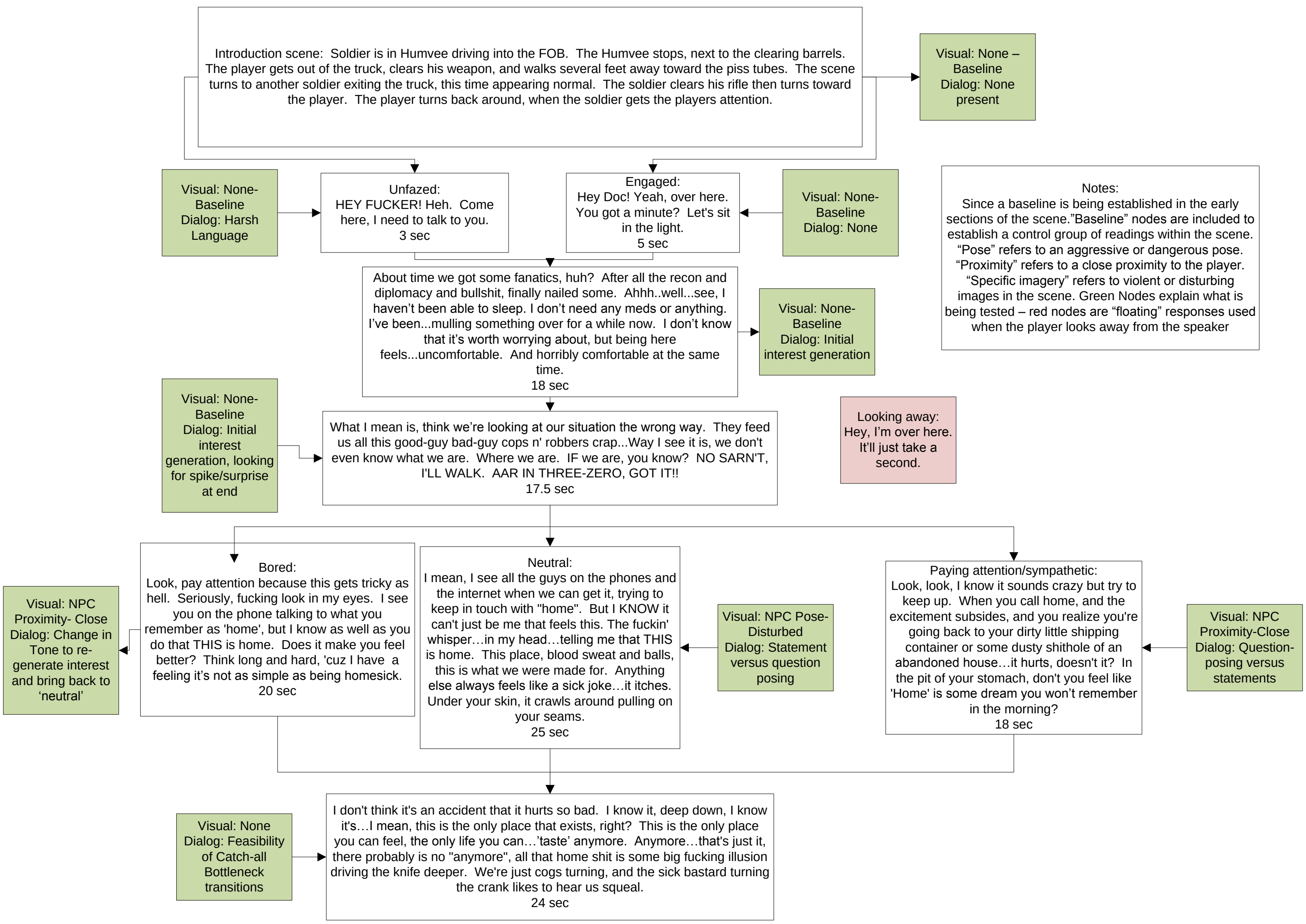
Major Characters/Vehicles

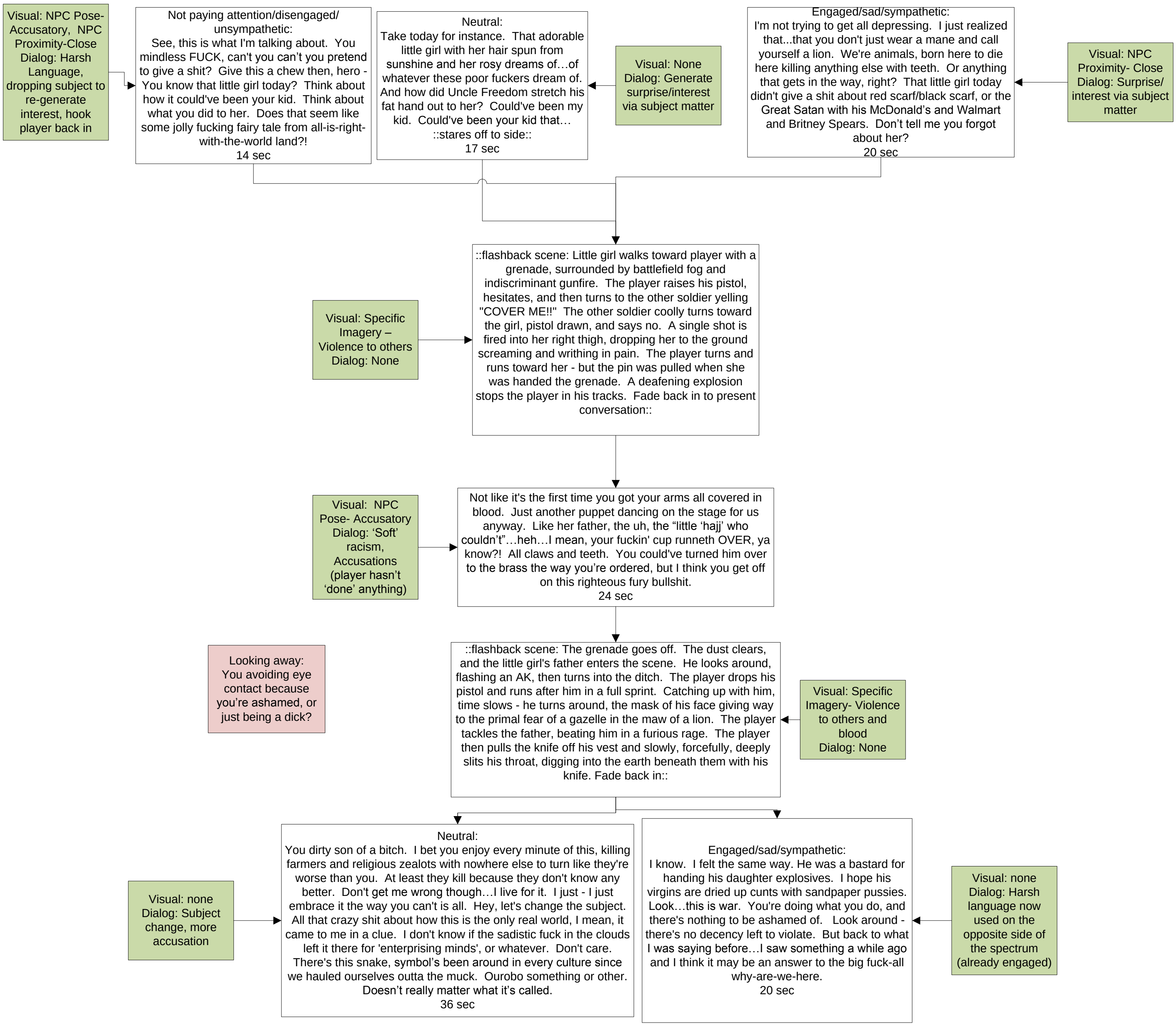
- NPC Soldier: A psychologically damaged soldier confiding a secret to the player. The NPC is distressed and dangerous, and the player's reaction impace his actions heavily.

