A Component-Based Architecture for Suspense Modelling

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Abstract. Suspense is a key narrative issue in terms of emotional gratification, influencing directly the way in which the audience experiences a story. Disciplines like psychology, neurology or e-learning study the suspense as the basis of useful techniques for the treatment of mental diseases or improving memory skills and the comprehension. In the field of creativity, it's an essential cross strategy found in almost any book, film and video-game plots, regardless of technology and genre. With the objective of generating engaging stories, some automatic storytelling systems implement a suspense generation module. These systems are mainly based on narrative theories. However, we observe a lack of aspects from behavioral sciences, involving the study of empathy and emotional effect of scene objects in the audience. Generated plots with an adequate treatment of these features may involve benefits in areas as education and psychology. In this paper, we propose a component-based architectural model that firstly aims to identify and extract all these individual factors of the suspense from a scene; in a second step, the system calculates the level of suspense using a weighted corpus; in the last step, it alters those elements to increase or decrease the original suspense level and reassembles them in a new scene. Further, we discuss the model facing the development challenges and its practical implications.

1 INTRODUCTION

Nowadays, technology allows to make interactive or pseudo-interactive spaces of choice that were unthinkable just two decades ago. Not only there are new interfaces for innovative functionalities, but people have access to a practically infinite cosmos of potential multimedia experiences through which can choice what and how to start to consume, and when to stop it. Electronic books, films, serials, comics, music and web site written contents are within reach. If any choice is not good enough, other stimulus can be easily found. Even in case that the election has been satisfactory, the ease to move forward the broadcast content allows that superfluous parts can be missed, so, keeping the interest is essential to maintain the fidelity.

In this context of endless offers, the audience has become more demanding. An example is the visible decrease of the consumption of horror and suspense literature and movies. Statistics about the number of tickets sold in horror films are determinant: in 2014, 63% less tickets were sold than eight years ago, in 2006, following a downward arc from then[5]. Thriller genre seems to do better, with only a

drop of 44% from 2013 to 2014 [1]. Therefore, the audience's score of the most watched horror movies per year conveys another important and continuous[6] descent of the assessment of the genre, from 71 points over 100 in 2006 ("Saw III") to 39 last year ("Annabelle") [2]. Blaming Internet piracy is not possible, while these statistics start in 2006, when piracy was already an established practice. In fact, even missing a serious official study from 2012, BSA Global Software Piracy Study reflects that Internet piracy rating globally decreased from 2006 to 2011, two points in North America and European Union [13]. More decisively, copycat products, predictability, annoying, boring, lack of atmosphere and insipid characters [51] affect the suspense and fear in a negative way. This seems to be leading to the apparently progressive decline of the most significant entertainment industry of suspense and fear during the last years [8], as happened with the horror literature in the nineties [28].

Suspense is an key narrative issue in terms of emotional gratifications. Reactions in response to this type of entertainment are positively related to enjoyment [40, p. 315], having a big impact on the audience's immersion and suspension of disbelief [29, p. 1359]. There is an interaction effect of negative valence and liking [4, p. 2]. The general pattern indicates that readers find literary texts interesting when the content is suspenseful, coherent, and thematically complex, accounting for approximately 54% of the variance in situational interest, where suspense made the single greatest contribution, explaining roughly 34% of variation [50, p. 445]. Consistent with this, experiments in video-games industry conclude that players find suspenseful games versions more enjoyable than non-suspenseful ones [34, p. 31].

Furthermore, suspense enjoyment is not subscribed only to the field of entertainment. For example, in the area of education, it is a direct way to create emotions that stimulate affective content, which influences positively the performance of the implicit and explicit memory [12, p. 223], and physiological responses in the way that we assimilate information [24]. Besides, in terms of psychological treatment, suspense is a subject of interest. To anticipating events as part of the experience of suspense is a creative problem solving that helps to counteract negative and stressful effects [58, p. 48]. Conversely, many people experience dramatic psychological consequences when they are exposed to suspenseful and fearful texts or movies. These consequences can be quite significant and include nightmares, physical stress, lingering fear, an increased heart rate, and heightened phobias [47, p. 48].

