



# An information-theoretic evaluation of narrative complexity for interactive writing support



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## ABSTRACT

Narrative complexity should be managed systematically during the creation process because it heavily influences the levels of understanding and the interest of recipients. Existing research has tended to depend on impressionist criticism or to deal with narrative complexity at general and superficial levels. In this paper, we consider the creation and acceptance of narrative as information processing mediated by a narrative text. Under this assumption, we propose a method to quantitatively evaluate narrative complexity at the recipient's cognitive level, and to effectively utilize the evaluation to aid in the author's narrative creation process. Within our knowledge distribution model, a narrative is represented as a *knowledge structure*, and the *knowledge state* and *knowledge flow* of narrative agents are evaluated using a probabilistic reasoning model. From the knowledge flows, the amount of information processed and required by the recipient is calculated as a measure of the narrative complexity using entropy theory. As a case study, we conduct a comparative analysis of an actual cinematic narrative and a structurally manipulated version of that narrative to show how the method captures characteristics and changes of the narrative; we also discuss the improvements presented in this paper as compared to our previous research.

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## 1. Introduction

Narrative is a recounting of event-based experiences and as such the most universal and common discourse genre. Narrative complexity is a cognitive phenomenon that occurs during the construction-integration process of recipients as they attempt to understand narrative (Kintsch, 1988). The cognitive process of understanding of narrative is affected by themes, narration methods, and contextual factors such as the following: personal traits of recipients, sociocultural contexts, background knowledge, the goals or motives of recipients, etc. Among these affecting factors, the points on which studies about narrative complexity focus in general are the structural property of narrative and its subsequent understanding by recipients. When properties such as multiple timelines, unreliable narrators, unmarked flashbacks, unexpected causal reversals, embedded or 'nested' (story-within-story) plots, etc., appear within narrative text, the narrative complexity increases and, accordingly, understanding by recipients becomes more difficult

(Bordwell, 2013). As such, when the cognitive load of recipients is taken into account, complexity should be suppressed in general in discourse genres (i.e. argumentation, description, and exposition), which aim mainly at effective knowledge delivery. However, narrative complexity is a determinant of the characteristics of specific narrative text, and often becomes the criterion for genre categorization. Narrative complexity also heavily influences the level of interest: it is directly related to the selection and appreciation of narrative text by recipients (Buckland, 2009). Thus narrative complexity, as it is associated with the experience of recipients (Kim, 1999), must be systematically managed with appropriate magnitude and period according to the intention of the author.

Because of the importance and the distinctiveness of narrative complexity in the creation and acceptance process, there have been a number of studies of this idea. However, many of those studies have tended to depend on impressionist criticism at an abstract level, or to handle complexity with elements exposed on the surface in the narrative text; this has made it difficult for those studies to utilize sophisticated analysis or evaluation of narrative. Also, studies so far have focused on static assessments based on the syntax of narrative texts that have been completed already; it would be difficult to apply such a static analysis to the dynamic creation process, in which complexity must be delicately managed

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by repeated steps of composing and evaluation (i.e. engagement and reflection) (Sharpley, 1999). One of the reasons for the problems of currently available research is the lack of attention that has been paid to the cognitive process of the author and the recipients, and to the dynamic characteristics of the narrative, which is constructed-reconstructed through an interaction between creation and acceptance.

In this paper, based on the narrative communication model, we propose a new method of evaluating narrative complexity that can be applied for narrative analysis and creation. We consider the creation and acceptance of narrative as information processing mediated by a narrative text (Graesser, Golding, & Long, 1991); we define the amount of information generated in the process of understanding as the narrative complexity. From this perspective, we propose a representation model for narrative as an object of information processing; we also present a method to evaluate narrative complexity at the recipient's cognitive level. To evaluate narrative complexity, the *knowledge distribution model*, which was suggested in a previous paper (Kwon, Jung, Kwon, & Yoon, 2014), is extended and used as a narrative representation and modeling framework. The knowledge distribution model highlights the information processing of narrative agents (i.e. recipient and character) (Graesser & Wiemer-Hastings, 1999) and suggests that the knowledge state is a result of information processing. An author can represent a narrative using a knowledge structure and can control the knowledge state and flow of each narrative agent. The amount of information generated in the process of narrative understanding is based on the recipient's knowledge flow, which is derived from the knowledge distribution model. The amount of information as the measure of narrative complexity is quantitatively calculated using the concept of entropy from information theory and a calculation method to determine the relative entropy. The author of a narrative can identify the level of multifaceted complexity quantitatively and can reconstruct the narrative configuration with reference to the evaluation of the narrative complexity. This iterative and interactive method can support the author in narrative creation.