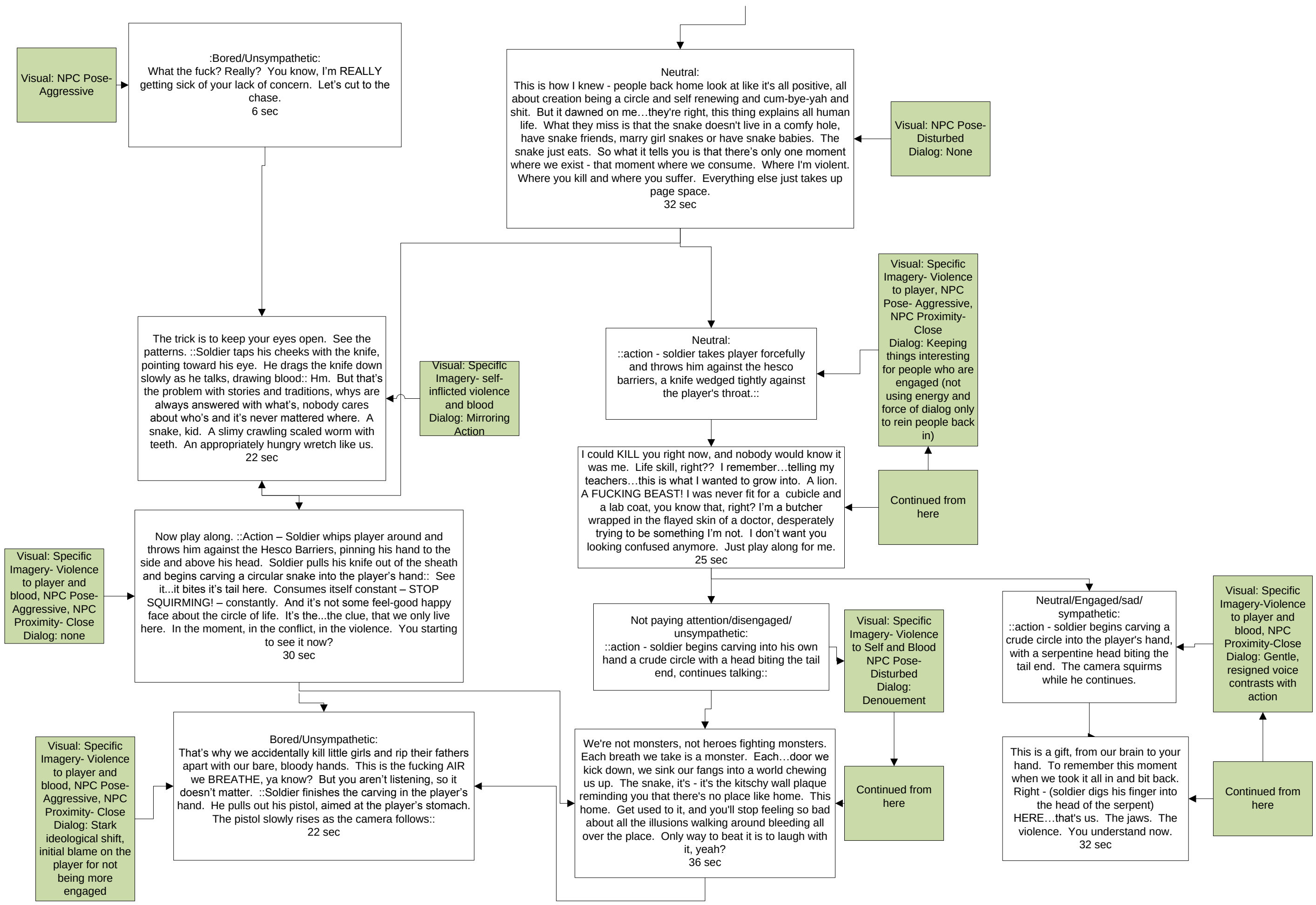
Gameplay Mechanics

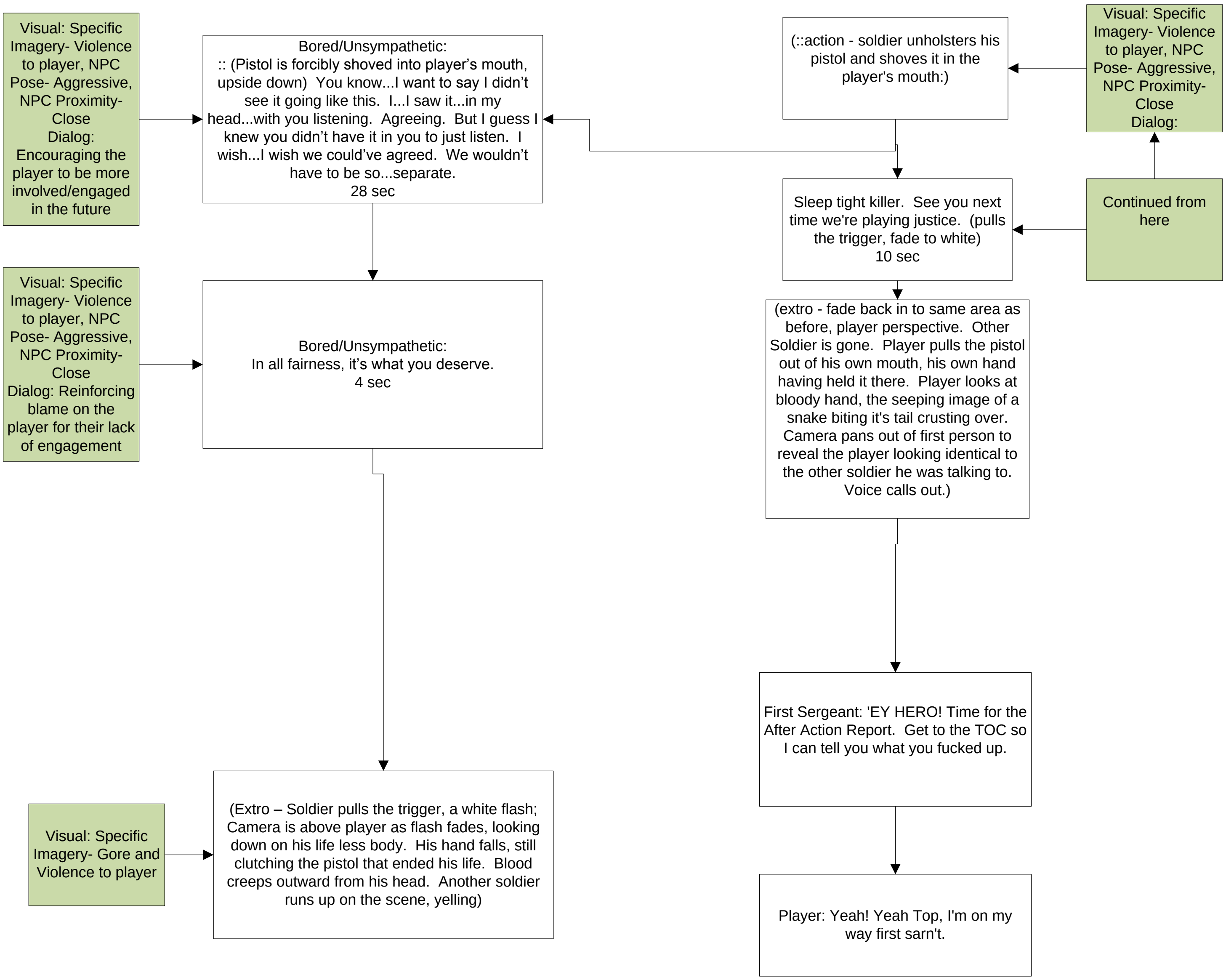
- Prerequisite Skills
    - Basic brain activity