According with these arguments, we aim to adequate the regu-

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[5] Two exceptions have been found: 2009 and 2013, supported only by the

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films "Paranormal activity" and "The conjuring" with almost fifteen millions of tickets sold each.
[6] One more time, the only exception has been "The conjuring", which in 2013 got 82 over 100.

lation of suspense as the one of the primary factor influencing the interest of a story as well as its benefits in other several fields. We support that suspense is a relevant cause of the audience's fearless and high emotional arousal level, and it has an important impact in the audience's rejection of this sort of exposition [47, p. 48]. In this context, our main goal is to propose a computer-based model which allows to increase or decrease on request this level of arousal in any potential suspenseful content, so it can enjoy with the same emotions under a different intensity anxiety level.

In this paper we explore a proposal to enrich a narrative by a computational model that makes possible two main goals: a) to measure the potential suspense intensity of any individual plot scene; b) to interactively increase or decrease that intensity by modifying the information that generates suspense, in a way that the suspense changes dynamically accordingly. In the section 2 we present the concept of suspense and its features. In section 3 we review several proposal systems that model suspense as element to generate stories. In section 4 we explain the model and detail the software architecture of our aimed application. Then, we finally discuss our proposal in section 5, and present our conclusions and argue about our future work in section 6.

2 ELEMENTS OF THE SUSPENSE AND READER AFFECTION

In this work, we adopt the Zillmann's definition of suspense [60, p. 208]: "A noxious affective reaction that characteristically derives from the respondents' acute, fearful apprehension about deplorable events that threaten liked protagonists, this apprehension being mediated by high but not complete subjective certainty about the occurrence of the anticipated deplorable event". This can be refined through the idea of suspense in drama as subject to further unique and seemingly universal restrictions: 1) the preoccupation with feared outcomes; 2) the selection of liked protagonists as targets for feared outcomes; and 3) the creation of high degrees of subjective certainty for the feared outcomes that threaten liked protagonists [59, p. 135].

In addition to this, we have identified three dimensions that essentially compose the suspense: emotional valence, empathy and arousal.

Emotional valence describes the extent to which something cause a positive or a negative emotion [19, p. 79]. In terms of the story, an element has a negative valence when it push towards a negative outcome. It has been extensively investigated the paradox in that texts with negative valence are perceived as more amusing than texts with neutral or positive valence. Citing Altmann [4, p. 2], the emotional reaction to uncomfortable expositions has been studied in media psychology regarding different narrative contexts. These contexts include tragic television news and crime drama [61][44][45], where enjoyment of unpleasant stories is not limited to a happy endings [49]. Suspense increases while the negative outcome probability [31, p. 107, 137] and the negative valence effect of the environment features do [26, p. 19].

According with this and as our second dimension, it has been tested that increased film enjoyment was reported for viewers with high empathy [22, p. 91]. Empathy is an emotional involvement related to the capacity to understand another's affective state [4, p. 2]. This positive emotional feeling occurs and increases with: a) the character's physical attractiveness [33, p. 2] and b) the audience's endorsement with the character's ethical behaviour and moral judgement [55, p. 344]. Specifically, suspense in fiction occurs, in general terms, when all likely outcomes are such that the outcome considered

as correct is perceived to be much less probable [15, p. 137].

Generally, a seemingly effective manner to predict the level of empathy is through a measure of similarity and dissimilarity [44, p. 405]: a reader will imagine a preferred outcome for a character that the reader identifies with [16, p. 13]. Suspense will increase the further the story keeps away from that desired result. By throwing obstacles in the character way, the narrative can generate the anticipatory emotion of the fear [32, p. 7]. Although nowadays in the field of psychology it's not clear how many features may provoke empathy, some characteristics like race [18] and attractiveness [23] has been verified as generators of it.

Our third dimension, is the arousal [7], that refers the intensity of the emotion [19, p. 79]. This dimension seems to have a similar effect on the audience that the pattern found in negative valence. So, the higher the discomfort during the tension phase, the higher the pleasure in the moment of resolution [36, p. 82]. Novelists and narratologists agree with that the duration of the scene has an important role in this tension. "Suspense" comes from the world "suspend". Its etymology suggest that the more suspense is wanted, the longer suspend the scene is needed [39, p. 106]. Presenting the outcome a little later than expected [21, p. 325] is a key that relates suspense and timing.

