

INTERACTIVITY OR NARRATIVE? A CRITICAL ANALYSIS OF THEIR IMPACT ON INTERACTIVE LEARNING

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ABSTRACT

This paper investigates methods to maximise the benefits of interactivity in the context of computer-based learning applications. To achieve this, the analysis initially reviews the factors which to date have defined interactivity and some recent assessments of its impact, with a subsequent assessment of interactivity in terms of three alternative components – narrative, play and agents. Commentary on perceived problems with interactivity are also discussed. Based on this analysis, the major finding is that mutual reciprocity, a critical element of interactivity, is not manifested in applications and that the introduction of elements of narrative and play have the potential to alter the dynamic of the interactive process. Of greater impact too is the potential to integrate the interplay between designer and learner into the interactive engagement. By integrating these elements, a revised model of the interactive environment is proposed, based on mutual adaptation by designer and learner. By developing our understanding of the complexity of interacting elements which impact the interactive process, we will take another step towards a truly interactive environment.

KEY WORDS

Interactivity, narrative, effective learning.

1. INTRODUCTION

This paper examines the concept of interactivity and, in terms of computer-based learning applications, the extent to which its characteristics contribute to the overall effectiveness of the learning experience. Throughout the discussion, the concept of interaction focuses on that which takes place between the human user or learner and the technology compared to that manifested through human:human communication embodied in on-line learning.

To provide a context for the analysis, the discussion initially reviews the factors commonly linked with computer-based interactivity in terms of their impact on the effectiveness of learning. By comparing the positive and negative potential of interactivity within this context, the major assessment focuses on the concepts of narrative, play and agency and the extent to which their characteristics might be applied to better understand interactivity. Through developing this analysis, a model of the interactive process is presented to enable more effective technology-based applications for learning to be developed.

2. REASSESSING INTERACTIVITY

2.1 THE INTERACTIVE WORLD

Interactivity, in the context of computer-based learning, can range from simple navigation through web-pages to the immersion in interactive virtual worlds with access to alternate realities. It is often portrayed as the distinguishing factor of the new media, with the assumption that “interactivity in a computer product means that the user, not the designer, controls the sequence, the pace, and most importantly, what to look at and what to ignore” (Kristof & Satran, 1995). While this holds true for recreational or information-seeking activities, the value of control for educational pursuits is less clear, as there are conflicts between the value of control for new learners as well as questions regarding the overall prescriptions for control identified through research findings (Reeves, 1993).

The overall aim of this discussion is to develop a better understanding of interaction in terms of the factors which inhibit or enhance content engagement, and the communication or transfer which results in deep processing and consequential learning. When considering technology-based learning the significant factor is the engagement which takes place between the learner and the content, and the extent to which there is a change, manifested through learning, skill formation or knowledge acquisition resulting from that engagement.

However, interactivity as a determinant of effective learning has yet to be fully established, based on analysis of a range of sources including theoretical limitations, research credibility and the variety of interactive constructs. For example, Whitby (no date) describes the vision of the future home with a video wall of sports, interactive access to player profiles and holographic video-phones. While acknowledging the popular appeal of this scenario, Whitby (no date) questions whether people really wish to interact that way and concludes:

... we are rushing to implement interactive CDs, cable shows and personal electronics in the crudest ways without pausing to consider whether an improved medium will result. Storytelling and narrative lie at the heart of all successful communication. Crude, explicit, button pushing interaction breaks the spell of engagement and makes it hard to present complex information that unfolds in careful sequence.

In this scenario, the problems confronting educational technology developers are clearly defined - how to develop computer-based environments to engage the learner in effective instructional communication without generating *interactive interference*? In addition, Whitby (no date) also introduces the notion that storytelling and narrative are critical determinants of communication, which is the ultimate goal for educational multimedia applications.