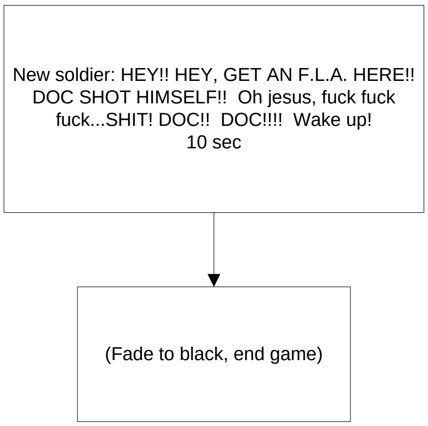
Dialog Tree

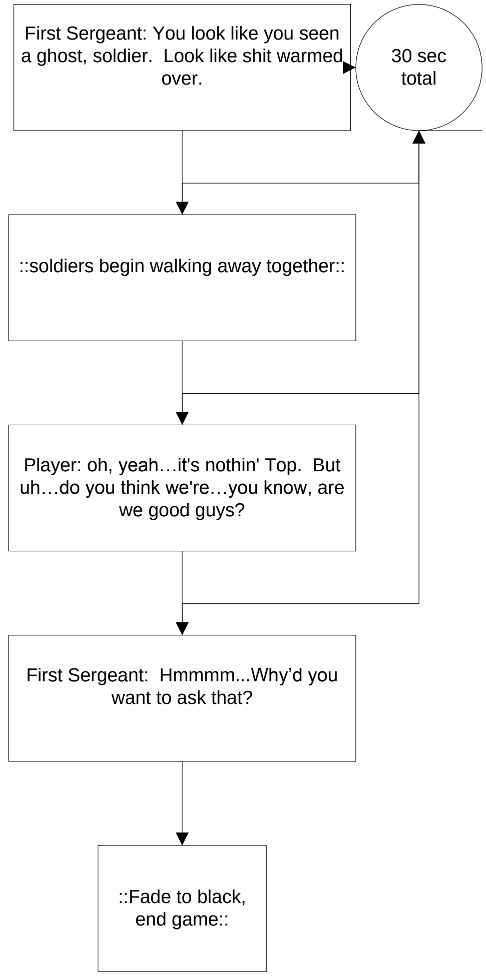



Visual: NPC Pose- Accusatory, NPC Proximity-Close Dialog: Harsh Language, dropping subject to re-generate interest, hook player back in
Not paying attention/disengaged/ unsympathetic: See, this is what I'm talking about. You mindless FUCK, can't you can't you pretend to give a shit? Give this a chew then, hero - You know that little girl today? Think about how it could've been your kid. Think about what you did to her. Does that seem like some jolly fucking fairy tale from all-is-right-with-the-world land?! 14 sec
Neutral: Take today for instance. That adorable little girl with her hair spun from sunshine and her rosy dreams of…of whatever these poor fuckers dream of. And how did Uncle Freedom stretch his fat hand out to her? Could've been my kid. Could've been your kid that… ::stares off to side:: 17 sec
Visual: None Dialog: Generate surprise/interest via subject matter
Engaged/sad/sympathetic: I'm not trying to get all depressing. I just realized that...that you don't just wear a mane and call yourself a lion. We're animals, born here to die here killing anything else with teeth. Or anything that gets in the way, right? That little girl today didn't give a shit about red scarf/black scarf, or the Great Satan with his McDonald's and Walmart and Britney Spears. Don't tell me you forgot about her? 20 sec
Visual: NPC Proximity- Close Dialog: Surprise/ interest via subject matter
Visual: Specific Imagery – Violence to others Dialog: None
::flashback scene: Little girl walks toward player with a grenade, surrounded by battlefield fog and indiscriminant gunfire. The player raises his pistol, hesitates, and then turns to the other soldier yelling "COVER ME!!" The other soldier coolly turns toward the girl, pistol drawn, and says no. A single shot is fired into her right thigh, dropping her to the ground screaming and writhing in pain. The player turns and runs toward her - but the pin was pulled when she was handed the grenade. A deafening explosion stops the player in his tracks. Fade back in to present conversation::
Visual: NPC Pose- Accusatory Dialog: 'Soft' racism, Accusations (player hasn't 'done' anything)
Not like it's the first time you got your arms all covered in blood. Just another puppet dancing on the stage for us anyway. Like her father, the uh, the "little 'hajj' who couldn't"…heh…I mean, your fuckin' cup runneth OVER, ya know?! All claws and teeth. You could've turned him over to the brass the way you're ordered, but I think you get off on this righteous fury bullshit. 24 sec
Looking away: You avoiding eye contact because you're ashamed, or just being a dick?
::flashback scene: The grenade goes off. The dust clears, and the little girl's father enters the scene. He looks around, flashing an AK, then turns into the ditch. The player drops his pistol and runs after him in a full sprint. Catching up with him, time slows - he turns around, the mask of his face giving way to the primal fear of a gazelle in the maw of a lion. The player tackles the father, beating him in a furious rage. The player then pulls the knife off his vest and slowly, forcefully, deeply slits his throat, digging into the earth beneath them with his knife. Fade back in::
Visual: Specific Imagery- Violence to others and blood Dialog: None
Visual: none Dialog: Subject change, more accusation
Neutral: You dirty son of a bitch. I bet you enjoy every minute of this, killing farmers and religious zealots with nowhere else to turn like they're worse than you. At least they kill because they don't know any better. Don't get me wrong though…I live for it. I just - I just embrace it the way you can't is all. Hey, let's change the subject. All that crazy shit about how this is the only real world, I mean, it came to me in a clue. I don't know if the sadistic fuck in the clouds left it there for 'enterprising minds', or whatever. Don't care. There's this snake, symbol's been around in every culture since we hauled ourselves outta the muck. Ourobo something or other. Doesn't really matter what it's called. 36 sec
Engaged/sad/sympathetic: I know. I felt the same way. He was a bastard for handing his daughter explosives. I hope his virgins are dried up cunts with sandpaper pussies. Look…this is war. You're doing what you do, and there's nothing to be ashamed of. Look around - there's no decency left to violate. But back to what I was saying before…I saw something a while ago and I think it may be an answer to the big fuck-all why-are-we-here. 20 sec
