EXTENDING SOFT MODELS TO GAME DESIGN : FLOW, CHALLENGES AND CONFLICTS

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ABSTRACT
Challenge and conflict are elements that all game designers strive to engineer into their games. Research shows that challenge is what drives a high proportion of games players yet there are few published tools that can be used to assist the game designer in constructing useful challenges and conflict leading many new game designers to resort to the 'tried and trusted' techniques used in previous games and hence limiting the originality of new games. In this paper we apply the Soft Systems Methodology to game design and assess its suitability as a tool for structured idea formulation in games.

Keywords
game design; idea formulation; soft systems modelling; designing challenges and conflict

INTRODUCTION
Computer games are creative and innovative artefacts that exploit interactivity to form a new genre in entertainment; interactive digital entertainment. Creating compelling games evolves from a primary source; creative and innovative ideas. Creativity is a process of exploration and exploitation of knowledge and experience with the aim to generate ideas that are original, novel, useful, relevant and possess adaptive value [8]. Though creative thinkers are able to formulate ideas for a given scenario in a timely manner, sometimes it requires numerous cases of trial and error before a truly novel idea can be formulated [10].

Soft Systems Methodology (SSM) aims to improve the areas of social concern by learning about a system through an iterative process with constant debates made to reflect on the real world reducing the whole problem area into smaller and manageable problems to develop a full understanding on the system [4].

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Computer games share many common characteristics of a social system but they are designed within a controlled environment. Computer games are (often) goal-driven interactive entertainment that incorporates challenges and conflicts to achieve a pleasurable emotional and intellectual engaging simulation [3][5]. This paper proposes the use of Soft System Methodology as a tool to design challenges and conflicts for computer games. In Section II we look at the roles of challenge and conflict before we take an in depth look at soft systems in Section III. In Section IV we step through the seven stages of an SSM approach and apply this to the Pac-Man game and draw some interesting conclusions in Section V.

CHALLENGE AND CONFLICT IN COMPUTER GAMES

The Need for Challenge in Computer Games

Computer games are a form of play that engages players to solve problems within an imaginary world. While the objective of playing games is to experience fun through the interactions within the imaginary world, games should possess lower level goals and elements that can raise the complexity to achieve these higher level goals [3]. Challenges invite the participant to be involved in an action or series of actions that can distinctively justify their superiority in mastering it. According to the Interactive Digital Software Association 2002 consumer survey, 71.4% of gamers play games because they are challenging [6]. Overcoming such challenges introduces the sense of accomplishment and satisfaction to gamers that will eventually enhance the fun factor in the game prolonging the hours of game play and increasing the value of the game.

Conflict Intensifies Challenge

Conflict presents a disagreement that often requires a series of challenges to be overcome in order to resolving it. In addition to initiating challenges of a different dimension, conflicts intensify challenges posed to gamers with a model opposing the gamers' objectives [4].

THINKING OF SYSTEMS

A system is a complex matter or set of matters that work together in an organized manner to achieve certain objectives.

Systemic thinking considers the problem as a whole to perceive a clear concept of the "system" context defined or to be defined. Properties, attributes and functions within the system should be identified and links between elements should be defined and organised to ensure it serves a purpose, which will lead to the defined objectives.

In the real world, systems can be either *hard* or *soft*. Hard systems are man-made systems with predictable behaviour which can be engineered to serve some purpose, whereas soft systems tend to inherit uncertainty and are less predictable.

If we analyse the definition of soft systems, computer games do not qualify to be categorised as such. However if we analyse from the design viewpoint, the initial game idea may qualify to be considered as a soft system. In typical game design activities, the game designer is required to imagine the game, define the way that it works, describe its internal elements and communicate this information to others [1]. In most game design texts, the authors always place emphasis on imagining a game idea as a story and associated mechanics (game rules) and the interactivity (gameplay) e.g. [1][5][9].

DESIGNING CHALLENGES AND CONFLICTS FOR COMPUTER GAMES USING SOFT SYSTEM METHODOLOGY

Soft Systems Methodology is an approach based on the theory of systemic thinking to study the components of, and relationships with, one another within the system in order to develop understanding about the system. We advocate SSM in the process of designing challenges and conflicts in computer games.