2.2 INTERACTIVE CHALLENGES

In addition to the impact of internet communication in the tertiary environment, the development of stand-alone computer-based learning applications is widespread and often a critical business risk. As we continue to research and develop computer-assisted learning applications, it becomes clear that there remains much to learn about the nature of interactivity and implementing its components effectively and appropriately. In noting that complexity comes with the freedom associated with learner control, Kirsh (1997) asserts that there are additional restrictions resulting from the scripting of applications which require the user to adapt to their structure, with the suggestion that:

Since interactive interfaces ought to foster this type of coordination between improvisation and planning we need to discover better theories of what is involved in the dynamic control of inquiry, line of thought, and action more generally. We need to discover more open-ended models of coherence and narrative structure (Kirsh, 1997).

While acknowledging that one solution is to scaffold a learning environment to support rather than direct, Kirsh (1997) argues that an analysis of the nature of interactivity in terms of reciprocity between the two parties (designer and user) suggests that “computer interfaces are rarely interactive because the programs that drive them are rarely intelligent enough to behave as tacit partners”. In this instance, as well as the observation by Whitby (no date), the concept of narrative for coherence is introduced, which Kirsh (1997) believes might be resolved through the application of a modified decision-cycle theory.

From a different perspective, Bardini (1997) compared the concepts of *association* and *connection* in relation to interaction with hypertext and hypermedia environments, observing that most implementations to date have been associationist, extending the argument to consider the relationship of the main protagonists (agents) in the interactive process. Ascribing the process of delegation and inscription to both the designer and user, “the degree of interactivity of the interface can be seen as the relative opportunity for both user and designer to take part in the two dimensions of the representation process” (Bardini, 1997). While this supports the position of Kirsh (1997), it also highlights the potential of creating gulfs (Norman – cited in Booth, 1989) which might compromise mutual engagement of the user and designer – the ideal of the interface as a socially constructed narrative (Bardini, 1997).

In brief, these two observations suggest that interactivity remains an uncertain concept and that developing applications in such a way that the learner is integrated into some form of narrative may lead to implementations which reduce the gulf-potential between user and designer. However, it is also necessary to appreciate that there are many factors that contribute to effectiveness of computer-based learning. The following section reviews these dimensions, with specific emphasis on the relationship between learning theory and subsequent learning.

2.3 CONTRIBUTING FACTORS

There are many factors which affect the way a learner interacts with content in a computer-based environment, and a comprehensive analysis of these has been provided by Reeves (1992) which contribute to our current understanding of effectiveness for technology-based learning systems. For example, the work on interface and metaphor design provides particular guidelines for assisting the user work through the various controls and tools provided to support the interactive experience, such as the use of roll-overs to indicate that an object is active. However, their meaning and subsequent assimilation prior to engagement with the content material is crucial and will contribute to whether or not interference with extracting meaning occurs. Many applications provide users with the widest possible array of tools (scaffolding) to support the learning or problem solving process. However, at the very nodes where those tools could be applied, the issue remains as to the extent to which the learner has sufficient understanding of their inter-connections to be able to apply them effectively. In other words, what factors contribute to a learner being integrated into the *narrative* of an interactive presentation, given the possibility of an alien environment with a time constraint to complete the various activities. Being confronted with an array of interface and metaphor parameters might also affect the overall learning experience.

The learner working with an application comes to the environment with a range of skills, knowledge and motivation as well as particular cognitive and learning styles, cultural heritage and expectations of outcomes. In many interactive multimedia applications very little attempt has been made to adapt to these individual differences inherent in the user, primarily because it is too complex to program and implement by the instructional development group. It is proposed that these factors themselves can have a significant impact on how the user will interact with the system, especially given the range of control options provided and the limited time with which the user can access the application. The extent to which the structure of the application can reduce cognitive load potential is also critical to its success.

