

Narrative Serious Game Mechanics (NSGM) – Insights into the Narrative-Pedagogical Mechanism

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Abstract. Narratives are used to construct and deconstruct the time and space of events. In games, as in real life, narratives add layers of meaning and engage players by enhancing or clarifying content. From an educational perspective, narratives are a semiotic conduit for evoking critical thinking skills and promoting knowledge discovery/acquisition. While narrative is central to Serious Games (SG), the relationships between gameplay, narrative and pedagogy in SG design remain unclear, and narrative's elemental influence on learning outcomes is not fully understood yet. This paper presents a purpose-processing methodology that aims to support the mapping of SG design patterns and pedagogical practices, allowing designers to create more meaningful SGs. In the case of narrative, the intention is to establish whether Narrative Serious Game Mechanics (NSGM) can provide players with opportunities for reasoning and reflective analysis that may even transcend the game-based learning environment.

1 Introduction

Discourse, the narration aspect of storytelling, plays an important role in defining a narrative environment through careful descriptions of both context and roles, ultimately motivating a player (in the case of Digital Games) to intervene and act. An often inherent part of the narrative discourse is the protagonists' exposition to a sequence of events that motivate them to act, essentially embarking on a narrative journey. Such exposition sections have been extensively documented by Propp [1],

Campbell [2] and many others [3-6]. They are extensively relied upon in Serious Game Design, where the learner is exposed to a narrative in order to evoke a player (as opposed to learner)'s desire to achieve the goals and discover what happens next. Three important techniques - immersion, reward, and identification [8] - are then exploited in order to keep the learner playing and thus learning.

At the most basic level, Chatman [7] differentiated between story and discourse, story representing the actual elements present in a story (content) and discourse the narration of a story and how it is presented to an audience (form). This distinction is relevant to the study of narrative mechanics in the context of Serious Games (SG) studies because story elements are tangible entities that can be analysed at a structural level, while discourse helps to shape an SG experience. For instance, if the purpose of an SG is to induce an affective response towards the negative aspects of a certain behaviour, the form and tone/aesthetics of the discourse (genre, filmography, graphic presentation, realism) are (or should be) in keeping with the main purpose of the SG, independent of the actual narrative content conveyed.

Research has revealed two key challenges in this area, namely a) the transition between an SG's underlying instructional design and its actual design implementation [9-11], and b) the insolvency in mapping game design patterns onto relevant pedagogical patterns [12]. A game mechanics workshop organised during the 2nd Alignment School of the EU co-funded Game and Learning Alliance Network of Excellence (GALA NoE) [13] concluded that the aforementioned transition lacks methodology. Consequently customers commissioning SGs are forced to make a leap of faith when gauging an SG developer's capacity to deliver a game that will achieve the desired learning outcomes. This echoes Wexler's [14] evidence on how the growing complexity of SGs impacts the way educators use SGs in teaching.

This paper presents a purpose-processing methodology to probe narrative discourse in SG and is ultimately intended as a means for investigating how SG design patterns map with pedagogical practices. To redress the dependence on SG developers in the creation/adaptation of SG content, a game-writing process based on narrative metaphors is also explored.

The proposed methodology has also been empirically elaborated [15] on eight SGs covering various genres and application domains of SGs: HotShot Business, Playing History: The Plague, SBCE (Set Based Concurrent Engineering process), ICURA, Go Venture Any Business, Prepare, Shortfall, Re-Mission.

2 Serious Games Design and Narrative Meaning Making

SGs are increasingly being seen as new ways of learning, and the subjective meanings given to elements of game architecture can result in players having a very different view about the game space. This is a key concern for SG designers, as the interrelationships between the motivational aspects of narrative game mechanics and gameplay style may not be fully appreciated.

Games with narrative elements are inherently a multidimensional comprising both a narrative genre and a gameplay genre. The fact that two games could share the same

narrative genre but with vastly different gameplay (first person shooter vs. adventure game) increases the complexity of the issues involved when addressing game narratives.