Visual: none Dialog: Harsh language now used on the opposite side of the spectrum (already engaged)


Visual: NPC Pose-Aggressive
:Bored/Unsympathetic:
What the fuck? Really? You know, I'm REALLY getting sick of your lack of concern. Let's cut to the chase.
6 sec
Neutral:
This is how I knew - people back home look at like it's all positive, all about creation being a circle and self renewing and cum-bye-yah and shit. But it dawned on me…they're right, this thing explains all human life. What they miss is that the snake doesn't live in a comfy hole, have snake friends, marry girl snakes or have snake babies. The snake just eats. So what it tells you is that there's only one moment where we exist - that moment where we consume. Where I'm violent. Where you kill and where you suffer. Everything else just takes up page space.
32 sec
Visual: NPC Pose-Disturbed Dialog: None
The trick is to keep your eyes open. See the patterns. ::Soldier taps his cheeks with the knife, pointing toward his eye. He drags the knife down slowly as he talks, drawing blood:: Hm. But that's the problem with stories and traditions, whys are always answered with what's, nobody cares about who's and it's never mattered where. A snake, kid. A slimy crawling scaled worm with teeth. An appropriately hungry wretch like us.
22 sec
Visual: Specific Imagery- self-inflicted violence and blood Dialog: Mirroring Action
Neutral:
::action - soldier takes player forcefully and throws him against the hesco barriers, a knife wedged tightly against the player's throat.::
Visual: Specific Imagery- Violence to player, NPC Pose- Aggressive, NPC Proximity-Close Dialog: Keeping things interesting for people who are engaged (not using energy and force of dialog only to rein people back in)
I could KILL you right now, and nobody would know it was me. Life skill, right?? I remember…telling my teachers…this is what I wanted to grow into. A lion. A FUCKING BEAST! I was never fit for a cubicle and a lab coat, you know that, right? I'm a butcher wrapped in the flayed skin of a doctor, desperately trying to be something I'm not. I don't want you looking confused anymore. Just play along for me.
25 sec
Continued from here
Visual: Specific Imagery- Violence to player and blood, NPC Pose- Aggressive, NPC Proximity- Close Dialog: none
Now play along. ::Action – Soldier whips player around and throws him against the Hesco Barriers, pinning his hand to the side and above his head. Soldier pulls his knife out of the sheath and begins carving a circular snake into the player's hand:: See it...it bites it's tail here. Consumes itself constant – STOP SQUIRMING! – constantly. And it's not some feel-good happy face about the circle of life. It's the...the clue, that we only live here. In the moment, in the conflict, in the violence. You starting to see it now?
30 sec
Not paying attention/disengaged/ unsympathetic:
::action - soldier begins carving into his own hand a crude circle with a head biting the tail end, continues talking::
Visual: Specific Imagery- Violence to Self and Blood NPC Pose-Disturbed Dialog: Denouement
Neutral/Engaged/sad/ sympathetic:
::action - soldier begins carving a crude circle into the player's hand, with a serpentine head biting the tail end. The camera squirms while he continues.
Visual: Specific Imagery-Violence to player and blood, NPC Proximity-Close Dialog: Gentle, resigned voice contrasts with action
Visual: Specific Imagery- Violence to player and blood, NPC Pose- Aggressive, NPC Proximity- Close Dialog: Stark ideological shift, initial blame on the player for not being more engaged
Bored/Unsympathetic:
That's why we accidentally kill little girls and rip their fathers apart with our bare, bloody hands. This is the fucking AIR we BREATHE, ya know? But you aren't listening, so it doesn't matter. ::Soldier finishes the carving in the player's hand. He pulls out his pistol, aimed at the player's stomach. The pistol slowly rises as the camera follows::
22 sec
We're not monsters, not heroes fighting monsters. Each breath we take is a monster. Each…door we kick down, we sink our fangs into a world chewing us up. The snake, it's - it's the kitschy wall plaque reminding you that there's no place like home. This home. Get used to it, and you'll stop feeling so bad about all the illusions walking around bleeding all over the place. Only way to beat it is to laugh with it, yeah?
36 sec
Continued from here
This is a gift, from our brain to your hand. To remember this moment when we took it all in and bit back. Right - (soldier digs his finger into the head of the serpent) HERE…that's us. The jaws. The violence. You understand now.
32 sec
Continued from here


