

Bernd Nuss

Base-1 method:

A structural-functional approach to word,
sentence and discourse readability

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This book is dedicated to my dear husband, Lincoln Fairweather.

Abstract

This paper combines linguistic research and comparative inquiry of existing English readability formulas with the ultimate end of outlining a procedure for a universally applicable approximation for text readability in other languages than English. This research will enable the development of leveled German for early reader programs. An analysis of early reading development in combination with structural-functional interrelationships between syntax and semantics according to generative grammar and functional discourse grammar are the theoretical foundations for the development of the *base-1 method*. This algorithmic method parses and factorizes language structures resulting in quantified text complexities on the word, sentence, and discourse level. To calibrate and evaluate the validity of the base-1 sentence complexity method, a leveled text comprehension matrix with the two parameters – syntactic and semantic complexity – was tested with second through eighth grade students in a German immersion program. For the featured text samples, the suggested readability evaluation process produced comparable correlation levels similar to Lexile® across the spectrum of sentence complexity. However, the base-1 method permits continued detail calibration refinements for grammatical feature difficulties. An increased number of diverse text samples along with extended experimental group sizes are required to confirm the validity of the base-1 method on a larger scale. In the absence of comprehensive German readability formulas, this paper intends to incite a new discussion about early literacy practice in Germany in terms of appropriate reading level provisions and a subsequent individualization of reading instruction.

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CHAPTER 1: INTRODUCTION TO THE STUDY

1. Background

There has been a long-standing tradition of text readability research in the United States, which has been increasingly utilized to improve individualized literacy instruction especially in early reading programs. In contrast, the interest to define the ease of text readability in Germany started much later. The German attempts have earned remarkably sparse public recognition and the focus of this research mostly centered on the simplification of highly complex texts. The path of research in the US has yet to find its counterpart in German educational practice.

The mutual exclusiveness of research culture on readability on both sides of the Atlantic Ocean becomes an issue, when bilingual educational programs need to merge teaching philosophies and instructional material from both cultural backgrounds. Specifically, public immersion programs in the US are obliged to strictly adhere to US federal and state laws, curricular standards, norms, and methodology, whereas simultaneously the instructional philosophy is to reflect target language cultural and educational practice. The provision of instructional resources in the target language that suffices the norms of state mandated teaching and testing is an immanent resulting dilemma. For instance, the North Carolina House Bill 950 (Excellent Public School Act, NC Assemb. 950, 2011), also known as “Read to Achieve” law, outlines an early reading testing program, that is in large part incompatible with the sequencing of commonly used German early reading programs: “Formative and diagnostic assessments and resultant instructional supports and services shall address oral language, phonological and phonemic awareness, phonics, vocabulary, fluency, and comprehension using developmentally appropriate practices” (SECTION 7A.1.(b), § 115C-83.1F. (b)). This bill resembles in detail the components of the intense testing program provided by mCLASS®: Reading 3D™ - Amplify, which has been used in NC to assess reading foundational skills and reading comprehension in English in Kindergarten through third grade. To comply with state standards, language immersion programs, which provide the literacy instruction in the target language, are obliged to adjust their literacy instruction practice and depend on translations of the testing program. However, the provision of leveled reading material used for the testing of reading comprehension poses a challenge for languages that traditionally do not employ leveled reading programs in their early reading instruction. The absence of commercially available leveled early reading programs in translation is founded in the absence of established and well-researched text rating system in other languages than English. A cross-comparison and calibration of readability approaches between languages is under these circumstances not even an option.

2. Research Questions

To bridge the trans-Atlantic research gap of text readability for beginning readers, this research study attempts to lay a foundation for a German text leveling procedure by examining existing English readability evaluation procedures and discussing their transferability to other languages based on early literacy research, general linguistic contemplations, and inter-idiomatic comparisons. The result is a factorized, algebraic readability approximation based on morphological, syntactic, semantic, and discourse cohesion following a set of guiding research questions:

- Which factors determine and support the early reading learning process?
- How do basic reading and text comprehension skills develop in beginning readers?
- How has readability research considered text comprehension challenges for beginning readers?
- How are linguistic text structures, such as morphology, syntax, semantics, and cohesion, functionally linked to building text complexity?
- How can such text structures be quantified in an algebraic method?
- How can the impact of distinct text features on text readability be weighed and factorized into the readability approach?
- How does such a readability approach compare to commonly used readability approaches in a cross-idiomatic comparison?