Narrative is an area where definitions are still being formulated. Lack of clear examples of great game narratives remains, especially since SG is a young medium compared to narrative compositions in the best novels, films, and plays often leaves games seeming slightly deficient. There are a lot of key problems in game design that need to be solved, and this limits the kinds of stories that can be told [16]. Great history stories can be told and learners may enjoy them, but the essential tension between the freedom of the player and the constraints of narratives places severe limits on what can be achieved at the present time. There is a conceptual gap between the conventions of digital games and those of non-theatrical drama that needs to be addressed.

Crucially, the narrative cannot be fully appreciated if learners cannot grasp the gestalt of semiotic communication. Lastly, players may play in a style that the game was not designed for. Ideally, the SG learner should develop and take forward the epistemic values posed by a game's narrative mechanics. Tochon's [17] position on educational narrative being tied to the philosophy of Signs and Meanings has deep implications for the way the narrative contributes to educating the individual. People acquire identity from and through discourse, not from life itself but from the stories they collectively construct from events. This aligns with constructivism, the dominant learning theory over the last decade. Herein lays the challenge for the SG developer: to pragmatically translate the many levels of abstractions for knowledge construction such that the epistemological underpinnings are a process of instruction [18]. While Lindley's [19] and Harrell's [20] work on narratives in computer games motivates this work, so does the hypothesis that narratives offer a gateway for learners to combine reflective analysis and explore connotative meanings with other learning tools. Through the study of narrative in SG context, one could potentially assess whether game design patterns can be mapped (at least at a high-level of abstraction) with pedagogical practices.

3 Defining Narrative Serious Game Mechanics (NSGM)

Through narrative discourse, the objective is to discern the possible relations between the elements of the narrative/pedagogy/game design triad, essentially the narrative-pedagogy implications. These relations operate within four analytical categories: *narrative purpose*, *narrative process and instance*, *narrative structure* and *pedagogical implication*. These categories are described in detail in the next sections in relation to NSGM.

To establish the cause and effect of designed narration in SGs, the concept of Narrative Serious Game Mechanics (NSGM) is proposed. An NSGM is identified in a game design when aspects of narrative/storytelling such as dialogue, plot events or character actions/behaviours are used to elicit specific pedagogical outcomes. An NSGM is represented by a narrative element which directly contributes to or

indirectly supports identified learning outcomes as part of a successful SG gaming experience. The definition is purposely broad as it needs to encompass the innovative ways in which narrative plays a role in SG design

The authors are currently investigating NSGM as part of their SG research in GALA NoE. The general aim is to map prevailing characteristics (patterns) of narrative mechanisms and shed light on the potential benefits of associated pedagogic goals and practices. This is being pursued through both top-down (theoretical) and bottom-up (analytical) investigation, an approach which should limit possible blurring of the boundaries between SGMs and allow the identification of a wide range of creative approaches adopted by SG designers.

4 A Purpose, Process and Structure Schemata

To establish an NSGM trace, it is important not only to investigate the purpose for narrative elements, but also their pedagogical context. A multi-layered approach that includes the individual, smaller story elements within the various interactive activities of an SG narrative is taken into account towards identifying NSGM. To extract a narrative-pedagogy association, there is a need to identify recurrent aspects such as the relationships between both protagonists and the narrative environment and the necessity for conflict, be it openly towards another person (person to person), environmental (person to context) or internal (person to self) [4].

Table 1. Establishing the purpose of an NSGM

Type of NSGM	Description	Game purpose	SG purpose
<i>Exposition:</i> the purpose of the NSGM	What is the overall function of the NSGM?	What function articulates or progresses the game? From the player's perspective, what function does this NSGM play?	Pedagogically, what learning outcomes or processes are related to this NSGM?
<i>Discourse:</i> the form of the NSGM	What form does it take and how is it represented?	How are these functions concretely represented in the game?	How does the form (style, pace etc.) of this NSGM contribute to learning?

