
© Copyright 2006 Ross A. Brown
Game Speed Industrial Revolution: the Ghost of Henry Ford Rises Again

Ross Brown
School of Software Engineering and Data Communications
QUT
Overview

• Henry Ford?
• Industrial Revolution?
• Digital Asset Manufacturing
• What we are doing at QUT
• Other Industries
• Research and Development
Henry Ford?

- Cars normally hand made
- Started using assembly lines
- Contributed to modern manufacturing
- Can now afford cars
Industrial Revolution?

- Games moved from garage to factory
- Crafted to manufactured games
Industrial Revolution?

- Metaphor for change in game production
- Cottage industries to manufacturing companies
- First revolution used steam
- No steam engines in game companies…
- Except for Valve…
Part Way Complete for Games Industry

- Still in-house tool/engine production
- Shrink wrapped middleware utilised
- Less expertise required due to tools
- Regularisation of work conditions
- Game Factories via acquisitions
Industrial Revolution?

• Compared to ICT industry
• Games industry somewhat different
• Software, art, narrative, design, publishing, entertainment business model
• Evolves in idiosyncratic manner
• General laws of business
Digital Asset Manufacturing

- Manufacture Digital Content – at an industrial scale
- Describes modern manufacturing
- Replaces concept of crafting and guilds…except for WOW
- Term for hardware/shrink wrapped production
- *Digital Asset Manufacturing*: automation of game asset production
Arrayed Forces

- Games is big business
- 2007 – US$35.8 billion @ 11% growth
- 2004 – $535 million in Oz @ 5% growth
- Game ~ around $10-15 million ~ 100 people
- Bigger than … Ben Hur
Arrayed Forces

- Next gen hardware
- Cinematic quality assets
- Skills shortage
- Tight deadlines
- Outsourcing
- Global market
- Profit motives
What we are doing at QUT

• With such pressures on the industry
• Good bet as area for R&D
• From Manufacturing or Engineering perspective
• Integrated into production line
Why?

- ICT research is support infrastructure
- Focussed on Asset Manufacturing support
- Engine technology is bought
- Duplication of effort
- Industry receptivity
- Research impact
Why?

- Engine features translate to er, hype…
- AI is major research field
- Improve efficiency
- More and better games
- Translates into $$$
- “Key to success is putting out games” – Brisbane programmer
- Universities should support local industry
Break it down - like James Brown!

- **Requirements**
  - Story Boarding
  - Conceptual Development Tools

- **Design**
  - Metaphor Mapping
  - Storylines
  - Emotional Content
  - Ontology Verification

- **Development**
  - Software development methods for gaming
  - Workflow Management
  - Asset Management
  - Usability analysis tools
  - Content Creation Tools

- **Maintenance**
  - Monitoring tools
  - Balancing tools
QUT Asset Manufacturing Projects

- Games Usability Visualisation
- Workflow Augmented Digital Asset Management
- Gameplay Workflow
- Affective Story Character Control
- Game Asset Tuning
- Ontology Assisted Game Conceptualisation
Games Usability Visualisation

• **Motivation:**
  – Game balancing
  – Gameplay log data
• **Area: Quality Assurance**
• **Team:** Ross Brown, Penny Drennan, Simon Joslin
• **Industry Participation:** Microsoft, THQ, Pandemic, Halfbrick
Quality Assurance - Usability Analysis

- **Outcomes:**
  - User requirements document
  - **Gameplay Visualisation** approach
  - Wiki (right image)
  - Focus Groups – useful???
Gameplay Visualisation Framework

- Service Oriented Architecture
- Event Model
- Visualisation Techniques
- User Interfaces
- Should fit well with XNA
- Asset usage & data model
Log Specification
Visualisation Specification

Visualisation Specification System

Game Engine Log Build

Game Log Data (XML)

Gameplay Data Viewer

Game Log Data (XML)

Visualisation Spec(s) (XML)
Event Model

- Event Types: Time, Interaction, Emergent
- Gameplay Areas: Immersion, Missions, Social
- Events:
  - Player Movements
  - Players Death Events
  - Design/Player Divergence
  - Content Utilisation
  - Mission Time Frame
  - Mission Groups
  - Mission Outcomes
  - Social Locations
Visualisations - Guild
Visualisations - Health
Visualisations – Content Usage
Visualisations - Movement
In Situ Interface
Aggregate Interface
Programmer Interface

```cpp
{
    public:
    Articulated(LPDIRECT3DDEVICE9 a_pD3DDevice);
    ~Articulated(void);

    private:
    FLOAT m_fLinkLength;
    FLOAT m_fLinkDisplacement;
    FLOAT m_fTwistAngle;
    FLOAT m_fLinkDisplacement;
    FLOAT m_fRotMax;
    FLOAT m_fRotMin;
    FLOAT m_fRotDefault;

    std::vector<std::pair<FLOAT, FLOAT>> m_vecKeyFrames;

    FLOAT m_fTimeOffset;
    int m_nCurrentFrame;

    public:
    void Render();
    void PostRender();
    void Update(FLOAT a_fTimeDiff);
}
```
Progress

• Ran one of two focus groups
• Wiki for focus group attendees
• Gameplay Visualisation Manifesto
• Best Paper at CyberGames 2006
Workflow Augmented Digital Asset Management

- **Motivation:**
  - Films use petabytes of assets / week
  - Games approach this figure
  - Outsourcing of asset manufacture

- **Team:** Ross Brown, Arthur Ter Hofstede BPM Group

- **Area:** All phases
Workflow Augmented Digital Asset Management

- Workflow augmented digital asset management
- Leveraging the research of workflow research group at QUT
- Expressive Yet Another Workflow Language (YAWL)
- Models concurrent processes at enterprise level
Prototype Solution