2.4 LEARNING THEORY AND INTERACTIVITY

To assess the relationship between learning and interactivity in a computer-based environment, it is necessary to examine the extent to which the various approaches to learning provide guidance or indices of relative and appropriate interactions to foster learning. By way of example, Craik & Lockhart (1972) suggest that the conditions of learning can affect whether surface or deep learning results. According to Kearsley (1998), the *levels of processing* approach views stimulus information as being processed at multiple levels simultaneously depending upon its characteristics, and that deeper processing will result in more being remembered. In addition, the meaning of the presentation will affect the extent to which material will be remembered; similarly the less meaning implies greater attention and therefore an interruption to the processing flow.

For the development of a learning task within this paradigm, educators are required to present information both meaningful and relevant, aiming to ensure that attention is focused on the content without interference. Transposed to a computer-based environment, the context within which the material is presented is alien, at least on the first encounter, and therefore attention can be required to de-construct the content from the interface, metaphor or context. If attention is too focused on the de-construction process, it can be argued that the consequential learning might be interrupted or de-emphasised, generating more superficial rather than deep learning. This reinforces the potential of interactivity to actually interfere with the learning process.

From a human-computer interface perspective, Booth (1989) identifies that users can have mapping difficulties when accessing computer systems (matching the information presented with their current experience), which have been described by Norman (cited in Booth, 1989) as being gulfs that prevent users from dealing easily and efficiently with computer-based tasks. The *gulf of execution* exists when the user knows what is to be achieved but does not know which physical variable to adjust or in what way to adjust them and the *gulf of evaluation* exists where the system has altered, usually as a result of the user's actions, but the user cannot easily understand the change in that system's state. The assertion by Craik & Lockhart (1989) that meaning is critical to deep processing underlies the importance of effective design of the human-computer interface if successful engagement is to occur. The interaction of the user in manipulating the system forms a precursor to their interaction with the content and thus any disturbance in the manipulation may have subsequent consequences with that engagement.

This example highlights the impact one approach can have on the way we think about interactions and supports further investigation of a wider range of learning theories and paradigms to help clarify the links between interactivity and learning. However, this form of analysis is beyond the scope of the present discussion.

2.5 TOWARDS SUCCESSFUL COMMUNICATION

Based on this brief introduction to the context of interactivity and its relationship with computer-based learning applications, the following conclusions are offered:

1. The success of educational multimedia applications is based on effective communication resulting from interactions and engagement.
2. There remains much to learn about the impact of interactivity on learning within the context of computer-based applications.
3. Linking our current understanding of interactivity with narrative may provide clues to appropriate use of interactivity.
4. The impact and role of the user and designer as integral components of narrative is gaining prominence as an issue for multimedia developers.

Given these observations, the following discussion provides an analysis of narrative and related fields in terms of its potential impact on the use of interactivity within computer-based learning.

3. INTERACTIVITY AND NARRATIVE

3.1 INTRODUCTION

The overt issues faced by prospective designers, developers and implementors of educational software is often the look and feel of the product. What is often omitted is an analysis of aspects of the total interactive experience that will maximise engagement (manifested through learning, knowledge acquisition or skill development) and the overall communication of content. However, it is proposed that the frequent development in the base technology (mainframe, desk-top, on-line) have taken precedence over developing a comprehensive understanding of the means by which the technology might enhance the learning process.

As a continually evolving field, educational technology is often subject to creativity and experimentation as the most legitimate means by which its potential can be realised. At the same time, there is considerable evidence to support the conclusion that we do not yet fully understand its similarity to or differences from current means of educational communication (Plowman, 1996b; Kirsch, 1997). There is no doubt that much of the development has assumed that the technology is simply an automated form of current practice, and this may in part be responsible for the often stated comment that educational technology has failed to live up to its original expectations. In other words, should the implementation of educational resources on a computer-based medium be a replication of current media, or are we dealing with a new environment that has not yet been fully explored in terms of interface to and interaction with its human users?

