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Creating an Information Structure E-Learning Module for Advanced German Learners of English

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Chapter 1

Introduction

The problem of learning a foreign language has been tackled by teachers and professors for centuries. With the availability of networked computers in every household — and considering the developments of the last years soon to be in every pocket — most of the basic problems of teaching in classrooms have been solved; getting the needed information to the student is easier than ever before.

With the new technologies come new possibilities; while the helping effect of modern technology in classic teaching scenarios progresses less and less slowly, new ways of learning emerge - from online classrooms to autonomous learning. E-learning solutions that explore this new field and new ways of learning with technology have to be implemented that go beyond a simple automated vocabulary-trainer. Now that the basic technical delivery medium is available to reach every student, e-learning has become a viable option for university-level education.

The budget is getting tighter while the number of students at German universities is increasing, 2011 had the highest rate of new students at German universities in history. E-learning offers a way to reduce personnel costs while at the same time improving the students freedom of choice what, when and how to learn.

The LEAR project is an innovative approach to increase the availability of advanced learning material to the students of English Linguistics at RWTH Aachen University. This work will join this approach by creating an e-learning module that will be part of the LEAR-project addressing the topic of information structure.

I have been working as a software developer for the last six years in parallel to my studies, which provides me with the knowledge needed to implement web-applications. The last two years of my work have been in the e-learning production department of a large German soft-

ware company, which helped me to gain practical experience in the field of education. This thesis is the consolidation of my working experience and my studies.

The following work will address the question of how to create an information structure e-learning module for advanced German learners of English. This main problem spawns additional questions, which will be dealt with in the specific chapters:

1. What is **I**nformation **S**tructure (IS)?
2. Is there a way to categorize and order the phenomena that IS consists of?
3. What is e-learning?
4. Which basic principles of learning can be applied to e-learning?
5. What specific peculiarities arise from the use of electronic media in learning?
6. What is the best way to implement an online e-learning module?
7. What technological and structural considerations have to be taken into account?
8. How can an online module be tested and evaluated?
9. What approach can be used to evaluate a specialized learning solution?
10. What future possibilities are available for further enhancement of the module?

Goal

The main goals of this thesis will be to

- research the basic theoretical background of information structure for the purpose of teaching to advanced German learners and select the most important topics,
- explore the principles of e-learning that can be applied to increase the efficiency of online learning,
- find the optimal technical framework for the online learning solution and implement the module,
- conduct an evaluation of the finished solution.

Procedure

This thesis is divided into four parts: Information structure, e-learning, implementation and evaluation. The central terms of "IS", "e-learning", "module" and "evaluation" will be defined and explained in the respective chapter.

In the chapter "Information Structure", I will find a general structure in which to order the several phenomena that make up information structure and find a balance between the complexity of the subject and a learner oriented approach of explanation; with the goal in mind to provide the learner with the fundamental knowledge to facilitate further self-education in

this field. I used the work of Callies (2009) as a basis to start the research of IS and followed his dimension-approach for the chapter structure. This chapter will be the ground work for the content of the module implemented later.

In the next chapter I will explore selected theories in the field of e-learning, the basic concepts behind effective learning strategies in general and the ways in which an online e-learning module can benefit from this research.

The chapter "Module Implementation" constitutes the theoretical basis for the main practical work of this thesis, the actual creation of a browser based e-learning solution that can be used to teach the subject of information structure to advanced linguistics students at RWTH Aachen University. I will assess the various options that are available for writing the application and explain the choices that I will make concerning technology, design, structure and interactive parts of the module.

The second to last chapter will be concerned with the evaluation process that is needed to ensure the quality and usability of the module after initially being deployed. Here I will explain the choices I made to implement a practical evaluation, the two part process of technical and manual evaluation as well as the results that will be gathered during these steps. I will further explain the choice of a three step evaluation system — technical, qualitative, quantitative — and present the results as well as the changes to the final implementation they have provoked.

The final result of this thesis will be a theoretical work that spans the linguistic background of information structure, e-learning, web-technology and software evaluations as well as a fully functional and tested module for advanced learner self-education.

Conventions used in this paper

I will use the following conventions throughout this paper:

Emphasis: In examples, specific words and phrases will either be set in a bold font, by grouping and optionally assigning a type to them, or a combination of both. Grouping can be done by either using square brackets or under- and over-braces. Examples:

1. A word **can** be emphasized.
2. $[\text{A word}]_{\text{t}}$ $[\textbf{can}\ \text{be emphasized}]_{\text{c}}$.
3. $\overbrace{\text{A word}}^{\text{topic}}\overbrace{\textbf{can}\ \text{be emphasized.}}^{\text{comment}}$
4. $\underbrace{\text{A word}}_{\text{theme}}\underbrace{\textbf{can}\ \text{be emphasized.}}_{\text{rheme}}$

I will use bold font in situations where the type of emphasis is either unambiguously clear from the context of the example or irrelevant. The choice of grouping format depends mainly on the amount of text needed to describe the groups and whether the groups overlap.[1] I will generally prefer bold emphasis and over- and under-braces over grouping with square brackets to increase readability.

Additionally I will underline text to highlight parts of sentences that are not necessarily emphasized themselves but are important to the example. For example, when talking about the placement of a particular word in a sentence, I might highlight that word by underlining it, while I continue to use the above strategies to highlight its linguistic effects. Example for the focus particle "only":

> Underline is only used to highlight a sentence part — without indicating an effect.

