

Deliberation using Three Dimensions

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ABSTRACT

Three dimensional games are compelling and provide a forum for interactivity and engagement. A dramatically different environment from typical settings for the discussion of issues in addition the interactivity and all-engaging nature of the 3D environment is expected to facilitate deliberative attitudes. Complex reasoning if represented in a 3D environment is likely to be more compelling and interesting than the same issue represented using other means.

Categories and Subject Descriptors

I.2.1 [Applications and Expert Systems]: Games; I.3.7 [Three-Dimensional Graphics and Realism]: Animation; I.2.4 [Knowledge Representation Formalisms and Methods]: Predicate logic; H.4.2 [Information Systems Applications]: Decision support

General Terms

Computer Games, Structured Argumentation, Online Dispute Resolution, Decision Support, Deliberation

1. INTRODUCTION

Deliberation involves a discussion of all sides of a question by two or more participants seeking to determine the best course of action for all. This involves accepting all points of view as valid and, without powerplays, dominance or ulterior motives work through possible solutions until one is found that all agree is the best outcome given current constraints.[6] Deliberation is typically absent from discussions involving controversial issues of current affairs. For example, an issue currently topical in Australia, revolves around the introduction of nuclear power generation. Discussions are typically polarized around camps strongly advocating one position or another with little sense of deliberation despite advantages identified by [2] that include improved decisions and a sense of engagement.

Walton and Krabbe[6] classify basic types of human dia-

logues including deliberation, persuasion, inquiry, eristic, heuristic and information-seeking dialogues. Natural dialogue typically shifts from one type of discourse to another in any conversation yet, according to our anecdotal experience, deliberative dialogue is the most difficult to perform for most individuals and groups, despite clear benefits.

In this paper we adopt a three-dimensional environment to facilitate deliberation. The environment includes a representation of key concerns within the sample issue; the introduction of nuclear power generation. Player/participants move to each concern where detailed information is available. They assert their own beliefs and view the beliefs others have asserted. The dramatically different environment from typical settings for the discussion of issues in addition interactivity and all-engaging nature of the 3D environment is expected to facilitate deliberative attitudes even though, ironically, the 3D environment adopted, is more often used for hit and shoot games.

The study is also motivated by a pedagogical objective. Complex information is often conveyed in narrative form to increase learning outcomes. For example, scenarios are widely used in medicine as case studies are in law. Stories are generally thought to be compelling because of the high degree of engagement an individual can have with the story. A enthralled listener identifies with characters and is engaged by the setting of the story and the dramatic points of the plot. A listener is rarely passive as the imagination creates multiple plausible story lines and produces an interactive relationship between story and listener. This interactivity and engagement is in such contrast to the detached abstractions of reasoning and argumentation. The 3D game environment provides a forum for interactivity and engagement that seems as immediate and compelling as a narrative. This means that complex reasoning, if represented in a 3D environment is likely to be more compelling and interesting than the same issue represented using other means.

The field of study selected involved introduction of nuclear power stations in Australia. This was selected because it is current, complex without being too complex and is reasonably emotive. Arguments for and against this form of power generation are involved. An argumentation based scheme is first adopted to structure the issue into sub-arguments. Following that, the environment constructed here using the Unreal Game Engine¹ includes zones that represent sub-

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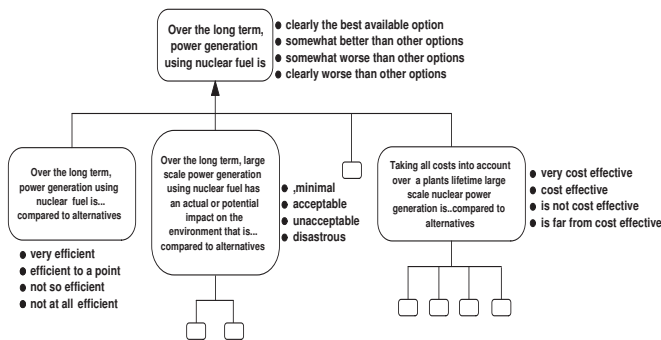


Figure 1: A generic argument tree for Nuclear Power

arguments.