There is a growing body of literature and discussion which supports the latter position, through a re-assessment of the way in which we conceptualise the use of interactivity in educational multimedia applications. One of the most interesting aspects of this research is the comparison of traditional story-telling techniques (narrative and play) with those presented through the technological medium. While the complex framework which surrounds the study of narrative and story-telling should not be trivialised, in the context of the growing demand for technology-based solutions to learning, the possibilities provide a novel and refreshing perspective.

3.2 INTERACTIVE IMPACT

Based on the previous discussion, there is an indication that if interactivity has the potential to distract, the use of narrative may be useful. Narrative can be viewed from a simplistic context of representing a linear storyline (Plowman, 1996a); it can also be perceived in the way it is deconstructed in terms of how the story is told, the way it is received, what meanings it can have and the specific social, cultural and technological context in which it is told (Humphreys, 1997b). An extension of this analysis is the assertion that narrative enables construction of mental models of the situation and environment (Bower & Morrow, 1990). Therefore it can be predicted that narrative may assist meaning, reduce the impact of interactive interference and provide the necessary framework to promote learning amongst diverse groups of learners.

But in what way can narrative, as currently understood, relate (or integrate) with the values of an interactive world? Josephson (1997) suggests that we are still learning to define a new media literacy, and by defining it we are also creating it. If we can define an effective interactive narrative, then we can begin to project what will happen to that narrative as the audience moves from being “actively engaged on an interpretive level to actively intervening in its representation” (Humphreys, 1997a). In a comprehensive analysis of narrative and interactivity, Plowman (1996a) observes that

Narrative coherence is identified here with a lack of redundancy and a fixed sequence. Interactive multimedia (IMM) programmes challenge these traditional definitions of narrative because it can be suspended or altered at discrete decision points, the foci of interactivity, and a rearrangement of discrete elements gives rise to new text and new meanings. While the concepts of wholeness, unity

and coherence of meanings are not fashionable in a post-modern world, in “*educational* multimedia... the notion of multiple interpretations has different implications, particularly for comprehension and cognition”.

Because these decision points represent the foci of interactivity, and a rearrangement (through branching or learner control) of discrete elements gives rise to new text and new meanings, the implication in educational multimedia of multiple interpretations becomes critical, particularly in relation to comprehension and cognition. While “narrative isn’t just a shaping device: it helps us think, remember, communicate, and make sense of ourselves and the world” (Plowman, 1996a), when contrasted with its implementation in an interactive environment, its efficacy is uncertain. So can narrative and interactivity co-exist? Plowman (1996b) argues that interactivity is at odds with our expectations of traditional narrative forms and communication. As disruption of the narrative is strongest at the foci of interactivity, interactive multimedia development should be considered in terms of how it can be integrated into the underlying narrative. However, by examining techniques for measuring interactivity and comparing these with the basic narrative structures, the potential for the new media to combine and incorporate effective narrative was examined by Plowman (1996a) who concluded that, with young learners at least, a meaningful narrative was beneficial for learning.

In an alternate view of interactivity, Hilf (1997) states that “through the interrupted narrative, the learner learns more about the story and characters through their own interaction”. Whereas Plowman (1996a, 1996b) recognised the negative interference potential of interactivity, Hilf (1997) declares the opposite. Clearly there are disparate views on narrative and interactivity, and their combined impact on the communication of content; whether an interactive device contributes to engagement and meaning or generates an interruption to that process is the underlying reason for considering the impact of narrative on the overall process.

In his analysis, Hilf (1997) introduces four narrative structures: linear (where the user is guided from beginning to middle to end), interrupted (where the narrative is halted while problems, tests or some other form of interaction is implemented), branching (where the user has the option to choose from a range of paths) and object-oriented (where elements within the narrative can be controlled or defined by the user, thereby impacting on other users within the system). In terms of interactive learning environments, it would appear that branching narrative is termed menu selection and interrupted narrative the tutorial model in which a pre-designed sequence is interspersed with interactivity in the form of the question-response-feedback loop. The object-oriented narrative conforms to the delegation/inscription factors, at least in terms of the user, as proposed by Bardini (1997).