- Executable game development model
- Data model – arbitrary XML data
- Integrated YAWL with the Subversion Revision Control System
Workflow Augmented Digital Asset Management

- Distributed game development workflow
- Outsource asset creation
- Multi-studio asset coordination
- Better management/analysis of assets
- Alien Brain...with brains
Amazon’s Mechanical Turk

- Back end for work tender system
- Like Amazon’s Mechanical Turk
- Human Intelligence Tasks
- Modified for Games Industry
Gameplay Workflow

• Motivation:
  – Mission/Quest design is a large component of online gaming
  – Design and edit own quests and missions
  – Missions are like workflows within games – Gameplay Workflow

• Team: Ross Brown, Arthur Ter Hofstede, BPM Group

• Area: Game Maintenance, Development
Gameplay Mission Authoring Tools

- YAWL as a Gameplay Mission control tool
- Mission Control Service Provision
- Provides diagrammatic interface
- Specification of non-trivial workflows
- Allows user mission creation
Gameplay Mission Authoring Tools

- Large, concurrent, non-linear workflows
- Enterprise scale
- Becomes a mission service
- Sounds like WOW
- Paper at CyberGames [4]
Example Location-based Game

- “Scoot” team from QUT implemented Spy game
- SMS based location dependent game
- YAWL able to cope with complex logic
Half Life 2 Interface

Half-Life 2 Work List Handler

Half Life 2 SDK

YAWL Env

YAWL Env API

YAWL Talker

YAWL Talker API

YAWL Int. B

Yawl Workflow Engine
Example Half-Life 2 Mod
Affective Story Character Control

• Motivation:
  – Modelling of believable personalities
• Area: Development Phase
• Team: Wen Poh-Suh, Binh Pham, Dian Tjondronegoro
Affective Story Character Control

- Story scripts similar to storyboards
- Big Five Circumplex (AB5C) Model
- Hierarchical fuzzy rule-based system
- Personality body language control
Affective Story Character Control

- Performs personality-based postures and gestures
- Story interface motivates personality
- Ultimate goal: high-level control
Game Asset Tuning

• Motivation:
  – Tristripping always an issue
  – NVTristrip is good
  – Thought we could do better

• Team: Kieren Lord, Ross Brown

• Area: Game Maintenance
Games that Tune Themselves?

- Used Genetic Algorithm (GA)
- Tuned parameters of NVTristrip
- Cache usually 12ish
- Nonsense caching parameters 195 & 85
- Created better strips
- Treats hardware like black box
- Eases the cross platform asset issues
Game Installation Tuning

- Configures itself to hardware specification
- Extension of present LOD
- Improves itself over time
- Reports results back to company
- Less time spent tuning games
Ontology Assisted Conceptualisation

• Motivation:
  – Verify game world
  – Design time error prevention

• Area: Game Design, Conceptualisation

• Team: Kevin Khoo, Ross Brown, Kerry Raymond
Ontology Assisted Conceptualisation

- For communicating knowledge structures
- Used in software engineering
- Explored prototyping game worlds
- High level conceptual representations
Concept Design Tools

- Analysed: Competitiveness, Economy, Character Motifs and Quest Structures

Diagram:

- Game Resources
  - Consists-of
  - Currency
    - Consists-of
    - Primary Currency
    - Consists-of
    - Secondary Currency
    - Consists-of
    - Raw Materials
    - Consists-of
  - Consists-of
  - Items
  - Consists-of
  - Goods

QUT
a university for the real world

CRICOS No. 000213J
Collaborative Design Tools

- Inspiration from argument visualisation
- Describe **well formed** game world
- Structure validated at conceptualisation
- Game argumentation tool
Other Industries

- Mining
- Agriculture
- ICT Industry
- Phases of mechanisation
- Competition from outsourcing/importation
- Component of strategy is R&D
Onto the Front Foot about R&D
Research and Development

- Part of sustainable industry
- Correlated with economic growth [1]
- Gives good returns - 22% [2]
- Successful industries: agriculture, mining, ICT
- Struggling industries – sugar industry
Research and Development

• Hold game IP in Australia
• Saves on duplication
• Shared risk
• Cost savings
Research and Development

- Constrained to bottom line
- Outcomes approach
- Games industry focussed
- IP generates income/control
Research and Development

- Effects scale
- Led by Games Industry
- Not research providers
- Government stakeholder
- R&D houses tender expertise
- Harmonises with industry initiatives
- *Research Brokerage Centre*
Example Research Brokerages

- Rural Industries Research Development Corporation (RIRDC) - www.rirdc.gov.au
- Sugar Research Institute (SRI) - www.sri.org.au
AMIRA 2006 Case Study

- Association of minerals companies
- Develop, broker and facilitate collaborative research projects
- Three Key Projects – Net Present Value 191, 8, 10 million dollars [3]
- Additional – Net Present Value 10, 32, 35 million dollars
AMIRA 2006 Case Study

- Sponsor Budget – $49 million and matching
- 68 Individual and 17 Group Members
- 23 out of 47 Australian research centres
- Universities and Industry
- International Members
- IP negotiated contract work
- Strategic work
Conclusion

• Many forces affecting industry
• Digital Asset Manufacturing R&D
• QUT example projects
• R&D Brokerage
• A key to competitive industry
References

  http://www.interacademycouncil.net/CMS/Reports/9866.aspx

• [2] Tsai, Kuen-Hung and Wang, Jiann-Chyuan, "The R&D Performance in
  Taiwan's Electronics Industry: A Longitudinal Examination". R&D
  Management, Vol. 34, No. 2, pp. 179-189, March 2004 Available at SSRN:
  http://ssrn.com/abstract=513919


  Approach, CyberGames 2006

  GRAPHITE 2005

  Designers, CyberGames 2006