3. Significance

This study is significant in three ways. First, it explores general predictors for early reading success to determine relevant contributors. The analysis of general readability contributors lays the foundation for comparisons in reading processing in different languages. Second, this study explores the foundational functions of text comprehension for beginning readers in a structural-functional approach. This exploration is generally independent of language, because it strictly analyzes base configurations of language structures through functional interdependencies that are common to most languages. Thirdly, this study highlights the implications of the structural-functional principles as employed historically by readability approaches for the methodology of early reading. This last step accomplishes the applied transition of readability principles on languages other than English. In summary, the research organization creates applicability on US readability research in other languages. The resulting readability method will be referred to as the *base-1 method*.

4. Outline

The principles of the base-1 method are exemplified in this study with its sentence specific application in an experimental setting. The test design generates German text selections that represent distinct combinations of semantic levels and syntactic levels represented by grammatical expressions. A spectrum of readers from second through eighth grade in a German immersion program demonstrate their text comprehension for each specific text selection through leveled sets of questions. The overall result profile leads to a regression analysis, which permits the quantification of the relative impact of individual grammatical expressions on general text readability for the specific set of text samples and the specific reader group. The experimental part of the study is not intended to generate an accurate, generalizable calibration of the method. However, it exemplifies the refinement process of the base-1 method for further extensive research. A comparison of the reduced base-1 method with other generally employed readability measurement tools indicates a competitive accuracy level. The method opens new fields of research in developmental language acquisition and inter-linguistic comparisons.

CHAPTER 2: DEFINITIONS

Before exploring the matter of text readability, the delineation of some terminology is a prerequisite. Especially, since such diverse research areas as methodology, psychology, and linguistics are part of the study, a common understanding of the core terminology for the purpose of this study is critical.

1. Text Reading Concepts: Literacy, Text Complexity, and Text Readability

In this study, *literacy* is not limited to grapheme-phoneme correspondences. Its interpretation encompasses a wider range of influences and implications, such as task-related impacts on the reading process or socio-cultural influences on the text and the reader (Barton, Chan, & Freebody, 2013, p. 304).

The terms *text complexity* and *readability* are two perceptions of the same phenomenon with different scope from different perspectives. Readability describes the ease of reading a text from the reader's perspective. It includes content specific text challenges as well as supportive text features that facilitate the comprehension of text. Specifically, the four main readability areas refer to, first, content through propositions and cohesion, second, style through semantics and syntax, third, design through typography and illustrations, and fourth, structure through headings, and navigation (DuBay, 2004, p. 18). This research study concentrates its attention on the areas of content, structure, and style. In particular, the study focuses on coherence and on syntax with morphology through semantic and propositional argumentations. These areas of readability are considered reader-independent properties (see Figure 1). In consequence, these focus areas are unbiased and quantifiable in contrast to reader-related areas as later elaborations will show.

The counterpart to readability is text complexity. It describes the density and gravity of text complications based on content, stylistic, and structural features only. Text complexity is defined as a set of reader-independent features that contribute to a decrease in text decodability and comprehensibility. Therefore, design features and in particular illustrations are not relevant factors of text complexity, even though they do contribute considerably to the ease of comprehension. However, reader specific predispositions have a considerable impact on the contextual processing of text design features. Hence, design features have to be considered predominantly reader related and constitute complementary features to text complexity features (see Figure 1). Together with text complexity, text design features form the equivalent of text readability.

There exists some contradiction between the definition and the linguistic application of both terms. Whereas, readability encompasses a wider array of conditions than text complexity, some of the traditional readability approaches employ mainly a very limiting

variety of text based parameters to determine text readability (Cai, Graesser, Louwerse, & McNamara, 2014, p. 2), namely sentence and word length.