Even considering that exists a possible dependency among these three dimensions (and more typically between valence and arousal) [10][29][20], we consider them separately. The reason is because, even if changes in one can affect the others with respect to the reader perception, we consider characteristics that can not be derived or transferred from one dimension to any other. For example, empathic features as victim physical attractiveness don't depend on negative valence nor the arousal, and cannot be extrapolated. Likewise, several models of emotion assume that valence and arousal are distinct variables [20, p. 324].

So far we have argued the dimensions of suspense in the narrative, we cannot obviate the variability of the effects in the individual spectators. It may be pointed out that emotional responses to narratives always are based some degree on personal experiences, real or experienced through fiction [56, p. 971], so, the suspense will be enjoyable or not depending of its impact in the reader. In addition, there is a fairly generalised consensus that this emotional effect is not just due to the story implicit or explicit characteristics (like the general meaning of words used), but the disposition of the reader to the patterns of the text [30, p. 279]. Under this standpoint, reading process is a reciprocal and transactional relation between the reader and the text. As the emotional effects, the "meaning" does not reside readymade in the text or in the reader, but happens during the transaction between them [48, p. 4]. Without leaving behind the unquestionable relevance of the words, there is a broad agreement that the meaning created when reader and author meet in the texts is higher than written text or previous reader's knowledges [9, p. 31]. Thus, the power of the worlds is tempered to the reader's internal process of assimilation in its context where they are presented. However, there are common narrative features involved globally in suspense, although the level of emotional effects depend on individual characteristics of the audience.

This approach must be taken into account when we consider the three dimensions of the suspense. Therefore, we don't understand valence, empathy and arousal of a concept regardless of the reader or the viewer. Moreover, the modulatory effect of emotional context was constrained by the inherent meaning of target word [37, p. 379], of an image or both as significant [57, p. 404]. It has also been demonstrated that affective content affects men and woman differ-

ently [12, p. 219, 223]. Individual perceptions as the prediction of the outcome of events (including the character's fate) depends of the culture and upbringing [35, p. 124].

We can conclude that the individual estimation (weight) of the concepts like meaningful context are necessary to understand the individual suspense in their three dimensions: emotional valence, empathy and arousal.

3 AUTOMATIC SUSPENSE GENERATION

The treatment of suspense in the main narrative automatic systems is briefly summarized and discussed below.

MEXICA [42] is a program that writes short stories about the Mexicas, the old inhabitants of what today is Mexico City [42, p. 2]. These stories are represented as clusters of emotional links and tensions between characters, progressing during development, and whose operators, intensity and predefined texts are customizable. In MEXICA, it is assumed that a story is interesting when it includes degradation-improvement processes (ie., conflict and resolution) [42, p. 4]. Throughout the history, emotional links among the characters vary as a result of their interactions; so, *princess healed jaguar knight* produces the effect of increasing a positive emotion (gratitude) from the knight to the princess.

MEXICA is an exception in the use of positive emotions to implement the narrative tension. The system works with two predefined types of emotion: brotherly love and amorous love, both ranging from -3 (negative emotion) to 3 (positive emotion). Aditionally, ten types of tension are defined (actor dead, love competition, health normal...), which are generated based on the type and emotional value of each character. The stories search degradation-improvement curves through actions that transform the extent of the tensions.

MINSTREL [54], meanwhile, is a complex program that writes short stories about Arthurian legends, implemented on a case-based problem-solver where past cases are stored in an episodic memory [43, p. 4]. MINSTREL recognizes narrative tension plots and tries to increase the suspense by adding more emotionally charged scenes, by storing a simple ranking which tells when such inclusion is reasonable; for example, when the action is preserving a life. It uses two strategies for generating suspense: via character emotion and via character escape. In the first one, it is included in the text a sentence that describes the fear of the character about the immediate threat. The second one adds another sentence that reports a failed character's attempt [54, p. 123–126].

Another initiative is Suspenser [17], that adapts the cognitive psychology theories for creating stories with the objective of increasing the reader's suspense. It provides an intermediate layer between the fabula generation and the discourse generation, which selects the steps of the plot according to their *value of importance* for the final goal. For this and based on the Gerrig & Bernardo's assumption[7], Suspenser uses a set of heuristics grounded in the number of paths available for the character to reach its goal, considering optimal the probability of protagonists' success as 1/100 [16, p. 59].