Table 1 and Table 2 are used to establish and trace the modus operandi of SG narratives. In this manner, the relationship between tangible narrative components and tangible activities or information within an SG game sequence can be documented, as can the events that directly impact player activity (from a pedagogical perspective) and those that do not, but still play a supporting role. This also allows the epistemic/semiotic mechanism and value to be established.

Table 2. Establishing Process and Structure within an NSGM

NSGM Experience	NSGM Process	Narrative Element	Description	Impact
<i>Pre, during and post:</i> event directly involving player interaction with the SG, or sequence where the player is not engaged in active game-like interaction with the SG, i.e., sequence of tasks / activities related to the NSGM occurrence.	<i>Process Step:</i> Chronology of activities /tasks related to the NSGM. Describes what comprises this step and its various elements.	<i>Structure:</i> Describes the mechanics of activity or information communicated to the player (information element, invitation to act, feedback, information communication, etc.)	Describes the actions of the player or the game in this phase of the process.	Describes the impact of the step on both the SG experience and the learning outcome both directly and indirectly

Taken together, an NSGM forms a conceptual/structural layer and typically comprises a combination of several GMs. This is exemplified in Fig. 1, which illustrates a mapping of the *GoVenture AnyBusiness* (GVAB) SG [21]. The Learning Mechanic and Game Mechanic (LM-GM) levels are drawn from earlier work produced by some members of the present authoring team [22-25]. This mapping shows where NSGMs do reside in GVAB, and how they bridge ludic mechanisms and learning contents.

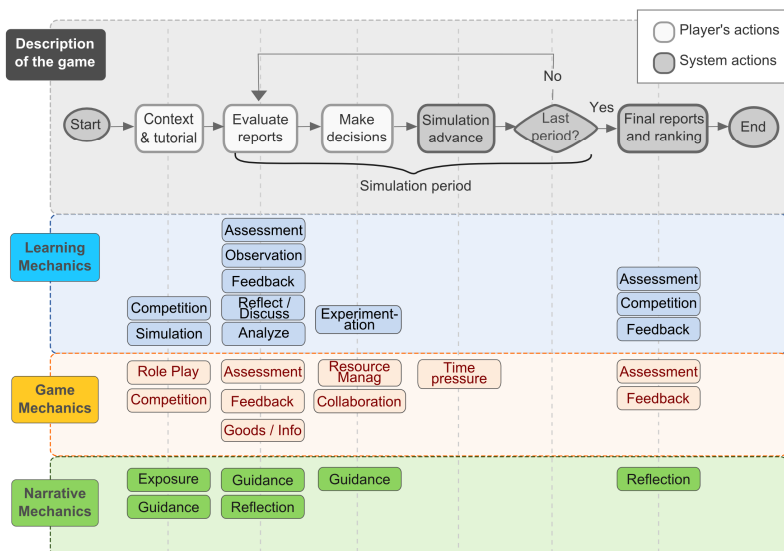


Fig. 1. NSGM mapping of Go Venture AnyBusiness

These mechanics layers can also be thought of as fibrous, mechanics-studded strands that are interlaced in different manners to form the fabric of SG design. The single mechanics on the different strands may overlap at some points in the weave to form a single node jointly serving learning, gameplay and narrative purposes. In other cases, the strands themselves may be tightly braided and bound so that the individual mechanics they bear are interlocked in a sequence or pattern. These are intuitive views of NSGMs.

5 NSGM Association with Pedagogy

At the most basic level, from a game design and pedagogic perspective, narrative exposition (NE), together with narrative discourse (ND), sets the scenario of the SG and enables the establishment of a ludo-pedagogic framework for learning. From the pedagogical perspective it introduces the domain area and the learning contents that the player will interact with as part of the SG-based learning experience. Critically, NE is central to how the SG simulates a context/situation. It is also the gateway to an immersive experience; it draws the player into an enticing, non-threatening game world that (amongst other things) offers the promise of a fruitful learning experience.