2. The Building Blocks of Text: Morphology, Syntax, Semantics, Propositions, and Context

The relationship between *propositions*, *context*, *semantics* along with *morphology* and *syntax* is crucial for the understanding of text processing and comprehension. Their relationship is built on the postulation that “meaning does not exist in the text, but rather must be actively constructed” (RAND, 2002, p. 32). Thus, “the meaning of a text is in the mind of a reader” (Adams, 1980, p. 23). The reader negotiates new information with prior knowledge and concepts reconstructing the knowledge base by integrating the new information (Artelt, Schiefele, & Schneider, 2001, p. 365). In other words, the dialogic relationship between text and reader is key to text comprehension (see Figure 1). Either side does not carry any inherent content understanding. Text comprehension is accomplished by combining text based information and reader dispositions through semantic meaning (Landi, Oakhill, & Perfetti, 2005, p. 237). On the text side, morphology, syntax and cohesion create a semantic framework through linguistic conventions (Kefer, 2008, p. 2) and the formation of propositions. Surface features, such as the use of pronouns, repetitions, or related word use, mark cohesion clues within and between sentences (Garbe, Holle, & Jesch, 2006, p. 41). Structural text features supply additional information, which support the building of text cohesion. On the reader side, the reader interprets the semantic construct and substitutes the propositions with concrete meaning units by activating and utilizing background knowledge, pragmatic reasoning, and discourse analysis. The reader creates a personalized context image by vitalizing the propositional, semantic construct with concrete meaning and by infusing individual interpretation, selection, and valuation of the content (Punz, 2010, slide 7). Whereas it is relatively easy for a reader to build such personalized relations with the text in fiction texts, the reader penetrates non-fiction texts in a similar fashion by building up abstract, mental “diagrams” and “pictograms” to represent the conceptual content of scientific texts (Garbe, Holle, & Jesch, 2006, p. 55).

3. Making Meaning

In more detail, semantic meaning constitutes the functions, connections and the quality of the relationships between word, sentence and text elements (Schründer-Lenzen, 2013, p. 41). Meaning as a semantic property on a content level is limited to propositional matter and not filled with concrete real-life attributions (Brauß, Breindl, Pasch, & Waßner, 2003, p. 30). In fact, two different texts may share exactly the same semantic framework. For instance, the semantic-structural frameworks in the two text samples are absolutely