3.3 FROM NARRATIVE TO PLAY

So does narrative interfere with or promote engagement during an interactive learning session? The answer is likely to be both, but possibly to the detriment of the final outcome. An extension of the narrative aspects of interactivity are proposed by Humphreys (1997a). Like Plowman (1996b), she suggests that giving the audience (or user) choices can disrupt the sequence of events, affecting the final closure of the narrative. From another perspective, “as the level of interactivity increases and the amount of agency for the user structured into the piece increases, the amount of ‘retelling’ done decreases” (Humphreys, 1996a).

To provide an answer to this, Humphreys (1997b) explored the concept of play and play theory, which she suggests are closely related to narrative, and notes that to maximise audience engagement through interactivity requires consideration of agency, narrative structure, emotional engagement and construction of meaning. The consequences of this conundrum may find some solutions in play theory, which Humphreys (1997b) suggests can provide a “framework which accommodates the audience or user into the process of engagement with interactive media in ways that narrative theory finds difficult”. While narrative is about the experience of a recounting of a story, play is the experience of enacting a story.

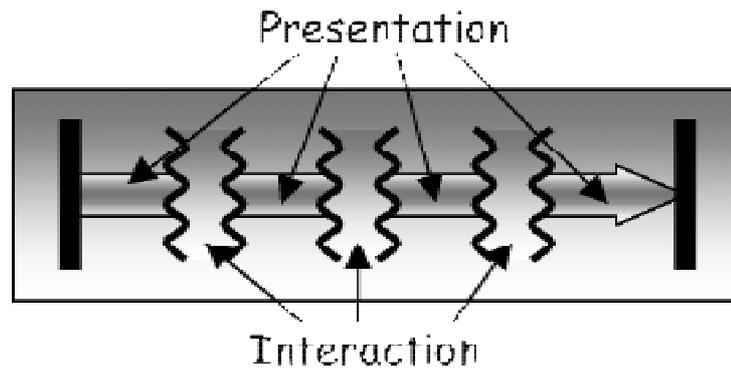
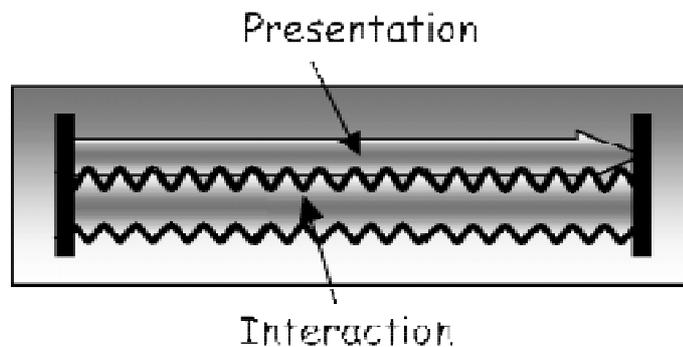


Figure 1: Intersection and Parallel Concepts of Interactivity

A preliminary comparison between narrative and play interactivity is represented in Figure 1. The top sample of an interactive sequence represents a narrative regularly intersected or interrupted by an interaction whereas the bottom sample depicts a constant interaction between user and story.



While play in terms of the instructional game has long been recognised as a valid model (Alessi & Trollip, 1991), the early implementations were not contextualised in narrative. By integrating play elements such as friendship, risk, problem solving, competition and creativity, Humphreys (1997b) suggests that “play theory offers a framework which accommodates the audience or user into the process of engagement with interactive media in ways that narrative theory finds difficult”. More importantly, in the context of educational applications using multimedia, Humphreys (1997) speculates that

Interactivity produces for the user of media a different relationship to story. This shift in relationship may be able to be framed as a shift from narrative, as an experience of recounting a story, to play, as an experience of enacting a story.