Also based in Gerrig & Bernardo's work, Dramatis proposes an implementation of a system to evaluate suspense in stories that utilizes a memory model and a goal selection process [41, p. 5], assuming that the reader, when faced with a narrative, evaluates the set of possible future states in order to find the best option for the protagonist. With a similar target, Dramatis generates escape plans attempting to "break" the causal links that would reach non-desired goals

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[7] "Readers feel suspense when led to believe that the quantity or quality of path through the hero's problem space has become diminished". [27]

(typically, the character death) and the reader could predict more easily. To do this, the memory model assigns more relevance to the elements recently narrated than to those mentioned at the beginning of the story.

Finally, we review IDtension [53], a drama project which comes up in order to demonstrate the possibility of combining narrative and interactivity. Unlike approaches based in character's chances or the course of the actions, it conceives the stories based on narrative properties (conflict or suspense).

Suspense is treated by IDtension as a reaction to the *obstacles* (conflicts), and is correlated to the risk of facing every expected obstacle (high or low risk, without intermediate values). The narrative effects of the tension are calculated by six criteria: ethical consistency, motivational consistency, relevance, cognitive load (influence in the story), characterization and conflict. Also, the condition is managed by a series of actions as accepting, refusing, congratulate, etc., available for use on / among the characters.

Although their purpose is not the generation of suspense, other proposals include mechanism for its treatment. IPOCL [46] is a kind of POCL planner (*Partial Order Causal Link*) which is improved by a factor of intention (*Intent-Driven*) on the part of the characters, denoted by a function `intends`; the planner attempts to satisfy the intention whenever possible. Indexter [14], based on IPOCL, offers a model that emulates the reader's memory, allowing use of knowledge previously presented as new (and surprising) information. To end this section, we mention Prevoyant [6], that enriches the stories with flashback (past events) and foreshadowing (hints of what is to come) strategies, providing additional data and tension ahead, respectively. For the first strategy, Prevoyand identifies causal links previous to the current event that haven't been described; as to the second, it submits a character or object participant of a future event.

With respect to our goals, the review of the above systems has exposed some comparative limitations. Firstly, we can observe that none of them takes into account the empathy as explicit part of the model, neither physical aspect nor moral and ethical issues. Additionally, as result of the evident limits of the current storytelling systems, the number of possible interactions between the characters and the environment is restricted by its respective internal base of events. In any case, MEXICA allows to redefine the actions.

On the other hand, all of them include arousal to a greater or lesser degree. MEXICA implements an emotional gradual intensity, ranging from -3 to 3, being the only that includes emotional valence both in this range and in the variability of possible interactions. MINSTREL, Suspenser, Dramatis and IDTension don't include the valence either. With respect to IDTension we haven't studied the effect of the interactivity narrative in the result of the suspense.

4 PROPOSED ARCHITECTURE

The main objective of the proposed architecture is the adaptation of the descriptive elements of a scene, in such a way that the scene output is adjusted to the required suspense intensity. Both the order and the result of the events will not be changed from the scene input to the output.

Following, we present our proposal. Figure 1 illustrates a simplified architecture of our model. This architecture consists in seven main elements (*Scene*, *Intensity*, *Extractor*, *Components transformer*, *Corpus*, *Reassembler* and *Output scene*) whose functions are described next.
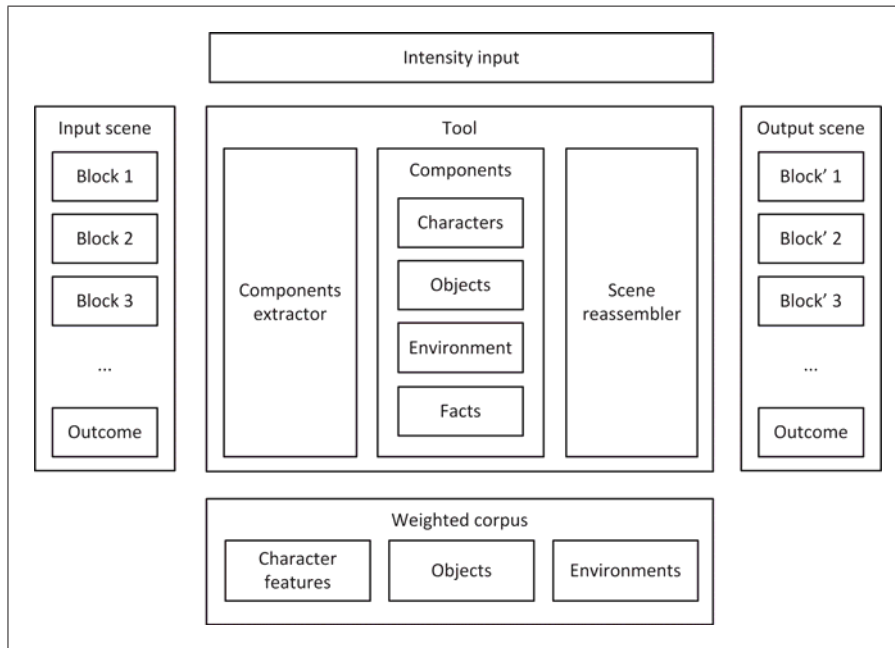
Figure 1. Proposed model architecture