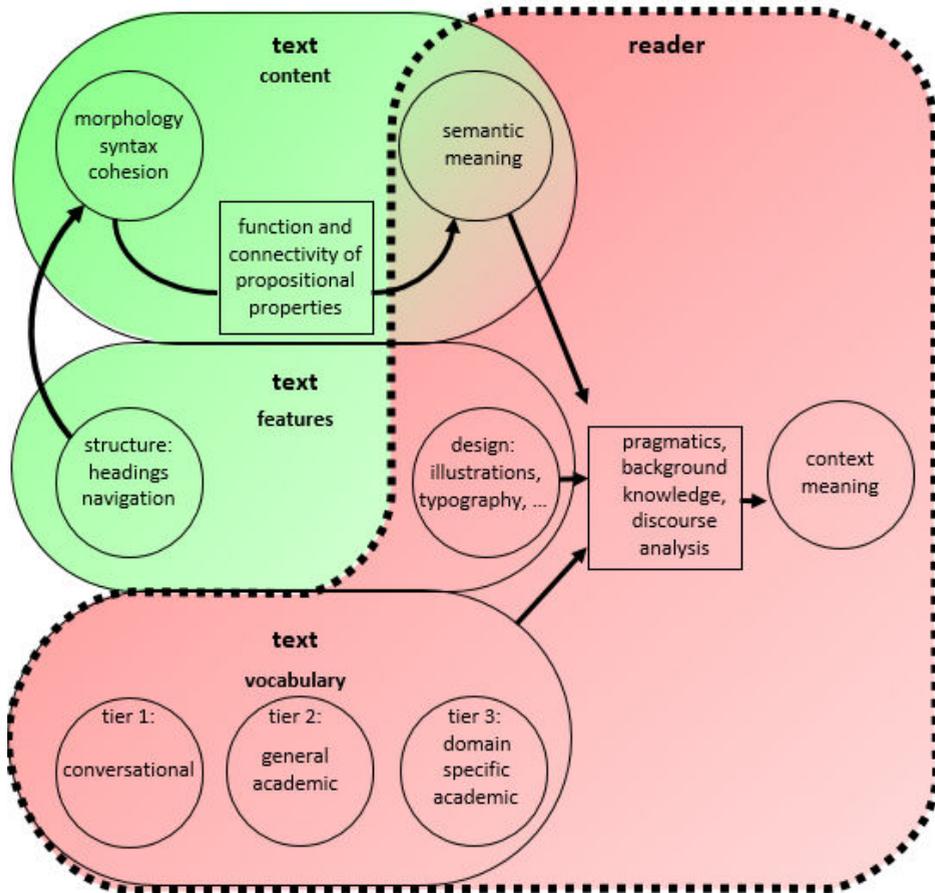


Figure 1. Meaning construct from text to reader.

identical: *All kids run toward the swimming pool. They get on the slide.* (see Figure 2) and *Three eggs go into the mixing bowl. All blend with the sugar.* (see Figure 3). Both figures disclose in a building block model the emergence from semantic meaning through morphological structures on the lowest level and syntactic structures on higher levels. The functional connectivity between any of these sentence elements constitutes the semantic quality of the text. By adding propositional concepts to words, phrases, and structures, the reader gains access to semantic content. Mainly through cognition, world knowledge, and language knowledge the reader contextualizes the propositional concepts and semantic framework to a coherent mental depiction that is in accordance with the reader's own experiences, expectations, and conceptual thinking.

Referring back to both sample texts, the same morphological word modification – noun plural (*kids/eggs*) and present participle (*swimming/mixing*) – appear in both text

samples at the same locations. Syntactic bonding of words to compound nouns or phrases and of sentence constituents to sentences occurs in a comparable manner (*kids – pool – slide/eggs – bows – sugar*). Referential cohesion (*they/all*) and deep cohesion within and between sentences indicate text connections in the same locations. Even morphological structures (*to-wards/in-to*) and compound word building (*swimming pool/mixing bowl*) are comparable. In essence, the semantic-structural framework is but a logical construct of text element functions along with the allocation and quality of their interrelations. The semantic framework provides referential and deep connections between sentence constituents. It also articulates relationship, for instance grammatical case, sequential information, or conditional associations. These relationships are objective, almost comparable to the laws of mathematical properties. For instance, anaphors operate in a very comparable way to the property of distributivity:

Fishes live in water. They have fins. [(a x b) + (a x c)]

These two sentences are semantically equivalent to

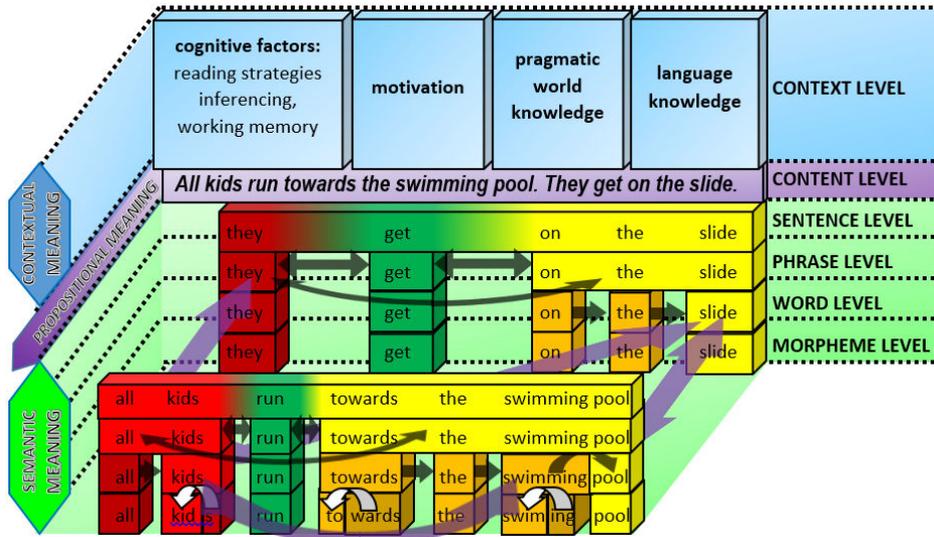
Fishes live in water and have fins. [a x (b + c)].

These text references are contributors to cohesion density and, thus, text comprehensibility.