Visual: Specific Imagery- Violence to player, NPC Pose- Aggressive, NPC Proximity- Close Dialog: Encouraging the player to be more involved/engaged in the future
Bored/Unsympathetic: :: (Pistol is forcibly shoved into player's mouth, upside down) You know...I want to say I didn't see it going like this. I...I saw it...in my head...with you listening. Agreeing. But I guess I knew you didn't have it in you to just listen. I wish...I wish we could've agreed. We wouldn't have to be so...separate. 28 sec
(::action - soldier unholsters his pistol and shoves it in the player's mouth:)
Visual: Specific Imagery- Violence to player, NPC Pose- Aggressive, NPC Proximity- Close Dialog:
Sleep tight killer. See you next time we're playing justice. (pulls the trigger, fade to white) 10 sec
Continued from here
Visual: Specific Imagery- Violence to player, NPC Pose- Aggressive, NPC Proximity- Close Dialog: Reinforcing blame on the player for their lack of engagement
Bored/Unsympathetic: In all fairness, it's what you deserve. 4 sec
(extro - fade back in to same area as before, player perspective. Other Soldier is gone. Player pulls the pistol out of his own mouth, his own hand having held it there. Player looks at bloody hand, the seeping image of a snake biting it's tail crusting over. Camera pans out of first person to reveal the player looking identical to the other soldier he was talking to. Voice calls out.)
First Sergeant: 'EY HERO! Time for the After Action Report. Get to the TOC so I can tell you what you fucked up.
Visual: Specific Imagery- Gore and Violence to player
(Extro – Soldier pulls the trigger, a white flash; Camera is above player as flash fades, looking down on his life less body. His hand falls, still clutching the pistol that ended his life. Blood creeps outward from his head. Another soldier runs up on the scene, yelling)
Player: Yeah! Yeah Top, I'm on my way first sarn't.


New soldier: HEY!! HEY, GET AN F.L.A. HERE!! DOC SHOT HIMSELF!! Oh jesus, fuck fuck fuck...SHIT! DOC!! DOC!!!! Wake up!
10 sec
(Fade to black, end game)


First Sergeant: You look like you seen a ghost, soldier. Look like shit warmed over.
30 sec total
::soldiers begin walking away together::
Player: oh, yeah…it's nothin' Top. But uh…do you think we're…you know, are we good guys?
First Sergeant: Hmmmm...Why'd you want to ask that?
::Fade to black, end game::

Visual References

Figure 5: FOB reference pic.


Figure 6: Iraqi town reference pic.

Figure 7: Barrel fires.

Figure 8: Battered transport reference

Figure 9: FOB layout.

Figure 10: Soldier reference

Figure 11: Desert lighting reference

Figure 12: Soldier's weapon and equipment reference

Figure 13: Base and surrourndinq landscape

Figure 5: Example of disturbing imagery

Figure 6: Equipment reference

Figure 7: Uniform reference

Figure 8: Soldier reference.

Figure 9: Vegetation reference.

Figure 10: Soldiers in Iraq.