Checkland's Formal Systems Model

The Checkland's Formal Systems Model defines a set of properties, which represent human activity systems. Checkland defines: "A system has a purpose(s), its performance can be measured, there is a mechanism for control, it has components, its components are related and interacting, it exist as a part of a wider system(s), it has a boundary, it has its own resources and it has an expectation to be adapted to."

Earlier we introduced the term "imaginary social system" and argued that computer games are soft systems. A level within a game can be considered as an imaginary social system because it allows gamers to interact with other characters. Therefore we can model a level within a game as an imaginary social system and apply SSM to it. Checkland's Formal Systems Model properties are represented in appropriate game terminology illustrated in Table 1 below.

Table 1: Checkland's Formal System Model in Game Terminology

Formal Systems Model	Game Level
Purpose(s)	Level objective
Performance measurement	Game statistics
Mechanism for control	Game rule
Components	Level objective
Relationships and Interactions within Components	Game play, Conflicts and Challenges
Exist as a sub system	Game
Boundary	Scope of the level
Resources	Game object
Expectation of continuity and adapt or recover from disturbance	Save state

The Seven-Stage Model of SSM

The initial model of SSM was defined as a seven-stage model back in the mid 1970s and is illustrated in Figure 1.

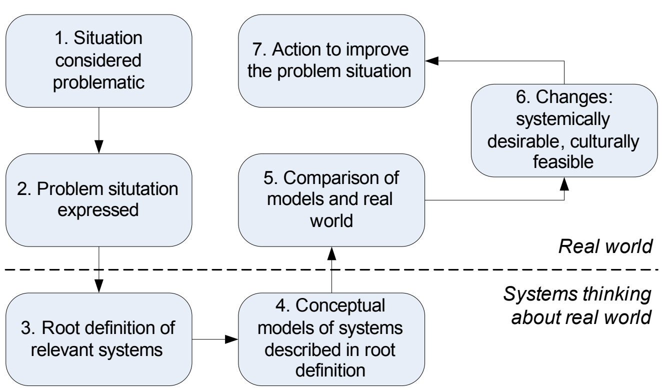

Figure 1: Checkland's Seven-Stage Model of SSM

In the process of designing games, we can also adopt such a model to improve the game play. In the following sections we will use this model as a framework to design challenges and conflicts within the game.

Stage 1: Consider the problematic situation

Level design requires designers to model the situation considering the properties presented in Table 1. If we perceive game design as system design, levels are similar to modules within a system and a game designer is required to design these modules to enrich the game in any given situation by incorporating interactions and details that can bring the situation into "reality".

Stage 2: Problem situation expressed

Analysis of any given problem situation requires a strong understanding of the given problem area to ensure appropriate solutions can be formulated. Checkland's seven-stage model uses the notion of a Rich Picture™. In the context of game design, visual representation helps the game designer to visualise the game better than textual descriptions.

We will use the Pac-Man game as an example. The "social system" in this context is rather simple. The game idea can be illustrated in Rich Picture form similar to that shown in Figure 2. Game designers can focus on the relationships between each entity within the game and think about the possible issues that can rise from such relationships (denoted by .) that can cause Mr. Pac-Man not to complete the objective.

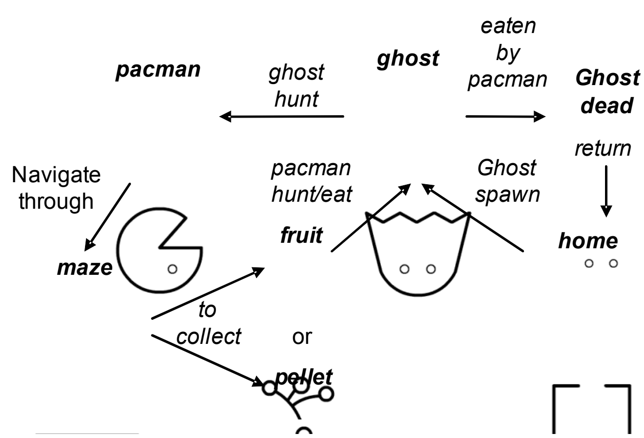

Figure 2: Pac-Man© Game Represented in Rich Picture™

Stage 3: Root definitions of relevant purposeful activity systems

The Root Definition (RD) provides a short textual description of the purposes and transformation processes of the system to be modelled according to the system's principles (rules within the system being modelled).