On a semantic level, content information provides only concept relationships that enable building a theoretical framework by rational, objective standards. But semantic meaning is void of any materialized, subjective content information. Hence semantic meaning holds objective status, suitable for extracting structural text complexity on a text surface level (Kintsch, Van Dijk, & Van Dijk, 1983, p. 11).

Adding content to this theoretical framework supplements the sentence constituents with “pragmatic presupposition” (Garbe, Holle, & Jesch, 2006, p. 48) based on basic world knowledge, conventions and inferential conclusions (Helbig, 2008, p. 21; Garbe, Holle, & Jesch, 2006, pp. 54-55). For instance, the concept of a table is defined as a horizontal plane with some support structure, which functions as a resting place for other objects. Design, size, condition, and other specifications are not relevant for the concept of a table. Hence, content embedded into the semantic framework is first of all conceptual content on the text based level (compare Kintsch, Van Dijk, & Van Dijk, 1983, p. 11). Both text samples in Figure 2 and Figure 3 describe rather different propositional contents, even though the semantic-structural matters are identical.

However, the reader is not yet personally involved on the semantic and propositional content levels. Only if the reader processes content in relation to personal prior experiences and expectations, does propositional meaning morph into contextual meaning. This integrated and multi-layered meaning making process is coined the *situation model* (compare Kintsch, Van Dijk, & Van Dijk, 1983, p. 11; Cai, Graesser, Louwerse, & McNamara,



semantic framework:



cohesion construct

- referential cohesion (anaphor on phrase level: All kids - They)
- deep cohesion (on word level: swimming pool – slide – kids)



morphological construct

- plural (kid – s)
- present participle (swim – ing)
- preposition of direction (to – wards)



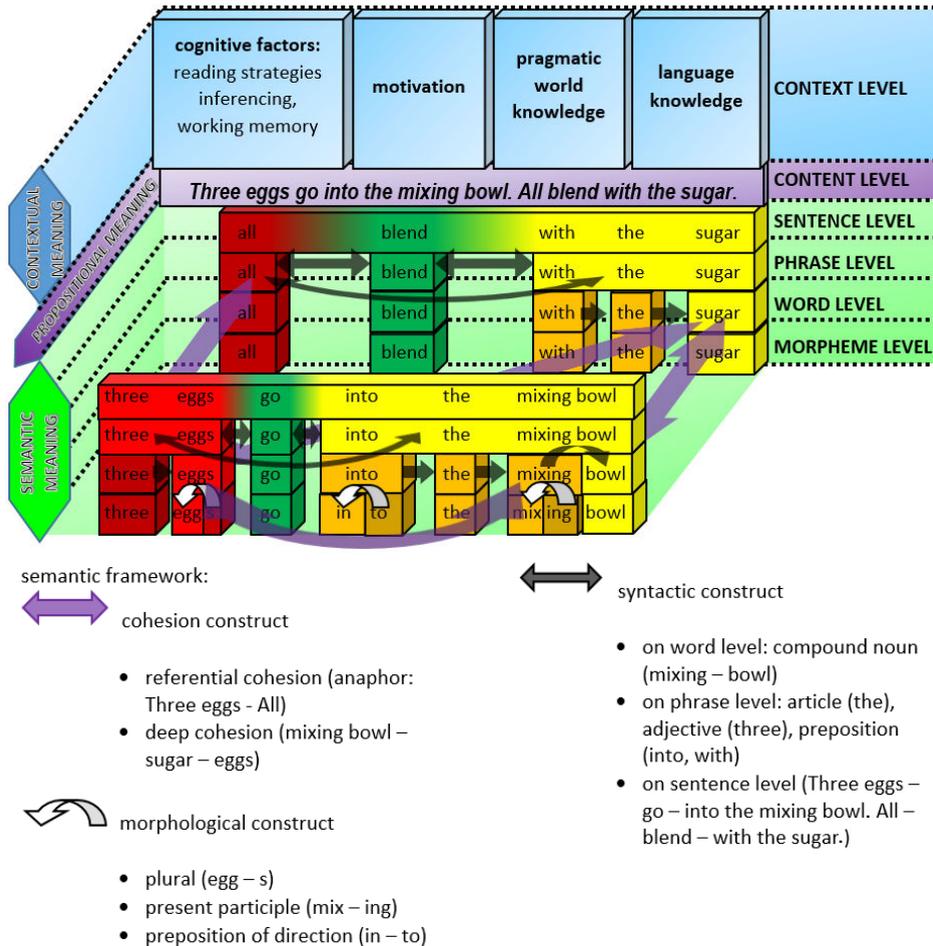
syntactic construct

- on word level: compound noun (swimming – pool)
- on phrase level: article (the), adjective (all), preposition (towards, on)
- on sentence level (All kids – run – towards the swimming pool. They – get – on the slide.)