The notion that multimedia applications for learning should focus on either narrative or play to enhance engagement implies that the interactivity provided to users must therefore be integrated in such a way that it not only provides opportunity to reinforce the specific learning objectives but also to maintain the user’s participation in the story.

3.4 MULTILINEAR NARRATIVE

Rather than comparing the traditional linear narrative with non-linear interactive multimedia, Johnson & Olivia (no date) use the term multilinear. This term implies a range of equally plausible paths which may be taken through the application and offer the suggestion (with respect to internet sites specifically) that beginnings and endings should be replaced with the terms entrance and exit. In discussing the relationship between the content and the medium, Johnson & Olivia (no date) cite the work of Liestol 1994:

The screen occupies a third position, between the three dimensions of space and the one dimension of time. The screen and what it presents is a manifestation of the present, between past and future. Therefore the movement from space to time and the reduction from three dimensions to one both halt at the position of the screen and its flatland of two dimensions. Obviously the design and composition of elements on the screen are of central importance to any critical study of hypermedia texts.

This introduces a further variable to the equation of effective interaction with respect to the user having to develop the skill to either adapt to changing dimensions or to create a new dimension by which they interpret the technology interface.

4. WITHIN THE LEARNING SPACE

4.1 FROM NARRATIVE TO MUTUAL ADAPTATION

Interactivity can therefore be manifested as a combination of narrative, whereby the user is engaged with a story presented by an author or designer; play, where the user has specific goals and agency, where both the user and designer provide delegation and inscription to the ongoing communication. Given this environment, in what ways can it help us understand the overall implementation of interactivity to technology-based learning systems?

This is best demonstrated by the sequence illustrated in Figure 1, which represents a simple linear encounter between user and application. Over a specific period of time, the user will have to deal with the presentation of content material followed by some form of interaction, breaking the sequence in some manner, after which the story will continue. Alternately, this structure could extend to the branching forms identified by Hilf (1997) and Plowman (1996) which varied from the linear (beginning-middle-end) to object-oriented (learner-enacted) narratives.

However, it is argued that this model is incomplete as there is no representation of the reciprocal roles of both designer and user in the overall interactive process. To represent this, the following three figures provide an initial concept of integrating the various elements as presented in the discussion. Figure 2 illustrates a fragment of computer-based content the user may enter and work through. The integral elements are the user illusion (used in place of the term metaphor) of the story-space, the interface which allows movement and control of that space, the paths which provide access to discrete content areas and the ability to enter and leave. This model can also be generalised to the macro (curriculum) level or the micro (content) level and intervening levels.

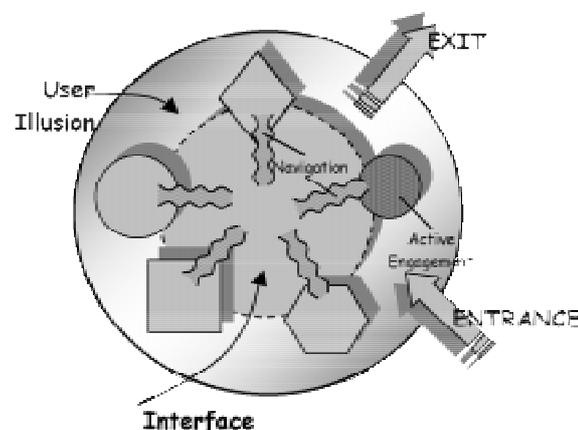


Figure 2: The Interactive Story Space

The diagram represents a single point in time at which the user has entered into a learning space and is currently engaging with the content, represented by the circle. The combination of interface and user illusion (metaphor) provide a context for the narrative and the user has the option to navigate to and engage with other content items (represented by the empty geometric shapes) or exit to another activity.

To extend the functionality of this model, Figure 3 introduces the designer and user to the process, with both having the option to interact with the content and each other reciprocally. While in the interpersonal world this contact is clearly synchronous, a computer-based application also enables asynchronous contact. This allows the option for both synchronous and asynchronous mutual reciprocity (SMR and AMR) to be introduced to the interactive model.