[1] Under- and over-braces can only overlap when used in combination.

References to sources are in parentheses and will be linked to the entry in the bibliography in the digital version of this thesis. The bibliography is sorted alphabetically by last name. Example:

> This is a reference to a source, referring to the module: (Himmelrath, 2012)

Internal references are given as title and page number of the referenced section and are also linked in the digital version. Example:

> To start reading this paper, see chapter 1 "Introduction" on page 1.

Sentence and clause: I will use the two almost synonymous words "sentence" and "clause" interchangeably when the distinction is not necessary. In cases where the difference matters, I will use "clause" as grammatical unit as in "group of words transporting meaning" and sentence as in as discourse unit as in "a group of one or more clauses". In examples that only consist of simple sentences, I use "clause" and "sentence" synonymously.

Student, learner and user: These words are used synonymously throughout this entire work. The words "student" and "learner" always refer to the same; "user" can additionally occur in a broader sense as a technical term to describe someone interacting with a computer program, this will be unambiguously clear from the context.

Gender-Neutral "they": I will use the gender neutral pronouns ("they", "their", "them") in the singular to avoid unnecessary complex constructions ("he/she") or not widely recognized forms ("ze"). Example: "A language menu is shown to the learner, they can choose their preferred content language, by clicking on the respective flag symbol."

Chapter 2

Information Structure

In order to develop an e-learning solution about **I**nformation **S**tructure (IS), the theoretical background must first be investigated. In light of the fact that the aim of this work is to create a learning solution, the main goal of this chapter is to give an overview of definitions and explanations for IS and the most important linguistic phenomena belonging to that category. In this chapter I will try to find answers to the following questions

Is there a general structure that underlies IS?
Are the definitions of IS consistent?
If not, what would be the most compatible ones?
What structure would be best suited for making the topic understandable to learners?

Brief Introduction to IS

A purely grammatical analysis of language can never include all language components. In order to understand sentences apart from the perfect examples usually depicted in linguistic literature, one has to extend the analysis beyond the scope of grammatical structure. "Certain formal properties of sentences cannot be fully understood without looking at the linguistic and extralinguistic contexts, in which the sentences having these properties are embedded" (Lambrecht, 1996). This is where IS comes in and describes the phenomena that are the result of combining grammatical and prosodic properties of speech.

When searching for a definition of IS, one finds many works about topics that fall under the category of IS, but only few that attempt to provide an overall definition of the subject.[1] While in Computer Science the definition of information structure is very straightforward, the definition in linguistics seems to be far more vague.[2]

[1] See for example Steedman (2000), Choi (1996), Jackendoff (1972), Beaver (1997)
[2] IS in Computer Science (also called "data structure") simply describes the way information is stored in the

Information structure is a very important part of language, its theoretical background is still highly discussed and not completely understood. One of the theoretical battlegrounds is the question whether IS is a mainly linguistic concept or underlying cognitive mechanism that forms the language. While this discussion still goes on, and will most likely go on for many years to come, it is quite clear that IS must at least be partly rooted in basic cognitive processes in the human brain, as there are phenomena of IS that can be found across several languages.[3] This makes it necessary to investigate these phenomena from a interdisciplinary point of view, since any study that only relies on either linguistics or cognition is destined to draw at least partly false conclusions. (Callies, 2009, p. 10) This, however, is not necessarily the prevailing opinion of all linguists. There is disagreement regarding the nature of information structure as a grammatical component. In contrast to most other grammatical components, IS does not only concern the linguistic form, but also the mental states of the participants involved in the communication; researchers of IS have to deal with the formal as well as the communicative aspect of language (Lambrecht, 1996).

Another discussion revolves around the question what parts of language use can be considered part of IS. Even though Lambrecht (1996) says that IS is more concerned with "the relations between different sentence structures as they are stored in the memory of speakers and hearers", than with syntagmatic relations of elements in a sentence, he explicitly states that "information structure is not concerned with psychological phenomena, which do not have correlates in grammatical form" (Lambrecht, 1994, p. 3), which would exclude purely prosodic changes from the study of IS. Féry and Krifka (2008), for example, describe IS as a response to the current informational need of the addressee, but does not explicitly exclude prosody — and according to Beaver and Clark (2008) "in English, information structure is largely marked through intonation", which is again in line with Halliday's original definition from 1967: The term "IS" was first used prominently by Halliday (1967) as "the status of the [clause-] elements not as participants in extralinguistic processes but as components of a message". He described text as organized into "information units", every clause has to consist of at least one. Whether a clause contains one or more information units is determined by marked tonality: "a clause may be realized as a single tone group ('unmarked tonality'), or as two or more tone groups, part of a tone group &c. ('marked tonality')." (Halliday, 1967) The concept of markedness will be discussed in section 2.2.3 "Markedness" on page 23.

Krifka (2006) defines information structure as the structuring of linguistic information with the intended purpose of optimizing information transfer within the discourse.[4] He describes

memory of a computer - basically, how to encode information in ones and zeros.