(compare for instance Kintsch, Van Dijk, & Van Dijk, 1983, p. 11; Helbig, 2008, p. 21; Halliday, 2014, p. 50)

Figure 2. Building block model of semantic and contextual meaning for the text: “All kids run towards the swimming pool. They get on the slide.”

2014, p. 6; Garbe, Holle, & Jesch, 2006, p. 56; Helbig, 2008, p. 21). The difference between propositional meaning and contextual meaning becomes obvious by pondering the associative power of the previously mentioned text samples. A cook and a child will likely relate to the text of their reference with increased attention and empathy compared to the contrasting text. In this sense, contextual meaning is a product of the interaction between a reader and the text. The text becomes alive through the reader’s mind. Since every reader has unique dispositions, the same text generates a unique context for every reader (RAND, 2002, p. 32).



(compare for instance Kintsch, Van Dijk, & Van Dijk, 1983, p. 11; Helbig, 2008, p. 21; Halliday, 2014, p. 50)

Figure 3. Building block model of semantic and contextual meaning for the text: “Three eggs go into the mixing bowl. All blend with the sugar.”

In addition, text design elements, such as illustrations or layout, meet singular reader predispositions depending on prior knowledge, learning styles and mastery of reading skills. The reader synchronizes and integrates text design information into semantic-pragmatic processing. But design elements are not an immediate part of semantic processing unless they convey explicit, additional information. In general, contextual meaning derived from text design depends on the reader’s biases and is, consequently, not objective. Equally, the vocabulary corpus used in the text depends on the matching vocabulary knowledge

on the side of the reader. Vocabulary knowledge may depend inter alia on age, heritage, interests, and socio-economic background (Cai, Graesser, Louwerse, & McNamara, 2014, p. 8). Consequently, generalizations about text readability based on a specific vocabulary corpus depends heavily on the addressed audience, which leads back to the meaning construct model in Figure 1. Based on this preliminary analysis, the most promising text properties for the purpose of developing a procedure to determine unbiased, quantifiable text complexity refer to morphology, syntax, and cohesion with supplemental information about reader groups in terms of specific world and language knowledge.

CHAPTER 3: READING DEVELOPMENT AND TEXT COMPREHENSION

A common way of looking at text readability is identifying critical text features, which are perceived as obstacles to text comprehension, and capture their empiric occurrences. Such obstacles are articulated in most traditional readability formulas as sentence length, word length, employed vocabulary corpus, or a combination of these. In fact, some of the most frequently used readability methods in US education history – Fry’s readability graph and Lexile® - follow these principles. But recent text readability researchers voice concerns about such oversimplification of text complexity. Cai, Graesser, Louwerse, & McNamara (2014) argue that the formulas do not consider the multi-layered processes of reading comprehension and, thus, can yield only limited results (p. 13). An incomplete perception of text complexity cannot nearly capture the multifaceted processes of reading. The processes are most clearly observable with reading novices. Beginning readers must decode text elements, assign and connect chunks of word meaning before they can gain full sentence and text comprehension. Readability formulas limiting themselves to selective surface measures are assumedly a tolerable readability approximation for adults with sufficient reading skills and abundant vocabulary knowledge. But, clearly, simplified text readability measures are not sensitive enough to reflect the practices and challenges of novice readers (Cai, Graesser, Louwerse, & McNamara, 2014, p. 13).