4.1 Scene

Our proposal adopt the concept of *Scene* from the cinematographic sphere. A scene is the unity of dramatic action which, endowed with initial approach, junction and outcome, is determined by a spacial location criteria and change at least one of the values of any character's life[8] [5, p. 195][38, p. 56]. For our purposes, we consider a scene as a succession of information blocks that are provided to the audience. Such information blocks will be divided in descriptions and actions. Descriptions are representations of characters or objects, relating or explaining their different parts, features or circumstances [25]. These representations can be described by specific sentences or through the optional enrichment with adjectives of the part of the narrative where the element is referred. Meanwhile, actions constitute a succession of events during the scene.

We illustrate a fragment of the original script of Psycho film's shower scene [52] as example of these descriptions and actions:

> *Over the bar on which hangs the shower curtain, we can see the bathroom door, not entirely closed. For a moment we watch Mary as she washes and soaps herself.*
> *There is still a small worry in her eyes, but generally she looks somewhat relieved.*
> *Now we see the bathroom door being pushed slowly open. The noise of the shower drowns out any sound. The door is then slowly and carefully closed.*
> *And we see the shadow of a woman fall across the shower curtain. Mary's back is turned to the curtain. The white brightness of the bathroom is almost blinding.*
> *Suddenly we see the hand reach up, grasp the shower curtain, rip it aside.*

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[8] "The scene is the unity of any dramatic action that, endowed with a beginning, middle and end, is determined by a criterion of spatial location" [5, p. 195]. "A scene is an action that occurs through a conflict in time and space more or less continuous, changing at least one of the values of the character's life" [38, p. 56].

In this fragment, we can observe the descriptions (bar, curtain, semi-closed door, Mary, sightly worried eyes, noise, shadow of a woman, white brightness and hand) and the actions (Mary washes and soaps herself, door is pushed slowly open, door is slowly and carefully closed and the shower curtain is grasped and ripped).

We represent each of the elements as an information block in the same order that they are narrated, being descriptions or actions. In any case, in this paper we focus on descriptions, as being the items which our model operates with. For this modeling, we are analyzing the description mode of some existent storytellings, searching for enough level of detail and robust knowledge representation. We put aside the process of actions for a future work.

4.2 Intensity

Intensity is represented as a quantitative integer value that indicates the desired level of suspense in the scene output. This way, if the difference between the required intensity and the intensity of the scene input is positive, the model will generate a more suspenseful scene, and vice versa. In case of coincidence, the scene output could involve a descriptive variation with respect to the scene input, but holding an equivalent suspense level.

As the intensity is an internal value whose range is not known by the user, we propose to specify the increment or decrement of the current intensity in the input. However, it is not necessary to include this option in the present model description, because the architecture is focuses on the functionality, not on the usability.

4.3 Extractor

The main process consists on three stages. In the first one, the extraction, description items have to be obtained from the information blocks. This step will depend on the scene input format: a) if scene

input contains the states of the plot including specify tags for identifying the suspense elements, the extraction is immediate; b) if scene input is a narrative discourse, a complex algorithm will be required for analysis, identification and classification. We are working on the first option, leaving the discourse for later.