[3] Such as syntactic weight, see 2.3 "Syntactic Weight" on page 33

[4] My translation of "Unter Informationsstruktur versteht man die Strukturierung von sprachlicher Information zum Zweck der Optimierung des Informationstransfers im Diskurs."

the main factors of information structure as the three polar opposites *1)* old information — new information *2)* topic — comment *3)* focus — background (presupposition), which are responsible for many kinds of linguistic phenomena, such as changes in phonetics, syntax and semantics. Krifka, who bases his definition on Chafe (1970), describes IS as the linguistic structure responding to "the temporary state of the addressee's mind" (Krifka, 2008).

I will settle for a relatively open definition and focus on explaining the effects and phenomena within the framework of IS. Since the main object of this thesis is to create an e-learning module, I chose to leave out minor theoretical details for the sake of learnability: Information structure is "the structure of a sentence or larger unit viewed as a means of communicating information to an addressee" (Matthews, 2007).

Analytical Approach

According to Lambrecht (1994, p. 6), the main strategy of analyzing IS is to compare sentences that are either semantically (nearly) equivalent but can be distinguished by their differences on a formal and/or pragmatic level and sentences that are formally equivalent but differ semantically, e.g. using the same words in the same order but having different truth conditions.[5] In this way it is possible to directly compare the information conveyed by the sentences and distinguish between grammatically and prosodically encoded messages. I will adopt this technique for the examples in this chapter and the module.

In order to create a clear structure for learners of IS, Callies (2009, p. 9) defines three main dimensions of information structure:

1. Sentence structure (sentence position)
2. Information status
3. Syntactic weight

I will adopt this division for the structure of this work. Sentence structure is the grammatical dimension of IS, while information status is the dimension that comprises the effects that a change in sentence structure can have and the prosodic elements of IS. Syntactic weight is the underlying principle — apart from word order — that accounts for the part of the general structure of English sentences that makes possible the transmission of information through changes in the other two dimensions.

In addition to Callies' three dimensions I will also briefly look into the topic of contrastive IS analysis in the last section of this chapter, since the module resulting from this work will be

[5] "nearly" equivalent in the sense that, if there was no difference, there would be no IS. Semantic equivalence means formal equivalence in this context, i.e. without considering implicational information.

addressing German learners. As a detailed analysis of contrastive IS between the two languages would go beyond the scope of this thesis, I will focus on what similarities can be used to teach and what differences have to be taught.

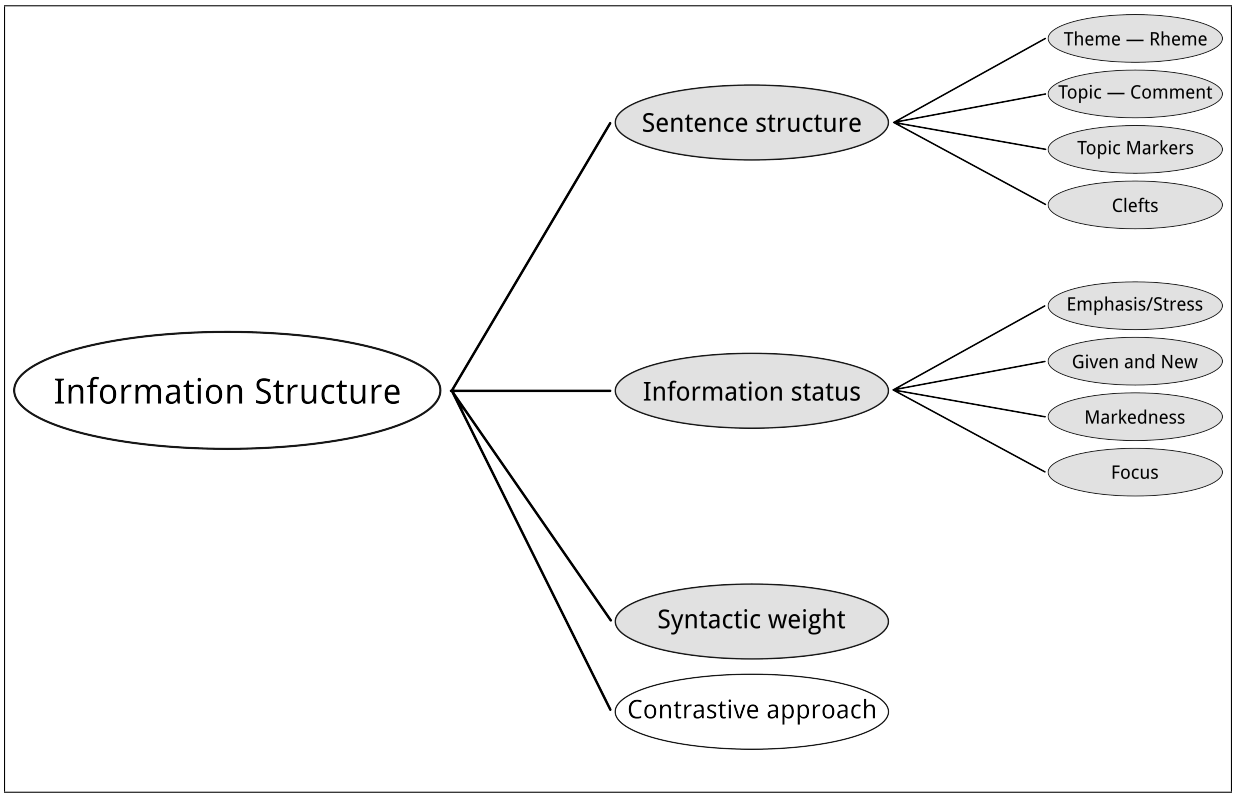

Figure 1: Chapter Structure - Information Structure

As didactic considerations are more important for implementing the module than a linguistically clear organization, I will explain the order of topics chosen for the module in section 4.4 "Structure" on page 84.