Rough Map w/ Legend

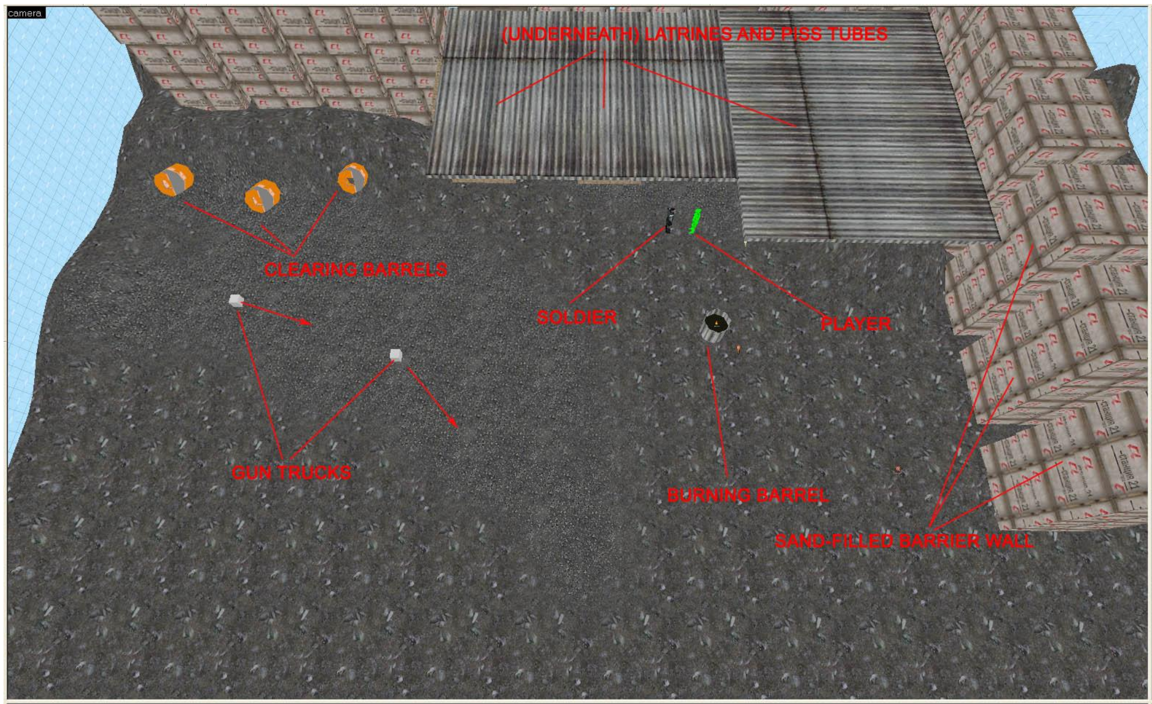


Figure 11: Base overhead layout.

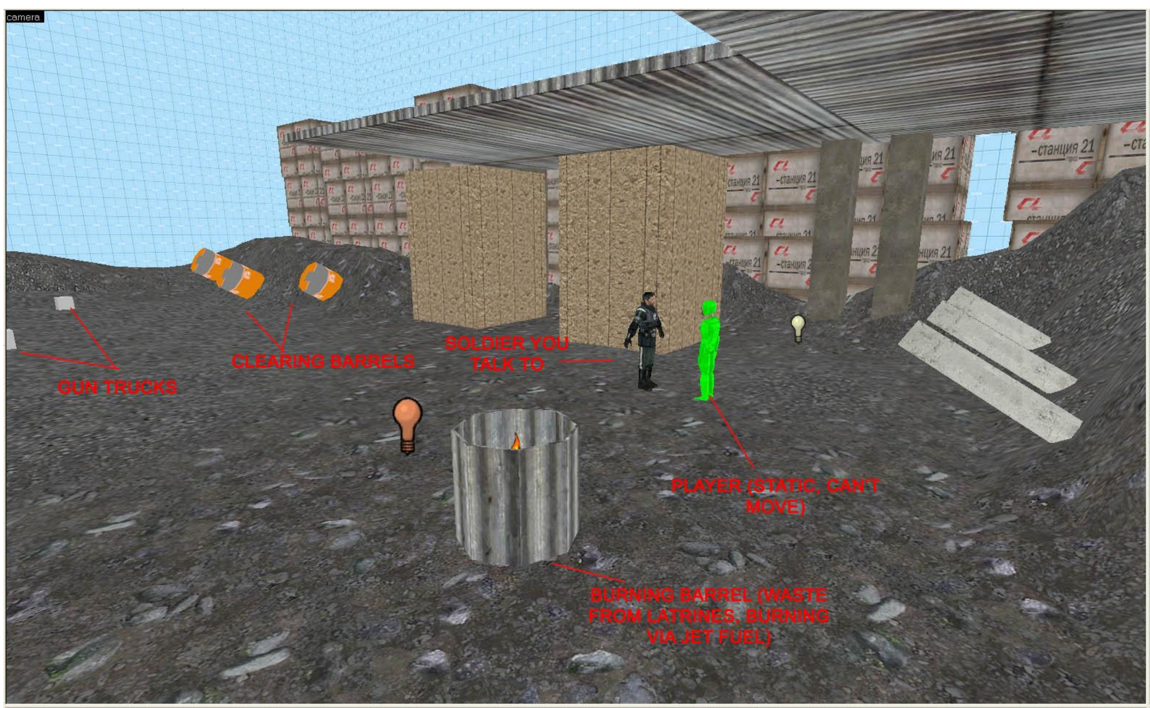


Figure 12: Perspective base view

Explanation

The product consists of an interactive dialog tree, in which the user's emotional reactions determine which branch of the tree the conversation progresses through. Based upon the user's reactions, the conversation evolves into a more emotionally charged encounter, with a lack of empathy or boredom being met with aggression and hostility. The emotion the user displays determines whether or not their digital avatar survives the encounter, or succumbs to his psychologically damaged alter ego and commits suicide.

The eMotiv Headset allows for the collection of data in real-time, uncolored by the user's faulty memory. Participants complete a survey at the end of each viewing. The survey data supplements the readings taken from the headset. The team plans to use the Unity engine, assuming the technology is available and the tools fit the team's needs. If Unity is unavailable or insufficient for the team's needs, Source SDK has all the features required for completion of the project.

The scene construction consists three distinct phases. The first two take the least amount of time. The final stage, scripting, takes the longest by far. The amount of work required for scripting depends entirely on the quality of the tools.

Phase 1: Area Layout

- Whitebox area
- Add terrain
- Add textures
- Add meshes

Phase 2: Atmosphere

- Add lighting
- Add sounds (distant gun fire, wind, radio chatter)
- Add level effects (dust, smoke)

Phase 3: Scripting

- Script dialog
- Integrate headset (Josh Mahan and Mike Tanfield)
- Integrate characters animations (Ryan Metcalf)