The technology to date has only seen this form of interaction in network games, but it could be extended to local networks with relevant information on learner-performance and design-options being continually monitored and updated. So as the learner enters the learning space, information on current and past performance can be made available to the designer (either in person or as an intelligent agent) in such a way that the structure of the interaction can be adapted.

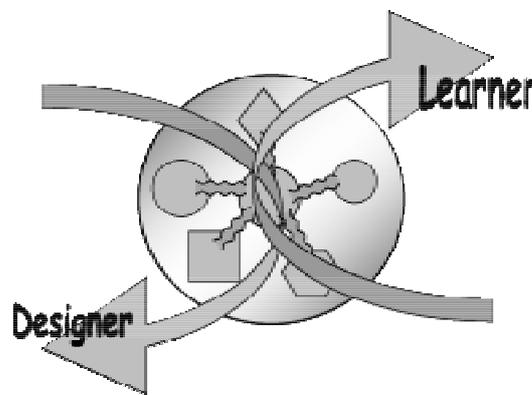


Figure 3: Designer/User Reciprocity

The implication is that when a user enters the learning space, they bring with them a set of characteristics both personal (in terms of learning style and motivation) and archival (in terms of their preferred options as recorded through previous interactive encounters) which affect the interaction. And this interaction needs to be processed by the application from a design perspective to cater for possible updates or alternative presentations. In brief, an application is adaptive to both user and designer characteristics.

One such outcome of this encounter is represented in Figure 4 where the user is now in a modified or evolved environment where the content elements, metaphor (user illusion) and interface have been altered. The originator of these alterations is unknown, but the outcome is based on mutual contact between user and designer. From another aspect, this might be perceived as real-time evaluation and modification, without the need for complex reworking of the system.

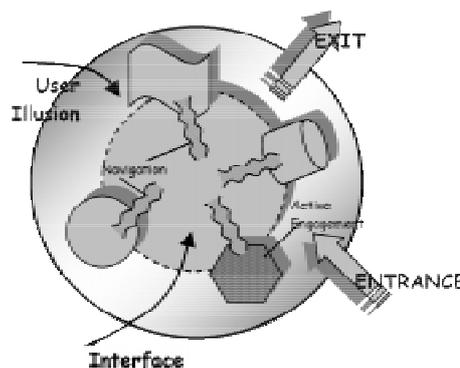


Figure 4: Modified Story Space

4.2 OPERATIONISATION

The implementation of this model will require elements of artificial intelligence, expert systems and adaptive learning environments. The reason for this is that the computer system has to be able to process data on agent characteristics, supplied by both the learner and the designer, as they cooperate in the knowledge construction process. The manageability of this is achieved through the fact that most computer-based learning environments will operate on a specific domain allowing some boundaries to be placed on the content range.

To demonstrate the model of *mutual reciprocity* in action it would be necessary to examine a range of applications (such as *Myst*, *Exploring the Nardoo* or *StageStruck*) which incorporate narrative, play, and either designer or user adaptation and then incorporate wider adaptation strategies for both the user and designer.

5. CONCLUSION

Interactivity is often portrayed as the crucial element of the new technology, and yet recent research has demonstrated that there is still much to understand about the ways in which the interactive process facilitates access to technology, especially in the context of computer-based learning applications. As Plowman (1996a) states,

“disruption of the narrative is strongest at the foci of interactivity ... (which) should be considered in terms of how they can be integrated into the overall narrative and how they can be used as a way of stimulating interest in the unfolding narrative . . . by considering the interrelationship of narrative, linearity and interactivity and their design implications we can help learners to make sense of interactive multimedia”.

And it is our challenge to develop applications which minimise the potential for interactive interference. By considering the concepts of narrative and play in association with the links between the designer and user, a model of adaptive applications which cater for both designer and user is proposed as a means to enhance the interactive process.

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