2.1 Sentence Structure

Sentences in English have to be formulated by adhering to grammatical rules; apart from these there are the rules of information structure that operate on a different level. The dimension of sentence structure interacts with grammar in that it changes the words or the sentence in order to convey information; in this respect, it is the most invasive of the three dimensions of IS.

The basic rule behind sentence structure of IS is that different positions in the sentence occupy different informational values — by moving constituents the values are automatically assigned to them.

2.1.1 Theme — Rheme

All sentences that contain a statement can be logically divided into these two parts:

1. The person or thing, about whom or which something is said.
2. What is said about 1.

This way of looking at sentence structure is the approach of theme — rheme: The theme is what comes first in the sentence and what the sentence is about. The rheme is the rest of the sentence, what is said about the theme.

Basically, we have a statement (2) with a specific "target" (1) that the statement is about. In English the order of these two parts is static: Whatever comes first in the sentence indicates what is being talked about. The rest contains the message describing the first part.

According to Halliday (1967, pp. 199f) this constitutes the thematic structure of a sentence; the first part is called "theme", the rest is identified as "rheme". Theme and rheme are exclusive and clearly separated; the two components do not overlap in the sentence. Apart from extreme exceptions, like sentences that only consist of one word, every sentence in English can be divided into these two parts:

- Zoe (Theme) drove the car (Rheme).
- Simon (Theme) had a very bad day (Rheme).
- Even in California (Theme), it sometimes rains (Rheme).
- While staying in London (Theme), make sure to visit the British Museum (Rheme).

Halliday and Matthiessen (2004, pp. 64–71) describe the division as follows: The theme is the given information, serving as the message's point of departure, while the rheme is the remainder of the message.[6]

The grammatical subject of a sentence is usually the same as the theme. By changing the word order of a sentence, for example by using passive voice, we can move the subject as well as the Theme:

1. A car (Subject / Theme) hit William.

[6] I will explain the concept of given and new information in section 2.2.2 "Given and New" on page 20

2. Subject: William (Theme) was hit by a car.

When "a car" is in the frontal position of the sentence, as in example 1, it is the theme of the sentence because of its prominent position. When we consider these sentences as part of a conversation where a question is asked before, they would not be considered equally appropriate answers, even though they contain the same semantic content:

Who was hit by a car?

1. William was hit by a car.
2. * A car hit William.

What hit William?

1. A car hit William.
2. * William was hit by a car.

Since whatever comes first in the sentence is what the sentence is about, answer 1 is the appropriate one in each case. In the first example the question is about William, so only the answer that is also about William — i.e. the one that uses William as its theme — is suitable for the question. The same principle applies for the second example, only this time it is about the car, so the car must be highlighted in the answer.

In General, the connection between thematic structure and information structure is that the same semantic content within a sentence can transport different messages to the addressee.

1. Philip drove Amy's car to the scrapyard.
2. It was Philip, who drove Amy's car to the scrapyard.
3. It was Amy's car, which Phillip drove to the scrapyard.
4. It was the scrapyard, where Philip drove Amy's car to.

While all four examples above contain the same elements, the order, in which they are placed, draws attention in a way that results in slightly different statements. 1. The first sentence starts with the theme "Phillip", which is the standard form and does not convey special meaning.[7] 2. In addition to being the theme, "Phillip" gains special emphasis through the construction that put him into a separate clause. This amplifies the the actor, "Phillip" (and the fact that he drove), as the important part of the message 3. Now, like in 2. before, a part is emphasized through reordering; in this case the part was not highlighted in the standard version. This means that not only is "Amy's car" now assigned more importance by the speaker, the special

[7] As opposed to the other three, which are marked and clefted. See section 2.2.3 "Markedness" on page 23 and section 2.1.4 "Clefts" on page 15 for more details.

importance of the "Phillip"-part has been removed. 4. The same applies for the last sentence, only this time the destination is highlighted.

2.1.2 Topic — Comment

Closely related to the notion theme above is the concept of "topic". Just like in Halliday's distinction between theme and rheme, topic and comment split up the sentence into two parts. The two ways of dividing a sentence differ concerning the concepts behind them. Topic can be used as a synonym for theme, but can also mean just one of the two concepts that are combined into one in the definition of theme.

There are several definitions of topic in the field of linguistics.[8] The most important definitions, according to (Callies, 2009, pp. 19f), that need to be separated are

(*a*) aboutness-concept - the discourse entity that the clause is about.
(*b*) familiarity-concept - topic defines the information that is familiar to the participants of the discourse.

The aboutness-concept is the one that is mostly used applied literature and can be expressed in a formal way as:

> (1) *Topic Definition*:
> An Entity, E, is the topic of a sentence, S, iff in using S the speaker intends to increase the addressee's knowledge about, request information about, or otherwise get the addressee to act with respect to E.
> (2) *Comment Definition*:
> A predication, P, is the comment of a sentence, S, iff, in using S the speaker intends P to be assessed relative to the topic of S.
>
> (Gundel, 1988, p. 210)

In other words, the topic of a sentence is that part of a sentence the rest of the sentence creates a message about. As seen in the example above, a sentence consisting of virtually the same words can have a different message due to the choice of topic.