4.4 Components transformer

As we have referred, an intrinsic part of the extraction system is the transformation of the concepts. This component selects elements of the plot considering the interesting elements: characters, environment descriptors, object y facts. Among these, a second stage will select those elements implied in the plot according to their arousal and value of valence as measure of suspense affection.

After this, the goal of the transformation stage is to modify the descriptive elements, so the total amount of estimated suspense matches the intensity input. This implies the selection and launching of actions as Substitution, Insertion and Elimination (SIE) of characters features, characteristics of the environment and object's descriptions.

Transformation stage is complex: it implies making up a set of SIEs and select the most accurate in one way that the story keeps its consistency and the descriptor density deviation fits a minimum valid range. An evolutionary algorithm with customized heuristic of fitness is currently under production to satisfy our requirements.

4.5 Corpus

Our corpus consists on a set of terms, each one associated to a quantitative value that represents its level of suspense based on the already referred emotional valence, potential empathy and arousal. This information allows to measure the intensity of the scene from the previously extracted methods, in the transformation stage.

In the current state of our research, we base the corpus information in three big groups: character features, objects and environments.

4.5.1 Character features

As the same way than corpus is weighted using emotional valence, potential empathy and arousal, character features are balanced. According to several definitions of suspense, in terms of the characters the emotion generated is related (although not only) to the fate of at least one of them (victim) due to the actions of another one (threat). Directly or indirectly, this figure and its features are the center of what happens in a scene. Regarding Zillmann, the more dangerous and near is the threat, the more apprehension is experienced at the approach of the deplorable event. However, even this may seem obvious, we can not forget that the threat is not a static independent actor. On the contrary, the circumstances of the potential victim can change its nature.

For example, just before the mentioned Psycho's shower scene, the film script describes Mary's circumstances as [52]:

> *She goes into the bathroom, drops the pieces into the toiler*
> *bowl, flushes the toilet. Then she drops her robe and steps into*
> *the tub and turns the shower on.*
> *Over the bar on which hangs the shower curtain, we can see*
> *the bathroom door, not entirely closed. For a moment we*
> *watch Mary as she washes and soaps herself.*

This way, the screenplay is preparing the viewer for amplifying the effect of the immediate scene of suspense through the victim's features, portraying her as a helpless person: she is nude, can not

hear or see well due to the shower, and her ability to escape is obviously limited[9]. On the contrary, if Mary had been warned, with the curtains open and a gun in her hands, suspense arousal would have been different comparing to the original script. Moreover, even if this is not the probable case, an extreme lack of sympathy for Mary could provoke that the spectator wouldn't really matter what will happen to her.

Summary up, a suspense generator must firstly take into account the character's features in the context of the threat, while the effect of its proximity in the viewer depends on the circumstances and characteristics of the victim that can be perceived and interpreted by the audience.

We propose three features to conform our corpus' *Character features* block: a) features related to balance of outcome oriented implicit strengths; b) features related to the empathy; and c) features related to the proximity between threat and victim to the outcome, as a spatial or temporal dimension concerning both sides.

The first one refers to the perceptible ability of the victim to counteract the threat. It implies an extensive ontology of features that includes physical aspects such as size, physical strength, intelligence, perceptive skills or endurance; capabilities such as experience in the use of weapon or fantastic abilities as crossing through walls; and resources at hand such as armours, guns or flashlights. These features are measured and quantified for both victim and threat, and the difference between both values represents the influence of the strength in the suspense. Considering the revisions about the suspense, our hypothesis is that the stronger the threat is for the victim, the more potential suspense can be generated.

The second character feature is about empathy: the features that generates feelings of identification in the viewer. As explained in the previous section, just few features have been proved as *empathizables*. Concretely, race and attractiveness[10] are two verified features that fit in the context of suspense. As well as the race can be easily represented by the model, the concept of "attractiveness" involves physical, mental, behavioural or derived from a position of power (including helplessness) which require a more complex treatment.

The last character feature refers to the proximity to the outcome. This is directly related to the scene *tempo*; as we have already mentioned, timing is an important criteria for evoking suspense. Therefore, suspense will increase as the threat is approaching the victim, physical (the killer) or just on time[11] (a countdown explosion). The behaviour of the victim and the threat are opposed: as the threat tries to reach the negative outcome, the victim struggles to get away from it. We consider that more suspense is inoculate in the audience the lower sum of the quantification of these distances is.

