SUPER TIME FORCE

SOLVING THE TIME TRAVEL PARADOX

WHO AM I?

WHAT THIS TALK IS NOT ABOUT

THE TECHNICAL IMPLEMENTATION OF TIME REWINDING

BUILDING REAL TIME MACHINES

WHAT THIS TALK IS ABOUT

THE GAME DESIGN PROBLEMS OF TIME MANIPULATION

HOW WE TACKLED IT USING "SCIENCE"

SOLVING THE TIME TRAVEL PARADOX*

*in a video game

WHAT IS
SUPER TIME FORCE?

VISION:
SIMPLE, FUN ACTION GAME

REALITY:
COMPLICATED, PARADOX-FILLED MESS

CHALLENGE:
MAKE COMPLICATED, PARADOX-FILLED MESS FEEL SIMPLE AND FUN

WHAT'S SO BAD ABOUT TIME TRAVEL?

ALTERING THE PAST AND PREVENTING VITAL EVENTS FROM HAPPENING

NULLIFYING ANY CHALLENGE BY KNOWING THE FUTURE

ACCIDENTALLY DATING YOUR MOM

PARADOXES!

"I GOT 99 PROBLEMS AND TIME IS 100 OF THEM"

BUILDING A TIME MANIPULATION GAME

1) BUILD AN ENGINE CAPABLE OF TIME REWINDING
(I.E. THE "EASY" PART)

2) BUILD SYSTEMS TO DEAL WITH TIME PARADOXES
(I.E. THE "FUN" PART)

WITHOUT THESE "FUN" SYSTEMS YOUR GAME WILL BREAK DOWN!

WHAT IS "FUN"?

FACILITATING THE **UN**-INTUITIVENESS OF **N**ON-LINEARITY

F**KED **U**P **N**ONSENSE

HOW TO CREATE "FUN"

1) CAUSALITY VIOLATION

2) BUTTERFLY EFFECT MANAGEMENT

3) THE QUANTUM MEASUREMENT PROBLEM

CAUSALITY VIOLATION

WHAT IS CAUSALITY?

"THE FUNDAMENTAL ONE-WAY RELATIONSHIP BETWEEN CAUSE AND EFFECT"

HOW ABOUT WE JUST NOT DO THAT?

(I.E. ALLOW AN EFFECT TO OCCUR EVEN IF THE ORIGINAL CAUSE NO LONGER OCCURS)

LET'S TALK ABOUT QUANTUM MECHANICS

QUANTUM ENTANGLEMENT

"THE PHENOMENON WHERE THE
STATE OF TWO PARTICLES BECOME
INTRINSICALLY LINKED,
REGARDLESS OF PHYSICAL SEPARATION"

ENTITY ENTANGLEMENT

THE IDEA THAT CERTAIN EVENTS
BETWEEN A PAIR OF ENTITIES BECOME
<u>INTRINSICALLY LINKED</u>,
REGARDLESS OF CHANGES IN TIME

THE ENTANGLEMENT SYSTEM

1. "ENTANGLE" ENTITIES TOGETHER AT KEY TIMELINE EVENTS

2. STORE ALL OF THE ENTANGLEMENT EVENTS FROM ALL PAST TIMELINES

3. FORCIBLY RE-INSERT THOSE OUTCOMES BACK INTO THE CURRENT TIMELINE

THINGS MAY NOT MAKE TEMPORAL
SENSE ANYMORE...

... BUT THE GAME WILL "FEEL"
MORE CORRECT

THE
BUTTERFLY
EFFECT

WHAT IS THE BUTTERFLY EFFECT?

"WHEN A <u>SMALL CHANGE</u>
IN THE INITIAL STATE OF A SYSTEM CAN
RESULT IN A <u>LARGE CHANGE</u> IN THE FINAL
STATE OF THAT SYSTEM"

HOW IT AFFECTS YOUR GAME

ALTERING THE PAST WILL CAUSE EVERYTHING
IN THE FUTURE TO PLAY OUT <u>DIFFERENTLY</u>

DIFFERENTLY IN A <u>HELPFUL</u> WAY
OR IN A <u>DETRIMENTAL</u> WAY

99.9% OF THE TIME IT'S DETRIMENTAL

THAT MAKES TIME TRAVEL
COMPLETELY USELESS

SO WHAT CAN WE DO?

SOMEHOW MONITOR AND MANAGE
ALL "NEGATIVE" TIMELINE EFFECTS

THE IDEA OF
"LEVEL ENTROPY"

WHAT IS ENTROPY?

"THE MEASURE OF HOW A THERMODYNAMIC SYSTEM PROGRESSES TOWARDS EQUILIBRIUM"

EQUILIBRIUM = HIGHEST ENTROPY

LEVEL ENTROPY

EQUILIBRIUM = ALL PLAYERS ALIVE AND
ALL ENEMIES DEAD

THE LEVEL MUST ALWAYS PROGRESS TOWARDS THIS EQUILIBRIUM

ANY MODIFICATIONS TO THE TIMELINE MUST:

A) NEVER CAUSE PAST ENEMIES TO BE BETTER OFF

B) NEVER CAUSE PAST PLAYERS TO BE WORSE OFF

THE LEVEL ENTROPY SYSTEM

1. MONITOR ALL EVENTS HAPPENING ACROSS ALL TIMELINES

2. KNOW THE ENTROPY OF THOSE EVENTS

3. DISALLOW ANY EVENTS WHICH WOULD DECREASE LEVEL ENTROPY IN A PAST TIMELINE

THINGS MAY NOT MAKE PHYSICAL
SENSE ANYMORE...

... BUT THE GAME WILL "FEEL"
MORE CORRECT

THE QUANTUM MEASUREMENT PROBLEM

"IF A TREE FALLS IN A FOREST AND NO ONE IS AROUND, DOES IT STILL MAKE A SOUND?"

...YES?

THE QUANTUM MEASUREMENT PROBLEM

"PARTICLES DO NOT EXIST IN A DEFINITE
STATE UNTIL THEY ARE ACTUALLY MEASURED
BY AN OBSERVER"

SCHRODINGER'S CAT

OK THAT'S NICE, SO WHAT?

THIS CONCEPT OF OBSERVER DEPENDENCE SOLVES A MAJOR PROBLEM

MAJOR PROBLEM?

PLAYERS CAN EXIST EVERYWHERE AND AT ANY TIME

⇩

EVERYTHING IN THE WORLD MUST BE PERSISTENTLY ACTIVE

⇩

UNINTENTIONAL INTERACTIONS WILL HAPPEN EVERYWHERE

MAJOR PROBLEM?

LOSE THE ABILITY TO
CONTROL THE FLOW OF A LEVEL

LET'S THINK QUANTUM MECHANICS

TREAT ENTITIES LIKE
QUANTUM PARTICLES:

THEY ARE ONLY ALLOWED
TO INTERACT IF THEY

HAVE AN OBSERVER

THE SCHRODINGER SYSTEM

1. CALCULATE THE SUM OF ALL REGIONS OF THE WORLD OBSERVABLE BY ANY PLAYER

2. STORE THESE OBSERVABLE REGIONS FOR EVERY MOMENT IN TIME

3. ONLY ALLOW ENTITIES DEEMED "OBSERVABLE" TO INTERACT

THINGS MAY SEEM PHYSICALLY
INCONSISTENT...

... BUT THE GAME WILL "FEEL"
MORE CORRECT

IN SUMMARY

1. MAKING A TIME MANIPULATION GAME "FUN" IS HARD

2. COUNTER-INTUITIVENESS CAN SOMETIMES "FEEL" RIGHT

3. SCIENCE RULEZ