1. It was Philip, who drove Amy's car to the scrapyard.
2. It was Amy's car, which Phillip drove to the scrapyard.

In 1, "Philip" is clearly the center of attention, the speaker wants to make sure that the addressee understands that Philip is the actor in the message. In 2, Philip is still the actor, but the important part is the object that he acted on.

[8] See for example Frey (2000) or Partee (1991, pp. 163)

In usual sentences the topic is something that is already known.[9] The element in the real world, referenced by the topic must be known to the addressees in order to process the information that they are given about it.

> Lilly read the whole book in one day.
> The car was too old to keep using it.

This comment usually adds information, intended to change the status of the addressee, to the discourse — for example to improve their knowledge or get them to do something — which us to the other concept of topic.

The familiarity concept is the connection between the structural dimension and information status, in that it relies on the availability of information in the discourse.[10] As said above, what is talked about should be known to the addressee in order to correctly process the message; this means that the part of the sentence, to which new information is added, is the topic.

This concept is pragmatically close to the concept of thematic structure, in that the familiar information tends to be placed at the beginning of a sentence in English. While Halliday (1967) strictly separates the two concepts — much as I do by distinguishing between the structural and the status dimension — the familiarity concept mixes them.

The main difference between the two definitions for the purpose of this thesis is that definition a) only correlates with the information status of the element, while b) has a direct connection to information status. Since the goal of this work is to implement an e-learning module to teach German learners about the English language, the distinction is of minor importance. The term "topic" was chosen in the following pages and in the module in the sense of the aboutness-concept, because it is the more widely accepted term that is closer to everyday speech.

One could say that the definition of theme and rheme is oriented towards English and similar languages. The terms topic and comment — while having the disadvantage of being every day language terms and thus being prone to confusion — can be divided into the information part (topic as the familiar constituent of a sentence) and the message part (topic as the part that the sentence is about), which are especially important to differentiate in contrastive linguistics, as these two definitions need not fall together in all languages.

[9] The above example uses clefts, which makes it "unusual" in this sense. Clefts will be discussed in section 2.1.4 "Clefts" on page 15

[10] See section 2.2.2 "Given and New" on page 20 for the closely related concept of givenness.

2.1.3 Topic Markers

Some languages have special topic markers that are a central part of their grammar. The Japanese language, for example, uses the suffix は ("-wa") for marking the topic, while a different particle が ("-ga") is used to identify the subject of a sentence. In English, word order is fixed as SVO: Subject – verb – object. Since the thematic structure of a sentence in English also cannot vary — the theme always comes first — the only way to change it is to build a construction that moves a constituent to the beginning of the sentence (Erteschik-Shir, 1997).

There are several ways in English to mark a topic using grammatical means. Examples of such marker constructions are

> Regarding [topic]...
> As for [topic]...
> With respect to [topic]...
> Concerning [topic]...
> While on the subject of [topic]...
> Speaking of [topic]...
> As far as [topic] goes...
> Personally, I... (where "I" is the topic)
>
> (McIntyre, 2007; Ward et al., 2002, p. 1371)

2.1.4 Clefts

Clefts work like topic markers, in that they move a constituent to the front of a sentence. In the following example sentence, we can clearly distinguish between topic and comment:

$$\underbrace{\text{John}}_{\text{Topic}}\ \underbrace{\text{was hit by a car.}}_{\text{Comment}}$$

$$\underbrace{\text{I}}_{\text{Topic}}\ \underbrace{\text{hit John with my car.}}_{\text{Comment}}$$

In most sentences, like the one above, these parts correspond to subject and predicate; but there are constellations in the English language that can change this division:

$$\overbrace{\underbrace{\text{I}}_{\text{Topic}}}^{\text{Subject}}\ \overbrace{\underbrace{\text{hit John with my car}}_{\text{Comment}}}^{\text{Predicate}}.$$

$$\overbrace{\text{It}}^{\text{Subject}}\ \overbrace{\text{was}\ \underbrace{\text{John,}}_{\text{Topic}}}^{\textit{Predicate}}\ \text{whom}\ \overbrace{\underbrace{\text{I}}_{\text{Subject}}\ \overbrace{\underbrace{\text{hit with my car}}_{\text{Comment}}}^{\text{Predicate}}}^{\text{Comment}}.$$

The second example contains an it-cleft that changes the Topic from the subject "I" in the relative clause to "John" in the main clause. The original clause is split into two clauses, of

which one — the cleft construction — only contains the "clefted" element. The main clause has itself a subject and a predicate, but they were introduced by way of the it-cleft for only one reason: to highlight the topic "John".

There are two main types of clefts: *a)* it-clefts, named after the word they start with — "it" — and *b)* wh-clefts, also known as pseudo-clefts, named after the group of words that they start with — "what", "who", "where", "when" or "why" (Callies, 2009, p. 41).

It clefts can shift virtually any constituent to the frontal/topical position by creating an additional clause in the form of "it" + [form of to be] + constituent and appending the rest as a relative clause.

> William was caught stealing from the register.
> It was William, who was caught stealing from the register.
> It was the register, which William was caught stealing from.
> It was stealing from the register, that William was caught doing.