Any learner-centred approach must include suitable and timely support for the learner. SGs must provide (or at least allow for) guidance whenever the player perceives the need for further information, specific input, clarification, decision-making advice, etc. [26]. Pedagogically speaking, when the perceived need concerns a gap in domain-related knowledge, such support falls within the sphere of the Zone of Proximal Development [27, 28], namely in the area between what a learner can do (or achieve) by themselves and what they can do with external help. Through the scaffolding /help provided by the game, the learner can reach some of the educational objectives which would otherwise not be possible by their own accord.

Game elements can thus contribute to bridge the gap between what the learner is currently able to do and what is meant to be achieved (expected learning outcomes) and this is done without human external help; the game itself supports the overall learning process and activates specific learner's "functions" that have not completely matured yet.

Thus, where guidance is contextualized by means of game elements, within the narrative space and made available via virtual interpersonal interaction (with a NPC), it could be associated with experiential learning and to some extent with Social Constructivism [23, 25]. On-demand guidance can also be regarded as learner scaffolding, which is the third of the six phases of cognitive apprenticeship, following coaching. In cognitive apprenticeship, on-demand support is a feature of a relatively advanced stage in the learning process, when direct support is diminishing and learner independence is strengthening in a relationship of inverse proportionality.

Learning approaches, both in a cognitivist and constructivist perspective, place particular emphasis on reflection as a means for constructing meaning, whether at personal or social level. As well as engaging the player, the narrative also needs to be suitably paced and balanced so as to foster reflection. From a cognitive viewpoint, reflection necessarily entails a certain detachment from narrative flow, a loosening of the narrative reins as it were. This mechanic is critical for balancing the ludic-learning dichotomy of SG and hence of SGs' efficacy as learning environments. This balance should be easier to attain and maintain, when the reflection mechanic is implemented in a way that resonates with the narrative flow.

Table 3. Analysis of narrative-pedagogical implications in the GVAB game and the potential benefits of associated pedagogic practices

NSGM - Type	Description of practice	Pedagogical implications
<p><i>Exposition:</i> To introduce and frame the world to engage the audience.</p>	<p>Text-based information push that presents game scenario / narrative: overall game mission, player role, objectives, environment features.</p>	<p>Introduces the learning contents and establishes gameplay motivation, which should be aligned and entwined with learning objectives and task/s. Only embodies experiential learning to the degree where information push is appropriately contextualized in the narrative and involves some interactivity/simulated experience, e.g. through interaction with NPC.</p>
<p><i>Guidance:</i> Narrative elements to drive the player into exploring the world or interacting with Non-Player Characters (NPC) or fellow players.</p>	<p>On-demand consultation of an information source to facilitate navigation and gameplay, support decision making, provide clarification, help unroll the narrative, etc. Guidance may be generic or personalized (related to performance). Consultation is often contextualized to fit the game/narrative scenario, e.g. via NPC or simulated messaging. This is a key to game environment authenticity and represents essential scaffolding of the gaming/learning experience.</p>	<p>To be effective, any learner-centred approach must include suitable and timely support for the learner. As effective agents of learner-centred experiences, SGs should provide such support whenever the player perceives the need for further information, specific input, clarification, decision-making advice, etc. In a wider sense, when the perceived need regards a gap in domain-related knowledge, the support falls within the Zone of Proximal Development; so if implemented as part of interaction with NPC, such support could be associated with Social Constructivism to some extent and also to experiential learning. More typically, on-demand guidance also represents (weak) learner scaffolding. This is the third of the six phases of cognitive apprenticeship, following coaching. In cognitive apprenticeship, on-demand support is a feature of a relatively advanced stage in the learning process, when direct support is diminishing and learner independence is strengthening (relationship of inverse proportionality).</p>
<p><i>Reflection:</i> Key to learning and knowing where mistakes have been made.</p>	<p>Performance summary in preceding game phase delivered to player via NPC in a format befitting the game scenario. Strengthens sense of narrative sequence and provides opportunity for self-assessment and reflection on adopted game strategy.</p>	<p>Reflection plays an important part in most learning paradigms, especially those that tend more towards to cognitivist and constructivist learning theory than to behaviourism. It is a pillar of experiential learning.</p>