The formulation of a root definition requires the practitioner to think about the transformation process which tends to change the form of input into output. CATWOE analysis (see Table 2) is a technique devised by Checkland to aid the formulation of coherent and comprehensive root definitions.

Defining root definitions requires SSM practitioners to identify the activity systems within the scope of the problem area by analysing the Rich Picture™. In SSM, there are two kinds of relevant systems; "primary-task system" and "issue-based system". In the context of computer games, a primary-task system is man-made system which can be defined as the activity systems which serve the main objective of the game. Examples from the Pac-Man game are the "Mr Pac-Man collecting fruit or palette", "Mr Pac-Man navigating through the maze", etc…. An issue-based system is defined as a problem area which inherits subjectivities which could not be modelled directly from the real world. Once the relevant systems activity has been identified, it can then be analysed using CATWOE analysis to ensure the root definition is valid and relevant.

Table 2: The CATWOE Mnemonic

CATWOE mnemonic		Description
C	Customers	The victims of beneficiaries of T
A	Actors	Those who would do T
T	Transformation process	The conversion of input to output
W	Weltanschauung	The worldview which makes this T meaningful in context
O	Owner(s)	Those who could stop T
E	Environmental Constraint	Elements outside the systems which it takes as given

In the context of this discussion, we would like to use CATWOE analysis to structure the user's thinking in the given scenario in order to introduce challenges and conflicts to the game.

Let's consider the "Mr Ghost is hunting Mr Pac-Man" activity system as an example. The transformation process is defined as "Mr Pac-Man is alive . Mr Pac-Man is dead" with the belief that Mr Pac-Man should be hunted in order to raise the challenge in the collection of pellets and fruits while navigating through the maze. Once the transformation process and *Weltanschauung* are defined, we should then think about the other constraints. The CATWOE analysis for the "Mr Ghost is hunting Mr Pac-Man" activity system based on the original game idea by Toru Iwatani is presented in Table 3.

Table 3: CATWOE Analysis for Hunter-Prey Scenario

CATWOE mnemonic		Analysis Made
C	Customers	Mr Pac-Man, Mr Ghost
A	Actors	Mr Ghost
T	Transformation process	Mr Pac-Man is alive . Mr Pac-Man is dead
W	Weltanschauung	The belief that Mr Pac-Man should be hunted in order to raise the challenge in the collection of pellets and fruits while navigating through the maze.
O	Owner(s)	Mr Pac-Man
E	Environmental Constraint	Insufficient time to complete the objective. Complexity of the maze. Placement of fruits on the maze.

The CATWOE analysis has provided sufficient information for naming the activity system to be modelled. Based on the definition schema, the root definition for the activity system being modelled (the "Mr Ghost is hunting Mr Pac-Man" activity system) is as follows;

An intelligent hunting system with Mr Ghost(s) to hunt Mr Pac-Man, by increasing the speed of Mr Ghost(s) as well as the ability to strategise and hunt in a group in order to complicate the process of collection.

In the context of game design, the environmental constraint(s) serve as challenges within the game. The activity system represented in the root definition also defines conflict which can introduce a different perspective of challenges.