It clefts are mostly used to create contrastive emphasis (Kiss, 1998). The use of "it" + a form of to be, distinctively identifies the highlighted element as an alternative to other elements. By saying "It was X", we implicitly say that it was not Y, or anything other than X for that matter. A combination of "It was X, [...] it was also Y" is technically possible but very rare.

The wh-cleft works the other way around; the clefted part of the sentence contains the main part of the message and separates a single constituent in an extra clause. Apart from that, wh-clefts work almost in the same way as it-clefts, except that they are more restricted in their use and emphasize actions.

> What William was caught doing, was stealing from the register.
> Who caught William stealing from the register, was his boss.[11]
> Where William was taken after stealing from the register, was prison.
> When William was caught, was yesterday.
> Why William stole from the register, nobody knew.

Wh-clefts are also called pseudo-clefts. They work differently compared to it-clefts, in that they cleft the other way around. The emphasized constituent is moved to the end of the sentence. While it-clefts concentrate the addressees' attention on one specific element using two highlighting instruments — topicalization and focus — wh-clefts usually put complete phrases in focus and isolate one constituent by postposing it (Ward et al., 2002). In terms of statistics, one could say that while the clefted elements in it-clefts only amount to $\frac{1}{3}$ of the sentence, the elements clefted by wh-clefts make up $\frac{3}{4}$ of the sentence (Prince, 1978).

[11] While technically correct, this sentence construction would most likely not be used by a native speaker.

Generally speaking, clefts can be created by putting the constituent to be emphasized into a separate clause, using an "empty" introductory word such as "it" and prefixing it to the rest of the sentence.

2.1.5 Other Structure Modifications

Apart from the strategies shown before, there are further ways of changing the structure of sentences, which leads to a change in emphasis. An in-depth discussion of all concepts would go beyond the scope of this work. The phenomena discussed before can explain the principles of IS and how they can be applied to achieve certain effects. The following concepts use the same principles in slightly different ways to produce very similar effects. Especially in the context of didactic optimization, discussing these in great detail would reduce the motivation of the learners. These concepts can be identified by the learners on their own, once they understand the general principles behind sentence- and information-structure. Should the demand to explain them in more detail arise in the future — which can be ascertained by feedback evaluation — additional lessons can be added to the module later on without the need for additional (software-) development.

Inversion

Inversion is one of the relatively productive ways to modify sentence-constituent order in the English language (Quirk, 1993). It often occurs when a sentence is transformed into a question or when a negation is part of the sentence. This kind of inversion is called subject-auxiliary inversion:

Peter will go.
Will Peter go?

Meg has finished it.
What has Meg finished?

Lois has been lying at no point.
At no point has Lois been lying.

This does not work, without the use of auxiliary verbs to form the sentence:

Chris left.
* Left Chris?
Did Chris leave?

Brian drank beer.

* What drank Brian?

What did Brian drink?

Another productive type of inversion is the subject-verb inversion with strong subjects:

Stewart went down to the pier.

Down to the pier, went Stewart.

Francis sat on a bench.

On a bench, sat Francis.

He was in his fifties.

* In his fifties was he.

Dislocation

Dislocating a constituent to influence the thematic structure of a sentence is another productive way in English (Trask, 1993). This is done by pre- or post-posing said constituent, i.e. putting it at the beginning or end of a sentence.

He said Thelma was a great teacher.

Thelma, he said, was a great teacher.

I love chocolate.

Chocolate, I love.

Barbara gave Patrick an expensive gift.

Barbara gave an expensive gift to Patrick.

The sentence structure is changed to move a constituent to a more prominent place in the sentence. Much like with clefts in 2.1.4 "Clefts" on page 15 above, but without the additional it- or wh-construction.

2.2 Information Status

The dimension of information status differs from the one of sentence structure, in that the status of information is not bound to the sentence level and does not need to interact with grammatical structures. Every constituent of a sentence can bear information status relative to the discourse, in which the sentence is uttered. This suprasetential information constitutes the most important factor of **I**nformation **S**tructure (IS) according to (Callies, 2009, p. 13).

There are several, mostly prosodic, strategies that can be employed by speakers of English to form a message that differs considerably from another one using almost exactly the same words and even sentence structure. The following sections will list the most important of these strategies and explain their use and effect.

2.2.1 Emphasis and Stress

Emphasis is defined as "any phenomenon which serves to draw particular attention to some element in a sentence or utterance" in the "Dictionary of grammatical terms in linguistics" (Trask, 1993, p. 89). Every sentence containing a message about something has the two-part structure described in the section above. Every difference in sentence structure automatically means a change in emphasis. When for example the object of a sentence is put into a cleft-sentence and moved to the front, it is emphasized by means of topicalization.

This kind of emphasis is bound to the grammatical system of the language, in which the sentence is formed. Since English has relatively strict rules of word order, the placement of emphasis by restructuring the sentence is also restricted by these rules.

In contrast to that, an almost unrestricted way to directly put emphasis on a constituent in the spoken language is to stress it.

> Did John go to the cinema yesterday?
> Yes he did.

The above conversation can have several different spoken versions, each putting the emphasis on a different part of the question. By emphasizing a specific part of the question the person answering the question is obliged to react according to information connected to the emphasized part.