6 NSGM Association with Pedagogical Practice

The picture of narrative components in SGs that emerges from the authors' case studies is similar to that in entertainment games. This poses a problem, as it hinders identification of the narratives' relationship with pedagogy and educational purposes (as reflected by Harrell [20]). However, the adopted purpose-processing method revealed that there is a distinct lack of consideration for drama in the eight SGs studied. This is interesting, since it shows that narrative and storytelling were intended as framing devices for capturing and maintaining player interest/motivation rather than real engines of the experience.

Table 3 presents an analysis of narrative-pedagogy in the GVAB game. The table highlights the features of the NSGM and the implications it has for pedagogic practice. It also highlights the challenge posed when seeking to apply constructivism in the process of instructional design. The narrative elements encountered mainly tie the player's interactions to a specific theme and motivate the player to keep playing.

7 Practical Considerations: Narrative-driven Game Authoring

The authors' current case studies as well as the works of Lindley [19], Tochon [17] and Harrell [20] all suggest that it is important to put educators in the driving seat, in order to achieve proper instructional game design. This requires creating appropriate instructor-oriented game-authoring tools so they can create/adapt contents in SGs [29].

However, most game-authoring tools and game engines (even those focused on narrative-centric genres) do not focus explicitly on designing narratives. Remarkably, most game-authoring metaphors focus solely on defining events and conditions, and the actual narrative of the game emerges by how those events and conditions happen at runtime (e.g., [30]). In consequence, the narrative of the game is typically represented in external documents, and the design and the actual implementation try to follow those documents and create a behaviour that matches that narrative.

This represents an important challenge when trying to create NSGMs, as the mechanic itself is never authored, but implied through other constructs. A deeper application of NSGMs would require game design and implementation processes that explicitly incorporate specific functions and capabilities for managing the narrative dimension of the authored game. This would ensure that the narrative have a central role in the SG design and explicitly contributes towards the learning and engagement goals.

However, this should not result in a process that can only edit narratives, as other game mechanics may typically be present even in strongly narrative games. As a potential approach, we could highlight the hybrid approach proposed by WEEV [24]. This is a methodology for authoring narrative-based point-and-click educational games tool and is embodied in an authoring tool of the same name. WEEV adopts a narrative metaphor to represent game stories as interaction elements of narrative significance (i.e. story, world and actors). An explicit visual representation of the story is used to describe the flow of the game (Fig. 2). This approach foregrounds the

flow of the interactive story, making it easier to co-locate the mixing of sociological ideas with semiotic epistemology.

Interestingly, this authoring approach focuses solely on creating the narrative and on defining NSGMs. Other game elements necessary for SG design (such as graphics, variables, event triggers and logic conditions) are not explicitly contemplated in this stage, with the aim of facilitating the narrative authoring process. Instead, after the narrative development has been completely designed and refined, WEEV can generate all the internal logic required to support the narrative and offer the possibility of further editing the game to add other, non-narrative, game elements.

This explicit distinction of processes favours an increase in focus on NSGMs but also introduces a sort of separation that could prevent a real harmonious integration of narrative and game mechanics.