Stage 4: Conceptual models of systems defined in root definition

In the stages of SSM, practitioners are required to model the system defined in the root definition from the previous stage by building a conceptual model of the activity system. Here is a conceptual model built from the *intelligent hunting system* root definition outlined above:

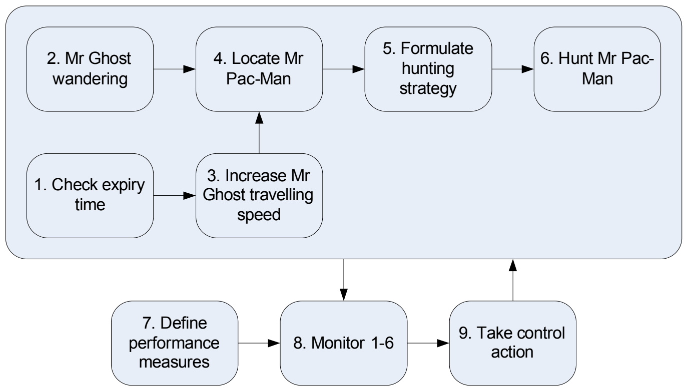

Figure 3: Initial Conceptual Model for Intelligent Hunting System Root Definition

An essential property within a system defined by Checkland is performance measurement which lacks in the conceptual model presented in Figure 3. SSM defines performance measurement in terms of *efficacy*, *efficiency* and *effectiveness* with its well-defined definition presented in Table 4.

Table 4: Three E's for Measurement of Performance

Criteria	Definition
Efficacy	"Does the system work?" — A logical prediction made onto the system determining the operational feasibility of the transformation process.
Efficiency	"The amount of output divided by the amount of resources used" — A cost benefit (not necessary monetary) comparison on the resources used and results obtained from the system.
Effectiveness	"Is the Transformation meeting the longer term aim?" — A judgemental prediction made onto the system determining the success towards achieving the aim(s) defined.

While the goal of designing challenges and conflicts is to enhance the fun aspect of playing games, measuring the performance is necessary in order to achieve a well-balanced game play. The revised conceptual model of the *intelligent hunting system* root definition incorporating the 3 E's for measurement of performance is presented in Figure 4.

