Iterative Development

Motivation
• Last thing you want to do is write critical code near end of a project
  – Induces huge stress on team
  – Introduces all kinds of "interesting" bugs that break working code
• Testing always gets cut in crunch
  – Makes problem even worse!
• Planning can help avoid writing critical code in alpha or beta phases

Wishes versus Reality
• Most games you make are smaller/less than you originally envisioned
  – Design was bigger than implementation
  – Or, tested/working implementation bigger than what made it into game
• That’s ok ➔ expect it
• So, how do we know when a game is “done”?

How Do We Estimate Progress?
Example:
• Jo is a programmer
• She estimates it will take 10 days to implement Smart Trap
• She is 4 days into implementation
• Is Smart Trap 40% complete? ➔ maybe
  – We may not see it "snap shut" until day 9
• She’s good, ➔ finishes in 8 days total
  – Yay, we are ahead!
• Later, decide to add functionality to Smart Trap (e.g., trap large bad guys, too)
  – Takes 4 days
  – Boo, now we’re behind!

What’s the Point?
• Most things get revisited multiple times during development
  – Fix bugs, modify functionality, etc.
  – “Refactoring” your code
    • Note, refactoring easier with clear, easy-to-understand code!
    – Expect this! Despite your careful planning …
• So, the "40% done" estimate looks pretty sketchy…
• Need way to account for time without driving project into trouble (and into panic)

Incremental Delivery
• Milestones are good things!
  – They let us get things “done”
• Milestones can have downside
  – If you miss one, people notice, action taken
  – Especially management people
• Developer’s view
  – Milestones (or plans, in general) are just best guesses for how implementation will evolve
• Management’s view
  – Schedules are contracts with developers
  – Promising certain things at certain times
• Different views cause problems
  – Developers: panic, pressure, long hours
  – Managers: justification for financial pressure
Milestones (1 of 2)

• Despite problems, necessary
  – Without milestones, unlikely to get done
• Unrealistic milestones mean work not done on time, no matter financial importance
  – Remember, are best guesses
• Managers need to know estimates of developers and key makers along the way
  – Plan financial/time links accordingly
• External milestones coarser
  – Tie to publishers, marketers, etc.
• Internal milestones have finer granularity
  – Used by team members

Milestones (2 of 2)

• Think of development plan as black box
  – Managers have specific “interface” to box
    • “Give me the latest build”
    • “Give me the latest (high-level) schedule”
• Clearly, this is too simplistic/wishful thinking
  – Managers just want to know more (and need to, to do their jobs better)
• But view as development plan as “black box” helps separate job roles better

There is More than Meets the Eye

• For many, “if I can’t see it, it is not important”
  – At takes time to build (and you don’t see it)
  – Network code to balance players is an optimization
    (and you don’t see it)
• Developers receive less “credit” for unseen code than for things that can be seen
• Good managers will probe deeper to see what is really going on
  – Requires technical ability (knowledge)
  – This is one reason Game Designer needs technical knowledge!

Iteration

• Make frequent working builds
  – “We don’t go home Friday until a working build checked in.”
  – Frequency (daily or weekly) depends upon project
• If management asks for latest build, give one from last week
  – Resist desire to show latest-and-greatest
    • Won’t always be bug free, ready to show
  – People will always expect it and leads to unrealistic expectations

Internal Scheduling

• Give detailed design document
  – Make list of all objects (e.g. players, items, NPCs...) that need to be built
  – Mark each as one of:
    • Core – base, fundamental functionality
    • Required – needed for working, playable game
    • Desired – icing on the cake, make game special but not required
• End result:
  – List of features sorted by importance
• Note, doing this planning gets easier the more you do!

Internal Scheduling Structure

• Could start from top of milestone list → Work down and when time runs out, then done
  – Produces whole lot of “complete” pieces, but no whole that works together
  – Makes management (and others) nervous since cannot see it “coming together”
• Better way → since list made in Object-Oriented (OO) fashion, start building objects!
OO Iterative Development – Object Versions (1 of 2)

- Create a Stub version of each object
  - Complete, but empty
  - Perhaps just print out message
- Basic version
  - Placeholder with some properties present
  - Set attributes, minimal functionality
- Nominal version
  - Commercial viable implementation
  - Most functionality in place
  - Tested
- Optimal version
  - State of the art
  - All polish present
  - Thoroughly tested

// Player.h
class Player {
    public:
        Player();
    ~Player();
};

// Player.cpp
#include "Player.h"
class Player {
    public:
        Player();
    ~Player();
};

Stub Nice feature about above development plan? Game will “build” even after Basic version!

OO Iterative Development – Object Versions (2 of 2)

- Some objects (classes) will be simpler
  - Fewer iterations (e.g. Position class)
- Some will be more complex
  - More iterations (e.g. WorldManager class)
- Can say have shippable game when every object at least in Nominal version
  - Working definition of “Good Enough”
- A complete game is one where all objects are at Optimal level

OO Iterative Development – Overall

- But, seems like need to write 3 versions of every object!
  - Yes, but would probably do that anyway with revisions
- Approach
  - Starting with core, then required, then desired, implement Stub versions of all objects
  - Starting with core, then required, implement Nominal versions
  - Code is now releasable
- Only now start to work on desired
- This is breadth-first approach
  - Better than “let’s do the cool bits first!”
  - Always have build-able game
  - Near-continuous growth
  - Can easily show refinement
  - Throughout, better handle on how “complete” game is

Scheduling – Naive

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Scheduling – Better (single programmer)

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Scheduling – Better (multiple programmers)

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Note! This is just one example
Alternate could be to finish Core Nominal before Base Required
Point is to “zig-zag” to bottom corner, with optimal last
Team Work

- Make sure to use skills of each team member well
- Keep everyone busy
  - No waiting, if possible
- Communication vital!
  - Every programmer should be aware of what others are doing
  - Code reviews (for sharing implementation details as much as writing solid code)
  - Joint status meetings (Daily! Even if brief)
  - Documentation (documented code, documented milestones and status, documented bug list)

Scheduling with Iteration

- Shift:
  - FROM: When will it be finished?
  - TO: When will it be good enough?
- "Finished" is meaningless, anyway
- Have definition of "good enough" now!
- Bad estimation often comes from top-down dissection
  - No accounting for learning curve, code revision, or integration
- Iterative development
  - Total time equals sum of the Stub, Base, Nominal, and Optimal levels

Consider Saucer Shoot

- **Core**
  - Ability for player to move ship, fire bullets
  - Saucers move
- **Required**
  - Bullets destroy saucers
  - Saucers respawn
  - Explosions
  - Animated Sprites
  - Game difficulty progresses and game ends
- **Desired**
  - Stars
  - Game start screen, game end screen
  - Score

Consider Dragonfly

- (Note, your development did separate 2a, 2b, 2c "mini-projects")
- **Core**
  - Log file management
  - Game loop with timing
  - Game objects with updates
- **Required**
  - User-input
  - User-defined events
  - Graphics support
  - Collisions
- **Desired**
  - Animated Sprites
  - Efficient scene management (e.g. for collision detection)
  - Multi-colored Sprites
  - Camera control

Group Exercise

- Split into Project 3 Teams
- Make list for your game, with one feature in each list
  - Core
  - Required
  - Desired
- Provide high-level class name(s) associated with each