4.5.2 Objects

Objects involved in a suspense scene can take the role of: a) elements which influences the scene plot; b) decorative elements without direct participation. The model works on a different way depending on the case. As it depends on the context, this difference is not specified directly in the corpus.

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[9] The effect of the escape's ways in suspense is already mentioned in Gerrig & Bernardo's assumption.

[10] Even the context in which its influence has been verified is very specific (a sexual aggression [23]), the consideration of that the feature can influence in the empathy of viewers in a suspense film is taken as hypothesis, extending the feeling to any kind of aggression as a generic helplessness situation.

[11] Physical approaching implies necessarily on time approaching, but not the reverse.

The elements that influences the plot are related to the character strength, while they can take the role of resources that can help or harm to the character. For example, in Psycho's shower scene, the curtain can be consider an element that creates a disadvantage for Mary, as the knife brings improvement for the killer objective. It is different from the balance of strengths of the block *Character features*: our concept of character features implies implicit attributes or *at hand* resources, but the *Object* block refers to potential resources. The effect in suspense is different: at the moment that the killer is approaching, it is not the same for the audience viewing the victim *having* a gun that realising that *there is* a gun on a table at hand (available for the first to catch it). The preferred objective and the expected steps change, influencing the perception of the proximity to the undesired outcome: defense capability of the victim is lower if the victim can not reach the weapon. Our proposal is that suspense is effective if the plot is pushed to balance the original difference of strengths while the outcome is approaching. Thus, the elements in the scene can contribute to strengthen or to weaken any of its parts.

The other kind of object has only a decorative function. Even though the influence of the aesthetic in objects with an active role in the plot, there are many others that just "colour" the localization. The valence of the elements influences its perception, which may have effect in suspense. For example, the toilet in Psycho's shower scene brings nothing to the events; moreover, it is not probably that the viewer can suppose any function related with the plot when the killer is approaching. However, Hitchcock decided to film it as he thought it would have emotional effects for the audience [3, p. 269].

4.5.3 Environments

Being called spacial context, atmosphere or scenery, the environment is a verifiable generator of suspense. In the one hand, it affects to the skills of the characters. Meteorological effects like fog and rain reduce the perception; snow makes the floor tricky; ice slides. As part of day cycle, twilight and night has similar impact in visual abilities. It affects to the balance of strength, usually negatively for the victim. For example, in Psycho's shower scene, the bathroom was full of steam; even if Mary had been facing the door or without curtains, it should have been hard to recognize the silhouette and to be on guard.

On the other hand, even if there is no objective reasons to have any kind of valence for an specific environment, we can not discard the classical conditioning: we have learnt that focusing a long corridor in an old castle usually precedes a negative outcome, even if there are no grounds to think that the corridor in and old castle is worse than a corridor in a beautiful mansion. This behaviour is similar to the decoration elements.

4.6 Reassembler

The scene reassembler is the part of the model responsible for building a new scened based on the original, putting all together the block of the plot, in the format of the chosen storytelling, as the has been modified by the Transformer step.

4.7 Output scene

On completion of the process, the scene output is the result of the model. We represents an example again from the scene input of the original script of Psycho film's shower scene [52], supposed a higher intensity required:

*Over the bar on which hangs the shower curtain, we can see the bathroom door, not entirely closed. For a moment we watch Mary as she washes and soaps herself. **Outside, we can hear a big storm in the middle of the night.**
There is still a small worry in her eyes, but generally she looks somewhat relieved. **She feels guilty and sad.**
Now we see the bathroom door being pushed slowly open. **A thunder resonates in the distance.**
The noise of the shower drowns out any sound. The door is then slowly and carefully closed.
And we see the shadow of a woman **crawling toward** the shower curtain. Mary's back is turned to the curtain. The white brightness of the bathroom is almost blinding.
Suddenly we see the hand reach up, grasp the shower curtain, rip it aside.*

There are differences between the scene input and the result. Firstly, an environment description has been included (the storm). Besides, it is reported that Mary feels guilty and repentant. Finally, the shadow is weirder that in the original version.