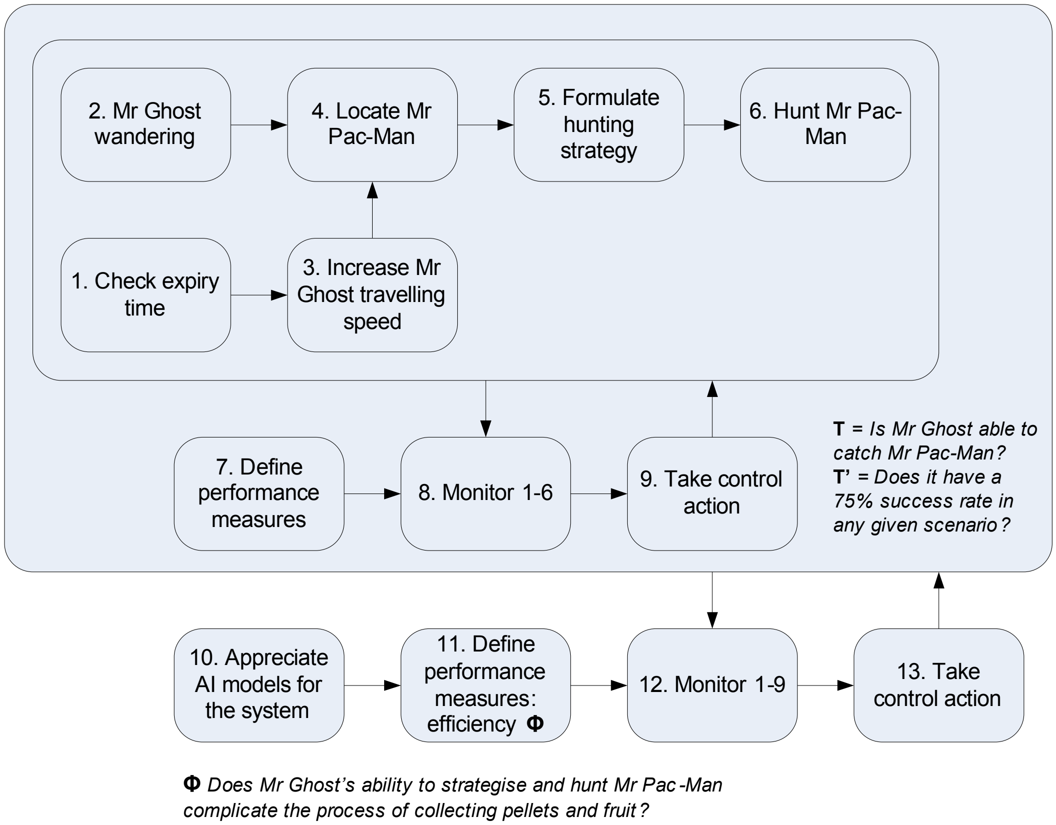

Figure 4: Final Conceptual Model for Intelligent Hunting System Root Definition

Stage 5: Comparison of models and real world

The early stages of SSM begin with problem definition followed by a series of analyses to gain understanding about the actual problem area and formulate solutions. The output from each stage (root definitions, CATWOE analysis, conceptual model and measurement of performance) is reviewed by comparing conceptual models developed with real world situation ensuring the activity systems are thoroughly analysed [7].

Considering the *intelligent hunting system*, game designers can use any hunter-prey scenario as a model to benchmark the conceptual model developed. Examples of some real world models are the wolf-pack hunting model and closed-exit hunting model illustrated in Figure 5 and Figure 6.

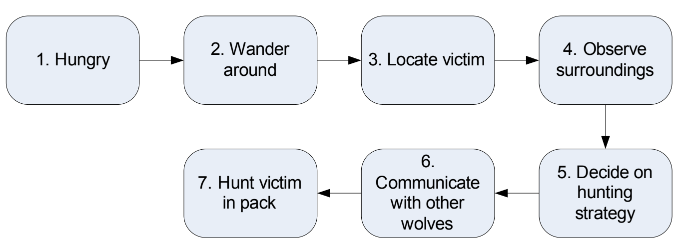

Figure 5: Wolf-Pack Hunting Model

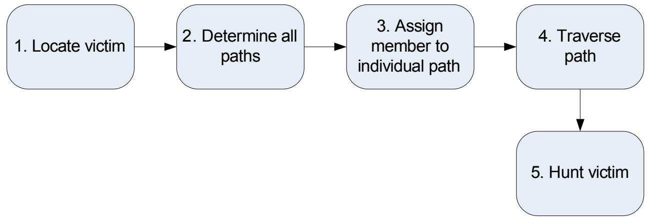

Figure 6: Closed-Exit Hunting Model

Comparison of various hunter-prey scenarios can provide insightful information which can then be used for improving the conceptual model. Though this paper only discusses a subset of activity systems identified from the Rich Picture, there are other activity systems to be compared with its related real world model. A list of activity systems identified from Figure 2 with its relevant real world model is presented in Table 5.

Table 5: List of Activity Systems and Relevant Real World Model from Pac-Man

Activity Systems	Real World Model
Mr Pac-Man collecting fruit or pellet	harvesting scenario
Mr Pac-Man navigating through the maze	maze scenario
Mr Pac-Man is hunting Mr Ghost	prey-hunter scenario
Mr Ghost spawned	resurrection scenario