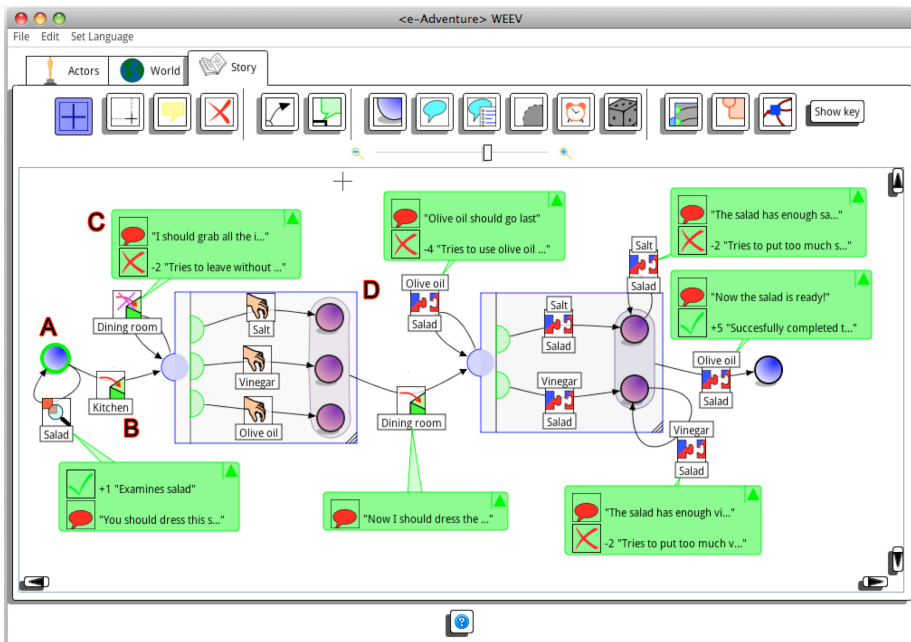


Fig. 2. The WEEV story editor

8 Conclusions

The Purpose/Process/Structure methodological approach has demonstrated its usefulness for identifying generic Narrative Serious Game Mechanics (NSGM) patterns. From a narrative perspective, this short study suggests that narrative in Serious Game design is so far limited to the application of narrative elements rather than to the development of a real drama. Drama structures narrative elements into a sequential manner so as to form a compelling user experience. The games that the

authors have studied thus far show little evidence of dramatic structuring taking place. Instead, they incorporate narrative elements to tie the player's interactions with a specific theme and motivate the player to keep playing [25]. This in itself does not constitute a problem but it calls for further investigation as it could indicate potential gaps between practices in SG design and practices in design of related entertainment forms.

It is also important to note that the focus here is to provide insights into the narrative-pedagogical mechanism. Preliminary findings indicate that *Narrative Exposition* (NE) is an important storytelling element as it is the first contact between an author and the audience. The main objectives are to introduce and represent a starting point for a drama to unfold. For this reason, NE is often used as a framing device.

Narrative Guidance (NG) uses narrative elements to drive the player/protagonist to explore the SG or interact with Non-Player Characters (NPC) or fellow players. This stimulation needs to be carefully handled so that it effectively supports and enhances the learning experience, rather than eclipsing it. Similar care is required when integrating NG with the WEEV methodology because not all game elements (e.g. art resources) are easily defined within the methodology.

Reflection and *feedback* are important aspects of SGs and fundamental to current theories of learning. In terms of feedback, the narrative mechanics adopted in the studied games are largely those used in entertainment video games. However, some examples have been found in which performance feedback is incorporated within the game narrative, better helping the player to understand the reasons of poor/good performance.

The practical implementation of NSGM during the game creation process is also a significant challenge, as most development tools support narrative constructs implicitly. Among those tools that foreground the narrative constructs, we have identified the WEEV methodology as a promising approach: On the forecourt of SG design, the mechanics of NE, NG and Reflection can be repurposed in WEEV as reusable narrative in-game learning objects that contain narrative learning patterns for creating a game world and characters.

Investigations using narrative discourse are still needed to account for the contingent events that employ verbs of speech, motion, and action. The fundamental complexity in any conceptual framework/method of any postulated semiotics requires abstracting a closed system of signification to directly comprehend all its individual entities. The present study indicates a direction, but there is still much work to do in order to support authors in the design of learning effective SGs based on compelling and relevant narratives.

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