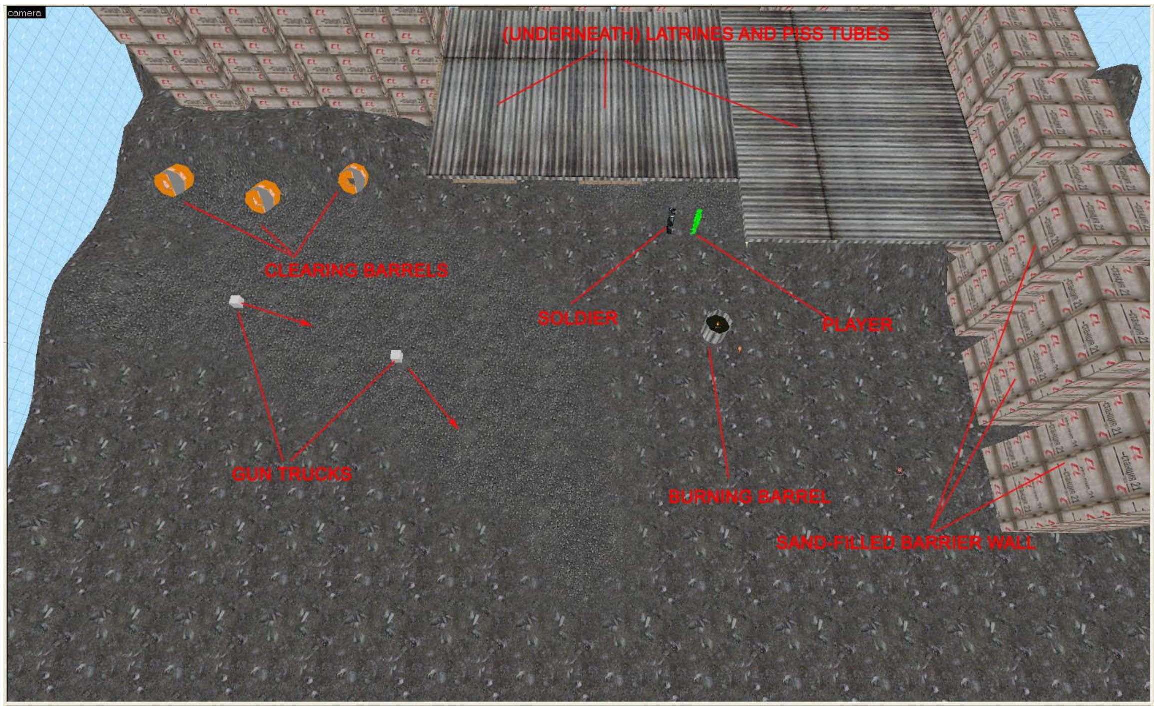


Figure 22: Rough layout in Source of the play space

The project revolves around a scripted conversation, in which the player has no control of their character. When the level starts the player clears their rifle in the clearing barrel, and moves towards the burning barrel. On the way to the barrel, the NPC accosts the player and asks to talk to him. Once the player and the NPC reach the conversation point, the test begins.

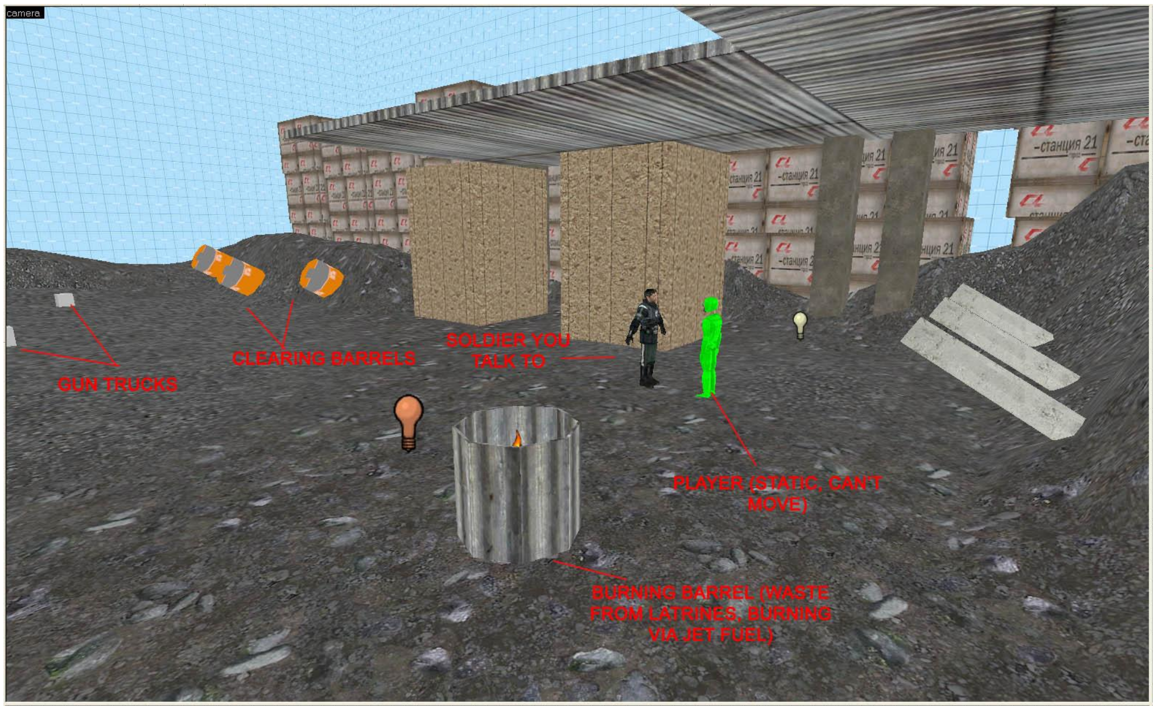


Figure 23: Perspective view of the play space mock-up

Throughout the conversation the eMotiv Headset takes multiple data readings. In the control group version of the test, the headset simply records data, and the conversation follows the baseline path through the dialog tree. In the test group, the eMotiv actually takes the data and plugs it back into the system. In this case, at critical points during the test the game will take the eMotiv’s data and makes a determination on which emotional response the player has. This data pushes the conversation down one of the branches. Different emotional responses unlock different dialog options.

Testing and Data Collection

The most important data collected from the headset revolves around what emotions the user was feeling, how strongly they were feeling it and what was happening on-screen at the time. This allows the team to analyze which techniques, and actions performed by the NPC elicited the strongest emotional responses. To acquire this data, the project includes a second camera in the level, designed to capture the player's responses for future reference.

The method for data collection falls into two groups. The control group uses the eMotiv Headset as a data collection device. They experience a pre-determined path through the gameplay experience, following the "neutral" path shown in the dialog tree. The test group uses the eMotiv Headset not only as a data collection device, but as a means for the player to interact with the system. At certain points throughout the experience the headset uses data collected from the user to determine which path the game takes. This allows for the user's emotional state to involuntarily guide the course of the game system, which in turn evokes different emotional responses from the test subject.