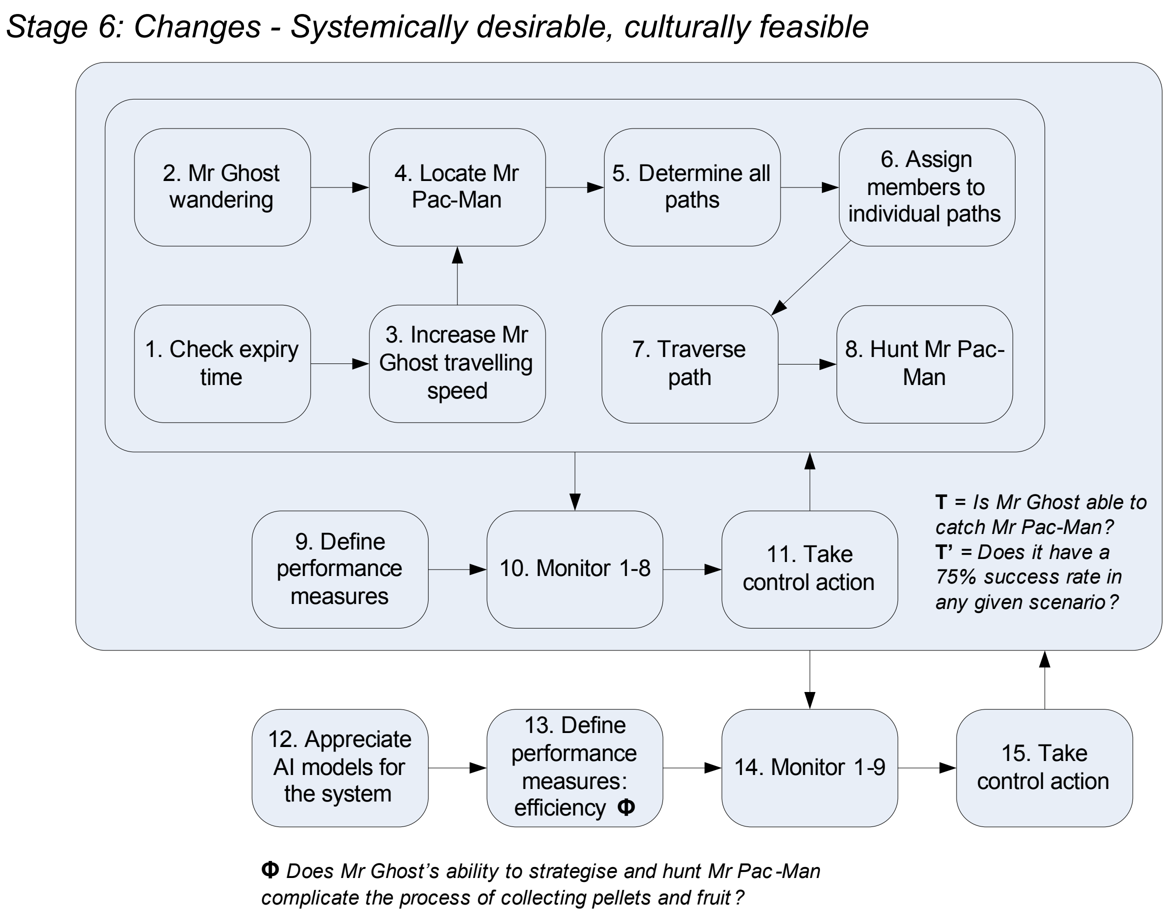

Figure 7: Improved Conceptual Model for Intelligent Hunting System Root Definition

In the seven-stage model, recommendations collected from stage 5 are used as suggestions for improving the real world situations. This should be based on the logic of the conceptual models developed in stage 4 by considering the systemic desirability and cultural feasibility of such changes proposed. However in the context of game design, the approach is reversed to yield a fun and entertaining simulation by using the real world situation logic to improve the conceptual models.

Considering the intelligent hunting system, the conceptual model presented in Figure 4 may seem to be generalised, especially activity 5, *formulate hunting strategy*. The improved conceptual model for the *intelligent hunting system* is presented in Figure 7.

Stage 7: Action to improve the problem situation

The final stage of SSM simply signifies the end of the methodological approach in developing understanding the problem area in order to propose improvements. In the context of designing challenges and conflicts for games, the final stage represents the beginning of the development of interactive entertainment. Game designers may undergo a few more cycles of the seven-stage model to gain more information and further refine the proposals of improvement through logical analysis, prototyping, play testing and finally tweaks that will eventually balanced the challenges and conflicts posed before the design is being finalised.

CONCLUSION

In this paper, we have introduced a methodological systemic approach, Soft Systems Methodology to gain understanding on an ill-structured problem area through an iterative process of logical reasoning. In this context, we exploit the structural and constructive methodology to aid game designers in designing better games by means of introducing appropriate challenges and conflicts within constrained situations where elaboration of an initial game idea is required. Further research in this area is focusing on the design of a generic game design-oriented methodology based on systemic epistemology. We are also investigating the application of other systemic models such as Stafford Beer's Viable Systems Model [2] and how this model of organisational behaviour can be applied to computer game worlds.

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