> Did **Jane** go to the cinema yesterday?
> Yes she did. (It was Jane who went.)
>
> Did Jane go to the **cinema** yesterday?
> Yes she did. (It was the cinema, where she went to.)
>
> Did Jane go to the cinema **yesterday**?
> Yes she did. (It was yesterday that Jane went to the cinema)

In this case the answer does not change, but its implied meaning does. If we imagine a negative answer to each of the above questions, we can see that a change in text can be necessary even if the text of the question stays the same:

Did **Jane** go to the cinema yesterday?
No, John did.

Did Jane go to the **cinema** yesterday?
No, she went to the market.

Did Jane go to the cinema **yesterday**?
Yes she went last week

The person answering could of course also answer with the same sentence "No she did not." in this case, but in contrast to the examples above, it would not end the conversation, since it would leave out the corrective information needed to satisfy the intention of the emphasized question. In case of a question without special emphasis, "unmarked"[12] (Halliday, 1967), the simple answer of "No she did not." might suffice, while the emphasis implies that the person that stated the question wants a more detailed answer.

2.2.2 Given and New

Information provided in a sentence can be either new (to the discourse and/or to other participants in a conversation) or given. According to Halliday (1967), given information is recoverable, while new information cannot be directly derived from the discourse.

According to Birner (1996) and Kuno (1972), information can have the status of "new" and "old". "Old" Information is recoverable from the current context, i.e. known, and "new" is information that adds to the discourse. Halliday defined his concept of "given" in 1967 differently than "old", in that he defined it in terms of intonation; whenever the speaker sets an intentional mark, the focus, on a sentence constituent, it is "new", while the unmarked part must be "given" (Prince, 1981, p. 226ff). Halliday and Matthiessen (2004, p. 39) later refined Halliday's older definition: "The Given is what you, the listener, already know about or have accessible to you. [...] Given + New is listener-oriented."

	discourse-new	**discourse-old**
hearer-old	unused	evoked and inferable
hearer-new	brand-new	- *

* does not occur in natural discourse

Table 1: Possible Information Status according to Birner (1996)

The distinction between "given" and "new" information has to be made on the discourse level; the speaker decides whether information is generally known or can be recovered (for

[12] See 2.2.3 "Markedness" on page 23.

example by reference to previous sentences or by inference) or new, in the sense that either it was not mentioned in the previous part of the discourse or invalidates information that was stated before, and places the constituents and highlights them accordingly. (Clark and Haviland, 1977, p. 3) calls this a co-operative principle, which is an "agreement about how a) information that is known to the listener, and b) information that is novel to the listener are to appear in sentences".

It is important to note that the context used by the speaker to decide whether something is new or given also includes extralinguistic information. A speaker that is having a conversation with a small child might not consider knowledge about political situations, like who is the current President of the United States, as given, while they would surely expect anyone living in the US and over the legal voting age to know it.

The concept of givenness is not only strongly connected to the one of focus, the definition of focus depends on givenness. I will explain the concept of focus in section 2.2.4 "Focus" on page 25. Information that is given does not need to be emphasized in a discourse since it does not change the status of the information shared by all participants. When looking at language as a means to transmit information, every piece of information that is given, is redundant and thereby technically unnecessary to understand the conversation.[13]

Emphasized information must be new. This does not necessarily mean that whatever is emphasized cannot be known to the other participants in the conversation, but it must "carry" some new information. In the sentence "Yesterday John bought **a car**", with a pitch accent on "a car", the emphasis is on the constituent "a car". While we can safely assume that everyone taking part in the conversation knows what "a car" is — which means that information is known — it can still be "new"; the speaker clearly thinks that the others know who "John" is, or else he would have to explain it, the same applies for "a car". At the same time, when stress is on the words "a car", it means that the speaker wants to show that this information contrasts with information that was available before in the discourse.

The above sentence would be a sensible follow-up response to a sentence like "Yesterday John bought a boat." if the speaker knows it to be false (usually preceded by a "No,"). In this case we have contrastive emphasis;[14] the speaker has new information about something that is already part of the discourse, i.e. the fact that John bought something. By emphasizing "a car", the speaker wants to make clear that he has new information that supersedes what was previously available.

Callies (2009, p. 23) calls this kind of information, "explicit contrast", because it directly

[13] It is, however, technically relevant as a reference for the new information to be assignable.
[14] Or "contrastive focus", see section 2.2.4 "Focus" on page 25

relates to an available alternative in the discourse; whereas a generally contrasting piece of information that has no directly opposing alternatives would be called "implicit contrast". As with the term "focus", there are several different, sometimes contradicting theories about the more specific properties, which would go beyond the scope of this work.[15]

A discourse consisting of a question and an answer can show the principle of givenness: A question is defined as an inquiry for new information.[16] When a question is asked, the given information is defined by the question. A question thereby defines a standard template for the answer: "John" should be the topic of the answer, while information about "what happened" should be the comment.[17]

What happened to John?

John _____

The above question defines John as the main given information, the subject that is asked about. In addition the question is about an event, which further narrows down the choice of new information. The question communicates the following given pieces of information to the addressee:

1. I know who or what is meant by "John".
2. I know that an event occurred that had an effect on John.
3. My inquiry is about that event in relation to John.

An answer to this question should therefore use John as the topic and focus on the information about John's actions in order to be conceived as valid.