Text readability formulas aim to predict text complexity, and, consequently, the likelihood of successful reading comprehension at a targeted reading level. Therefore, beginning readers are naturally a reasonable starting point for an analysis of reading comprehension and text complexity. The research of early literacy processes elucidates most clearly preconditions and key components that constitute reading challenges within and outside a text. Some of the key components describe the layered processes of text decoding on grapheme, morpheme, word, sentence, and discourse level. But beyond the decoding of surface structures, the semantic disclosure is an even more important part of reading comprehension. The reader adds semantic attributions to each structural element and processes that information by connecting the semantic information from all components (Landi, Oakhill, & Perfetti, 2005, p. 230). Only by reflecting and connecting that semantic information with personal background knowledge, is true meaning created, which ultimately results in the understanding of a piece of text (Rychener, 2011, p. 34-35). Text gains meaning only through its reader’s perception and interpretation (Iser, 1994, cited in Rychener, 2011, p. 45). This research study intends to embed the development of a new readability approach into the context of beginning readers. Thus, the analysis of general reading comprehension conditions and of strings of interrelated reading processes at distinct stages of the reading acquisition process are possible. More specifically, it is postulated that the role of text complexity in early reading acquisition permits conclusions on general features of text readability.

1. Reading Processing

The starting point for the theoretical analysis in this study is the observation of the reading process most deliberately and systematically performed by beginning readers. It is hypothesized that the same processes can be extended to advanced readers as the functional-linguistic text features remain constant while the reader acquires skills over time. With skills emerging, the reader also acquires more efficiency, accuracy, and intensity of previously learned skills, whereas the intentionality and consciousness of certain skills declines with practice and automatization (Chall, 1983; Sticht, 1979 as cited in Cunningham, & Stanovich, 1998, p. 1). Both, conscious and unconscious skills, empower a reader to decode text on a certain level. Yet, the reader is not the only element involved in the comprehension process. Text interpretation depends on three plus one elements according to RAND (2002):

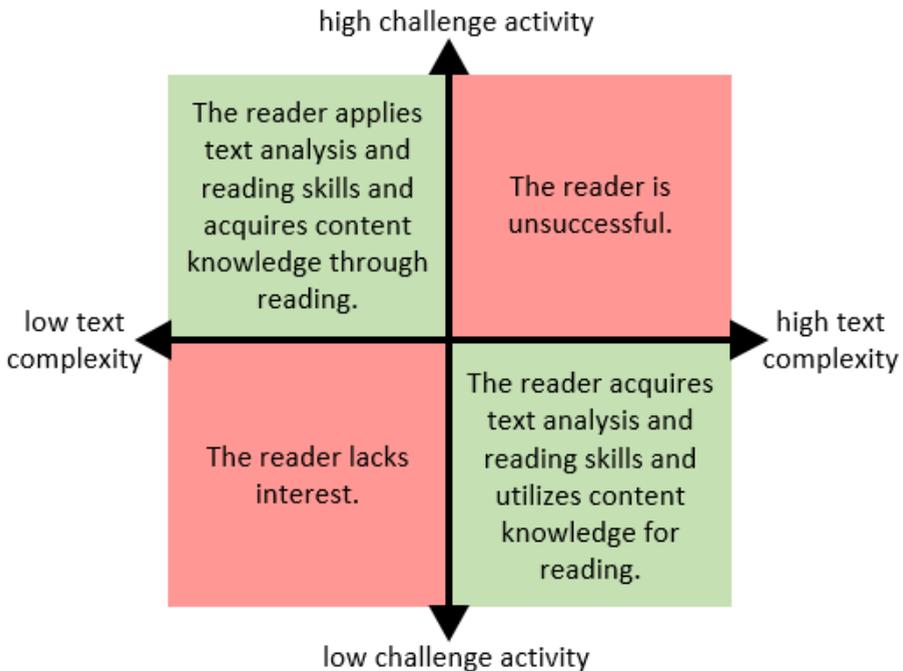
- The reader who is doing the comprehending
- The text that is to be comprehended
- The activity in which comprehension is a part.

In considering the reader, we include all the capacities, abilities, knowledge, and experiences that a person brings to the act of reading. Text is broadly construed to include any printed text or electronic text. In considering activity, we include the purposes, processes, and consequences associated with the act of reading. These three dimensions define a phenomenon that occurs within a larger socio-cultural context (...) that shapes and is shaped by the reader and that interacts with each of the three elements (p. 11).