The argumentation representation is described in the next section of this paper. Following that the game environment is described before concluding remarks.

2. STRUCTURED ARGUMENTATION

In recent decades, techniques have been developed to structure reasoning, typically diagrammatically so that complex reasoning can be made more accessible. IBIS (Issue-Based Information System) captures reasoning as issues in contention, positions that can be taken on issues and pro and con arguments associated with positions [3]. In contrast, the Toulmin Argument Structure (TAS) identifies six elements fundamental to all arguments; claims, data, force, warrant, backing and rebuttal [5]. Although, Stephen Toulmin's main objective was to illustrate that scientific reasoning was more a kind of generalized jurisprudence than the result of logical deduction, the argument structure he described is used in numerous settings to organize complex reasoning. Numerous computer implementations of that enable a user to diagrammatically represent reasoning using IBIS, TAS, hybrids or variations have been advanced.

An approach for representing knowledge called the Generic Actual Argument Model (GAAM) advanced by [7] has been applied to the development of numerous decision support systems and data mining exercises. An argument tree is a structure central to the representation of knowledge in the GAAM. Figure 1 illustrates part of one of the trees elicited in the nuclear power study. The root node of Figure 1 (top) represents the uppermost claim in the tree concerned with inferring whether nuclear power generation should be introduced commercially. The claim values for this node reflect four possibilities; nuclear power is clearly the best option, somewhat better than other options, somewhat worse than other options and clearly worse than other options. A claim value is inferred from four main factors representing efficiency, impact on the environment, reliability and cost. The environment and the cost factor are decomposed into a subtree. Figure 1 illustrates 11 nodes or factors. The 3D environment implements a zone for each factor.

In the following sections elements of the design of the 3D environment are described.

3. SAM

In this section, the Structured Argumentation Model, SAM is introduced. Using the object-oriented UnrealScripting language for the Unreal Game Engine, a three dimensional decision support application that facilitates effective dialogue is described.

SAM game design draws from a structured argumentation tree where knowledge is represented in nodes. Nodes contain essential arguments for a discussion about a matter in question.

3.1 Implementing SAM Structure

The SAM three dimensional game world is designed from an argument structure. Player avatars move around the game world, examining and deliberating on arguments represented by game zones.

Each game zone provides interactive objects a player uses to make an assertion that best represents his or her point of view about the issue in question for the zone. For example, a zone in the Nuclear Energy application has a set of objects that each clearly represent an assertion the player may make. By interacting with the appropriate object, a player is able to indicate a point of view.

When players make claims for a zone argument, the claims are processed by the game engine to determine points of difference and points in common.

Where different points of view exist, the supporting data zones (child nodes of the argument tree) are explored and deliberated. If agreement for a zone argument is found, deliberation on the supporting arguments is not necessary, so players then move freely to another zone. In this way, deliberation of core issues for an argument node can occur. Actual dialectic exchange can occur within the game chat space, implementing Yearwood and Stranieri's two tiered dialectic structure[7]. This aspect of a SAM design is discussed in more detail in the following subsections.

3.2 Decisions

What makes a *thing* into a *game* is the need to make decisions[1]. In-game goals motivate players to improve their player character. The character is improved by the type of decisions that the player makes, but whatever mechanism is used to enable character improvement, character improvement as a goal remains fundamental[1] to a successful game. A SAM game provides an environment where improvement of the player character is aligned with improvement in the player's real-world. Through decision making and deliberation in the game, a SAM player is better prepared to make effective and prudent decisions in the real-world with a greater understanding of the key issues resulting in improved outcomes.

In SAM, participants are often involved in emotionally-charged struggles. The goal is not to vanquish an enemy, but by heeding the call to adventure, return to the ordinary world with the treasure or lesson in a spirit of reflection and deliberation. Games are ultimately about character development after challenge and struggle. The Homeric Odyssey, the standard narrative, has the protagonist struggling against obstacles at each turn and growing as a person in the quest for the ultimate goal and these obstacles or ordeals need



Figure 2: SAM decision teapot objects

not be the villain or the monster. In a SAM application the challenge is to overcome obstacles in socially engineered communication and the player's own feelings in the quest for a satisfactory resolution of issues.