5 DISCUSSION

Our proposed model does not only apply to movies, but to any kind of narrative created from a plot: games and automatic storytelling are good candidates to approach the system, as they can dynamically change part of the story before being presented to the audience. It provides the chance for changing the level of suspense as interaction with the story.

We do not expected problems in implementing technical issues, while nowadays there are plot generators, extractors and algorithms capable of generating different combinations of SIEs events according to a quantitative objective (for example, the scene arousal level). Once we get a functional model, a future objective will be extending the model beyond descriptions and characters features, but with facts (like movements of curtains or doors). However, our immediate challenge at this time is to get the *weighted* corpus, proposing a formal model for giving that quantitative measure for each element: within narratives a one-to-one mapping between words denoting emotions and actual experienced emotion is rarely found [56, p. 964].

At the time of this writing, we are working on it. The selection and analysis of suspense and horror movies may help to develop a first ontology and subsequent formulation of characters features; from the field of psychology, the study of classical conditioning comparing with the classical scenes will provide information to measure the importance of the environment in the arousal; finally, the revision of different studies of emotional affection generated by physical concepts will be useful to quantify the effect of the decoration objects [57][56].

Related to this, there are other limitations that we need to consider. We have distinguished between objects which influences the scene plot and decorative elements without direct participation. Assuming that some elements have an evident and natural effect in suspense because of its common purpose (knives, corpses or wardrobes), the utility of other specific objects in the plot is individually determined by each spectator or can depend on the context. Since the semantic meaning of a word can be selected by context, it seems reasonable that evaluation of the emotional tone of a word could be shaped by an emotional context, as emotional evaluation is more subjective and changeable than semantic meaning [37, p. 380]. For example, a laptop on a table can be only an inoffensive decoration, but it could be used as a blunt weapon too. It might lead to consider decorative ef-

fects negligible while we have other effects that influence directly the plot. We need conclude our study to confirm this hypothesis.

An additional difficult issue has been found analyzing the effect of the identification between audience and character. Although it is included in the model, we suspect that the concept of *empathy* (as an emotional, social and unconscious approach based on identification) has not a determinant weight in the suspense. This is extensible to other related aspects like moral or ethical behaviour. Therefore, we do not agree with a moral disagreement with a character is enough to desire an awful outcome, and a moral agreement is not enough to feel more suspense. We need to analyze the concept and effect of empathy in order to support this assertion.

At all events, we conceive the existence of an "internal conflict" due to the spectator's belief in a "just world" [11, p. 114, 116] that makes the vision of a character under threat as root of discomfort. However, this feeling seems independent of the empathy, as we sense it even the character actions had been at the antipodes of our ethical criteria.

Finally, we are convinced that the balance of implicit strengths and the proximity between threat and victim to the outcome are important features affecting to the suspense.

6 CONCLUSIONS

In this paper, we have presented a model schema that aims to: a) measure the arousal of a suspense scene; b) compose a new scene by replacing and adding elements and characters features, adapting the audience's preferred intensity level. We consider this objective as interesting in terms of enjoyment: while some people experience excitement and intellectual stimulation when watching suspenseful or horror films, others experience dramatic psychological consequences. People more sensitive to this kind of emotional immersion are influenced to think that something bad is going to happen, and they report experiencing physical stress waiting for it to actually happen: being so scared that they are afraid to go home after the movie or walk to their cars in the parking lot, or need to sleep with someone else. They get truly scared and are affected physically and psychologically [47]. Providing to this people to enjoy and share horror common films is a reason for measuring and adjust the suspense arousal.

Besides, in the field of the computational creativity we expect that this general quantitative prediction model will serve as a basis for benchmarks on stories based on their potential interest to the viewer, in the form of suspense. Likewise we aim to provide, for automatic, interactive or supervised storytelling generators, models of decision regarding choosing conceptual spaces in the plot development.

Although the model is defined enough, some specifications must still be concreted. Firstly, potential storytellers, one of which will support the descriptions of the plot, objects and characters features, are currently being analyzed. Secondly, we need explore more deeply the relation between suspense and its dimensional components: emotional valence, empathy and arousal. This will allow us to determine a quantitative formal method to assign the weight to the elements involved in the stories. Finally, an optimal algorithm is under study to select the most adequate SIEs depending on the required intensity.

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