1.1 Text and Task

All four domains of reading are closely inter-reliant. The impact on one determines the effects of other domains on text readability. With regard to the reading task, the demands of an activity on the reader governs an instructional text choice. For instance, if an assignment is formulated as identifying colors as cited in a text, the text complexity may be almost infinitely high without impairing the complexity of the task. No comprehension is required other than isolated word recognition. Reversely, a more demanding task as comparing and evaluating the effectiveness of intentional strategies employed by a protagonist and an antagonist surely requires higher order processing skills. If a reader is not skilled at working at that accomplishment level, a challenging text choice is detrimental to the task completion. A graphic representation of these interdependencies between reading activity demands and text complexity is visualized in the quartile chart in Figure 4. It is an adaptation of Allen, Bennett, & Bennett's (2003, p. 254) graphic, which originally related skills and knowledge level to two variables, process and content. But the basic

dependency grid is directly transferable to the rate of reading acquisition and reading application independent of the variables text complexity and activity challenge (Adams, 1980, p. 13).



(adapted from Allen, Bennett, & Bennett, 2003, p.254)

Figure 4. Quartile chart of demand balance between reading activity and text complexity.

1.2 Reader

The interdependency between task and text is also reader related following Vygotsky's (1978) theory of the *Zone of Proximal Development*. The theory, which is widely referred to in the US educational system, explains how the instructional level should match the student's actual developmental level (pp. 84, 85). In addition, this zone is constantly pushed to higher levels by scaffolding higher level tasks first and removing these scaffolds later on to guide a continuous learning growth (ibid. p. 87). Applying Vygotsky to Benet's et al (2003) adapted representation of text-task-complexity, the text complexity level

or the activity challenge has to constantly grow with increasing reading and comprehension skills in order to keep the student within the zone of proximal development. Applying the principles of the zone of proximal development to the task-text complexity challenge representation (see Figure 4), a progressing reader pushes the axis intersection towards the top right corner of the graphic.

1.3 Socio-Cultural Context

The dominance of socio-cultural context on the other three reading domains, reader, task, and text may be best exemplified with the cultural phenomenon humor. Humor is one of the last concepts for a language learner to understand in the target culture (Vega, 1990). Humor is so difficult to grasp, because it is not only a manifestation of a culture, but it is a self-reflection of its cultural perspective by its own standards and conventions, not easily accessible to external observers of a target culture (Bell, 2009, pp. 248, 251). At the same time humor twists, stretches, and questions exactly these standards and conventions. For language and culture learners humor can pose a major impediment to fully participating in the target culture. First, knowledge about the target culture does not directly apply anymore, because the value system is subject to distortion. Second, humor is a highly specialized and contextualized cultural phenomenon. It defines itself through its own cultural context, which it simultaneously questions. In other words, humor simultaneously lives within and outside of socio-cultural conventions.

Because humor is such a seclusive phenomenon, it is often subject to misunderstanding from outside observers. Humor derives its affect from crossing moral conventions that are anchored in society. Language is but one distinctive divider between socio-cultural groups. Equally important are societal views on values, religious beliefs, political positions, the level of subtleness or overtness, and, most importantly, the grade of transgression of societal conventions in combination with the level of practiced and expected tolerance. The purpose of humor may be entertainment as in *Commedias dell'arte*, romantic comedies, or sitcoms. But humor has also always carried social and political messages from classic Greek comedies to medieval jesters, and to modern political cartoons (Attardo, 2008, p. 102). It has been used to voice an inconvenient truth in a tolerable format; but it also has been an instrument of provocation and challenge of opponents. The delivery of any form of humor has always depended on the climate of tolerance within a society or under a regime ranging from metaphoric disguise through parody to irony and open satire (Attardo, 2008, p. 122). Combining conflicting socio-cultural conventions is a common strategy to create humorous situations. But the distance of acceptable standards between originators and intended addressees of humor may create true interpersonal conflicts (Attardo, 2008, p. 104). If there is no balance of tolerance, then the intention of irony on the originator's side mutates into a perception of spiteful sarcasm on the addressee's side. In an atmosphere of political correctness, freedom of speech easily clashes with personal or minority rights conflicts, because "it frees the speaker from the constraints of