3.3 SAM Deconstructed

This section discusses the generic elements in a SAM game design. The Unreal development environment provides some generic modules easily modified by game designers. SAM adds sets of generic objects that can be re-used or modified for deliberative dialogues.

Unreal Objects

1. UnrealEd provides meshes to build an environment, also called a *level*.
2. Extendable classes for player, bot, mutators and so on
3. Player Characters
4. Chat

SAM Objects and Attributes

1. Claim class objects. Each class contains sets of class variables, meshes, textures, models and sound files. These can be set using UnrealEd's properties dialog and texture mapping can be done within UnrealEd. Each instantiation of a class object represents one of the set of possible assertions a player can make. Figure 2 illustrates a set of claim objects and Figure 3 shows the properties dialog for the *ILikeYou* class. Class variables are set or overwritten by any of the class objects. On touch, the claim value is added to the player data store.
2. The Structured Argument Tree contains the dialectical rules for a deliberative dialogue. Game design must be informed by this structure. Claims in supporting data branches are made by players where points of difference in opinion within a zone claim exists.
3. Navigation provides players with choices. A player can walk around the game, but walkways and ladders are limited. Instead, SAM uses a series of jump pads, teleporters and other Mover Class features enabling players to fly to a specified location.



Figure 3: Properties dialog for the *ILikeYou* class

4. Heads Up Display (HUD), provides game information statistics. This is a modification of the Unreal HUD game statistics screen display. Instead of number of kills and deaths, SAM provides a player's personal record of claims set. Additionally, a game wide screen display shows the state of claims agreed, disagreed or not yet deliberated.

3.4 Dialogue

In this subsection an example dialogue for the Nuclear Energy application is described. The Nuclear Energy dialogue can be between two or more players who have agreed to deliberate about the long term usage of nuclear fuel. As well as selecting a claim value object in key argument zones to record their points of view about that issue, actual deliberative dialogue can occur via the generic Unreal Tournament chat module. Dialogue shifts can occur at this point as players are free to use persuasion and negotiation dialogues to advocate their own points of view. Players may freely engage in dialogue or not engage. Hot keys are also enabled for players to send messages via the screen.

A dialogue commences by players agreeing to discuss the impact of large scale power generation on the environment. Player one may assert that this type of power generation is acceptable compared to alternatives. Player two might assert that it is disastrous compared to the alternatives. Since they do not agree, they move to a zone containing a supporting argument. This zone may deal with the issue of the impact on plants and wildlife. One player may claim that the impact of large scale power generation on plants and wildlife is acceptable. Another player may claim that is disastrous. Since they do not agree and there are no supporting arguments, a point of difference is logged. The players may communicate via short screen messages and then to discuss the issue in more detail by exchanging views via the chat facility.

One player may have more persuasive arguments that result in an agreement about the issue. They can then decide to move to a higher level zone argument that deals for exam-

ple, with the cost effectiveness of large scale nuclear power generation. This process continues until all key issues have been deliberated.

Having deliberated on the key domain arguments for large scale nuclear power generation, a group of participants are now better able to reach a consensus about a possible action or point of view the group may take. The benefits of this is a democratic decision process where all voices and opinions can be heard without hierarchical power plays and with a greater sense of involvement.

4. CONCLUSION

A 3D environment developed with the Unreal Game Engine has been described that has, as its aim, the facilitation of deliberative attitudes when players explore issues of current affairs. Future work aims to fully implement the environment and to perform empirical evaluation to identify pedagogical and/or other benefits. The approach has natural application in Online Dispute Resolution (ODR) and mediation processes and future work is planned in this direction using an argumentation representation of property proceedings in the Family Court of Australia that was originally developed for a decision support system called Split Up [4]

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