Additionally, the data given by the eMotiv Headset has a timestamp that allows for comparison between the game and the collected data. The data for each test subject includes this video footage and data backlog, in order to facilitate detailed study of each key interaction point. The data required to accurately analyze the question comes from the eMotiv Headset. Supplementary data comes from the exit surveys. The exit surveys use the Likert Scale. The team has determined that likely questions in the exit surveys include:

- How realistic do you think the graphics in the scenario were?
- Subject matter aside, was this experience close to an actual conversation?
- How impactful did you feel the scenario was? Were you engaged?
- How strong do you feel your emotional response to the scenario was?
- Was the scenario entertaining?
- Were you frustrated that you couldn't choose your responses?
- Would you buy a game that used this system for Dialog?
- Would you buy a game that was primarily driven by involuntary feedback?

Additional likely questions specific to this master's project include:

- During (specific event), which emotion most closely resembles what you felt? (several questions of this type)
- During (specific event), how did the NPC's proximity make you feel? (several questions of this type)
- How did you feel about the NPC at the beginning of the experience?
- How did you feel about the NPC at the end of the experience?

The test group consists of 50 subjects across numerous demographics. The first 25 subjects participate in the control group, and the other 25 participate in the test group. The breakdown of these demographics is as follows:

- Ten Guildhall Students/professors (no Cohort 11 students or Advisors/Supervisors involved in the project)
- Ten randomly selected SMU students
- Ten SMU psychology/psychiatry students from the building adjacent to Guildhall
- Ten randomly selected Dallas-IGDA members
- Ten disabled veterans suffering from combat-related Post-Traumatic Stress Disorder (PTSD) and/or Traumatic Brain Injury (TBI).

However, if calibration or technology issues cause the testing process to go slower than anticipated, volunteers in the Guildhall community provide the required 20 subjects.

- Ten students from various cohorts
- Ten members of the Guildhall at SMU faculty

In either case, each half of each demographic group participates in the control group, using the eMotiv Headset only as a data collection device and the other half of the test subjects participates in the test group. The test group uses the eMotiv Headset as an emotional feedback device.

Schedule

This project begins in the first week of summer, and continues up until a few weeks before graduation. The project enters the testing phase at the end of September. By Early November the project plans to have final revision of the document completed.

- July 1, 2009 – Begin work in earnest
- July 8, 2009 – Engine choice, asset list, first draft of Dialog, initial emotion-detection values all finalized.
- July 22, 2009 – Initial integration of Engine and EPOC detection suites complete (may include bugs)
- August 5, 2009 – Integration of Engine and EPOC using vertical slice of dialog interactions complete
- August 19, 2009 – Refinement of emotion-detection values, detection functionality, alpha-quality assets implemented
- September 2, 2009 – Continued refinement of dialog, asset implementation, detection functionality; few to no bugs
- September 16, 2009 – Beta-quality build, including finalized dialog and beta-quality assets
- September 23, 2009 – Final (or near final) quality build of project completed
- September 30, 2009 – Data gathering phase begins
- October 7, 2009 – Continued Data Gathering
- October 14, 2009 – First draft of full Thesis submitted
- October 21, 2009 – Second draft of full Thesis submitted
- October 28, 2009 – Third draft of full Thesis submitted
- November 4, 2009 – Final draft of full Thesis submitted

- November 25, 2009 – Thesis Defense
- December 19, 2009 – Graduation

Conclusion

The eMotiv Headset is an emerging technology that the games industry cannot afford to ignore. The headset's ability to allow for deeper interaction between the player and the game has long term implications not only for the games industry, but for the field of human-computer interaction as a whole. However, with these changes come new challenges. In order to properly respond to these changes, the games industry must dispose of many of its assumptions about narrative and player interaction. The eMotive Headset allows developers a unique opportunity to better understand the psychology of their users, and to create a broader range of interaction in their games.

This project focuses on understanding how players react to in-game characters, and the stories they have to tell. The eMotiv Headset allows for the opportunity to set up a clear set of metrics by which to gauge the player's reaction to certain stimuli throughout the game experience.

Throughout the project, the eMotiv Headset gathers user's emotional responses to visual stimuli such as gestures, proximity to the player, and implicit and explicit imagery. In the case of the control group, the headset acts as a data collection device, allowing conclusions to be drawn about the effectiveness of non-interactive visual storytelling techniques. In the case of the test group, the headset gathers data, but the eMotiv Headset also feeds the data back into the game system. This allows conclusions to be drawn about interactive visual storytelling techniques.

The project consists of a gameplay experience that branches based upon the player's emotional responses to the NPC's actions. This in turn causes the test group to react in different ways from the control group.

This project aims to demonstrate the viability of the eMotiv Headset, as a device for gathering and information on the player's emotional state by examining changes in test subject's reaction to the game experience over time, and weighing them against the corresponding stimuli. In addition to this, the project examines what effect an interactive system has on the player's involuntary responses to the material. There are several questions that this project addresses:

Primary Questions:

- Which visual storytelling techniques are most effective at eliciting specific emotional responses to further enhance an interactive experience using emotional feedback?

Secondary Questions:

- Do players react differently in an interactive emotional feedback system, as opposed to a pre-determined experience?
- Is there a correlation between demographic and reaction to the NPC?
- What challenges does the research present for future developers and researchers of emotional feedback systems, and what can be done to adequately meet these challenges?

The project hypothesizes that flashbacks are the most effective means for eliciting a reaction from the player. Additionally, the project hypothesizes that players react very differently in an interactive system, and that a strong correlation exists between emotional reactions and the demographic of the test subject. Simply put, people of similar age and life experiences react the same way, when exposed to a specific situation.

Despite the numerous questions this project explores, there remain many more topics that demand more attention before fully embracing the technology. These topics include:

- Long term effects on exposure to media
- Non-gaming uses for the eMotiv Headset
- Procedurally generated content and its applications in creating a stronger narrative
- Complementary technology/sensors for the eMotiv Headset

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