This paper consists of the following sections. In Section 2, studies on narrative complexity in various fields are examined and their limits are analyzed. Section 3 examines the knowledge distribution model, which is focused on extended and complemented in this paper, and explains how this model can be applied to evaluate narrative complexity. In Section 4, a new method based on the concept of entropy in information theory is suggested to evaluate narrative complexity. In Section 5, the effectiveness of the proposed method is verified by analyzing an actual cinematic narrative; this section also discusses improvements that have been made to the previous method (Kwon, Kwon, & Yoon, 2014) based on the structure of event networks. Finally, in Section 6, we give our conclusions.

## 2. Related work

In narratology or cinema studies, which are based on the daily experiences of recipients who enjoy story-based contents (i.e. movies, dramas, novels, etc.), narrative complexity is discussed using diachronic study. Mittell (2015) developed a wide ranging discussion of narrative complexity based on contemporary TV dramas (including *The Wire*, *Lost*, *Breaking Bad*, *The Sopranos*, *Veronica Mars*, *Curb Your Enthusiasm*, and *Mad Men*). He identified narrative complexity basis on poetics, including concepts from literary theory and film studies. He focused on the following characteristics that appear in TV drama narratives: diversification and hybridization of genres, increasing numbers of sub-plots and characters, and fluctuation of character arcs and event developments, etc. Mittell traced the emergence of this narrative complexity (mode), focusing on issues such as spectatorship, media

format, the studio system, and cultural evaluation. In a book analyzing the complex trends that appeared in movies during and after the 1990s, Elsaesser (2009) explained narrative complexity with the term 'mind game'. He analyzed 'mind-game movies' (including *Memento*, *Matrix*, *Sixth Sense*, the *Truman Show*, etc.), broadly arguing that the most important and common characteristic is the posing of epistemological problems such as "How do we know what we know?" and the expressing of ontological doubts—about other worlds and other minds—to the characters and audiences. Such 'mind-game' characteristics appear in both the content and form of the narratives, and audiences feel both cognitive load and interest while attempting to understand such 'complex' narratives.

Based widely on social, cultural, philosophical, and industrial contexts, these studies are excellent at suggesting the characteristics of narrative texts that influence complexity. However, for specific narrative text analysis, the studies often rely on qualitative impressionist criticism. They evaluate narrative complexity on an abstract level and stick with theoretical discussion; as such, the studies are not useful for narrative analysis and creation.

In the field of education, evaluation of the narrative competence of learners is one of the major topics due to the importance of narratives in identity formation, social relations, and external world and event understanding (Bruner, 1987). Complexity is one of the major criteria used to evaluate competence in narrative understanding and creation. That is, the more complex the narrative that a test subject can process, the better the narrative competence that that subject has. As for the general assessment methods in the field of education, there are two assessment methods for narrative competence: norm-referenced assessment and criterion-referenced assessment. The former refers to standardized tests that are designed to compare and rank test takers in relation to one another, and the latter refers to tests that are designed to measure test takers' performance against a fixed set of predetermined criteria or learning standards (Linn, 2008).

One standardized norm-referenced test which is specifically designed for the assessment of narratives is the Renfrew Bus Story (Cowley & Glasgow, 1994). In this test, the examiner tells the Bus Story with a series of pictures, and then test takers retell the story after a while. The examiner marks them by transcribing and coding the retold story. The complexity is one of the indexes in four quantitative categories (i.e., information, sentence length, complexity, and independence) for scoring. The test assesses the ability to retrieve the relevant information then construct a coherent description of continuous series of events. Since the test highlights the integrated language skill focused on syntactic aspect of the narrative text, the complexity is evaluated by counting the numbers of sentences containing subordinate and relative clauses. The test has the merit of proceeding easily and quickly with reliable score. However, it has weak psychometric qualities for the complexity dimension (Petersen, Gillam, & Gillam, 2008).

Among criterion-referenced assessments, 'Index of Narrative Complexity' (INC) scoring system (Petersen et al., 2008) is a comprehensive and remarkable study focusing on complexity. The INC integrated existing research and conceptual/analytic approaches related to the assessment of macrostructural and microstructural aspects of oral narratives. The INC scoring system includes categories for rating the complexity of characters, setting, initiating events, internal responses, plans, action/attempts, complications, consequences, narrator evaluations, formulaic markers, temporal markers, causal adverbial clauses, and knowledge of dialogue. In the INC scoring system, the examiner transcribes and codes the oral narrative based on the above mentioned thirteen categories, then scores from zero to three points according to the given conditions of each category. This method is good for quantitative evaluation

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