What happened to John?

1. John was hit by a car.
2. John was hit by **a car**.
3. * John **is 43 years old**.
4. * Mary **works at the bookstore**.

Sentence No. 1 is the most intuitively correct way to answer the question; the topic is John, as in the question, and the focus matches the comment, which contains the new information.

The second sentence can also be considered a valid answer; the focus is narrower and lies on "a car": the comment contains the new information. The emphasis on "a car" is unusual, but does not completely invalidate the answer, even though it might lead to further inquiries.

As for the last two sentences, they are not considered valid answers to the question; in No. 3 the comment does not contain any information that relates to the "what happened" part of

[15] For the sake of learnability, I will not mention this distinction in the online module, but refer to sources that go into detail about different types of contrast and focus.

[16] Even a rhetorical question is an inquiry for new information and can only be interpreted correctly in a situation where the addressee knows that the person asking the question has the information he asks for.

[17] This template is the most usual way to answer the question, but does not necessarily have to be used. There are multiple other ways to answer the question, as discussed later.

the question, while in No. 4 the topic does not match the one in the question, which renders the comment irrelevant.

However, the two "invalid" answers might be valid in a different context. In the case of No. 3, the topic did not change, which means that the question "What happened?" is answered with an obviously ill-fitting property description "X is y", but matching the correct topic, namely John. If the person asking the question assumes that the one answering intends to answer correctly and has the relevant information, No. 3 might be interpretable as "he realized that he is too old for that".

A: What happened to John?

B: John is 43 years old.

A: So that's why he stopped wearing baseball caps.

The same principle could be applied to No. 4; if the answer is considered valid because of information outside of the discourse, it is possible to imagine a situation where the fact that "Mary works at the bookstore" could be considered something that happened to John. Mary might, for example, be known to fill a management position and be very unfriendly, which, combined with the information that John works at the (same) bookstore, would explain John's bad mood, resulting in the inquiry.[18]

A: What happened to John?

B: Mary works at the bookstore.

A: So she made him work late again, I guess.

2.2.3 Markedness

The most common use of the term "marked" refers to single words. A word is marked in comparison to "another with which it stands in a paradigmatic relationship (the **unmarked form**) by the presence of additional morphological material [emphasis in the original]" (Trask, 1993, p. 167). The word "marked" for example is in itself marked because it contains "additional morphological material" compared to the form "mark" — it is "mark" + "-ed". The word "unmarked" is also marked, as it can be described as "un-" + "mark" + "ed". Or in simpler terms: The unmarked form is "that one of two or more competing forms, which is in some sense the 'simplest' or 'most basic'" (Trask, 1993, p. 293).

According to Dryer (1995), a sentence construction is marked if "the range of contexts in which it is appropriate is a proper subset of the set of contexts in which the unmarked construction is used". In other words: Dryer defines markedness from a pragmatic point of view. When taking all forms of a sentence and all contexts in which they can be uttered and creat-

[18] The interpretation of an answer that does not follow the "correct" scheme heavily relies on context. This context can often include way more than the conversation around the question/answer-pair. It could for example refer to a shared knowledge about the circumstances of John and Mary's personal life, or even the information that someone likes to answer in obscure ways.

ing a statistical analysis about which form could be applied where, the form that has the most accepted (as in productive) uses is the unmarked form. If a sentence fits into more contexts, it must also mean that it carries less meaning. A sentence that has connected implications can logically not work in as many contexts as one that does not have additional, implicational meaning. The short version of Dryer's definition might be stated as: A sentence is unmarked if it does not imply anything.

What will you be starting next week?
I will start working on the module next week.
When will you start working on the module?
I will start working on the module next week.

What will you be starting next week?
I will start **working on the module** next week.
When will you start working on the module?
* I will start **working on the module** next week.

The example above shows how a sentence with unmarked focus can be used in several contexts, i.e. to answer different questions. The marked variant cannot be used in the same way. The person answering the question has to highlight the new information. When they highlight the information that was explicitly given by the answer, they basically break a social contract, which makes the sentence unacceptable in that form. The unmarked variant does not specifically emphasize information and can thus be used to answer the question.

Halliday (1967) distinguishes marked and unmarked from a phonological perspective. He argues that the sentence stress in English falls on the clause-final constituent in cases where no special emphasis is intended by the speaker.[19] Following this argument, every deviation from this norm means special emphasis and makes the sentence marked in terms of IS. As a general rule Halliday and Matthiessen (2004, p. 92) states that "the focus is in its unmarked place, at the end", which also means emphasis.[20]

Simon took his bike.
Simon [took his bike]$_f$.
m Simon [took **his** bike]$_f$.

The first sentence is the standard-form and and is thus unmarked. The second version is essentially the same, since emphasis lies on the end-constituent — the comment — which

[19] See also section 2.3 "Syntactic Weight" on page 33, which explains the English rule that more complex constituents are placed towards the end of a clause.
[20] See section 2.2.4 "Focus" on page 25 for more details on focus.

means that, according to Halliday and Matthiessen (2004, p. 92), the two versions are the same. The last version is undoubtedly marked, as it lays special emphasis on the word "his", which creates a contrastive implication (he did not take anyone else's bike).

Another definition of markedness can be constructed from the field of psycholinguistics. Along the definition of syntactic weight in section 2.3 "Syntactic Weight" on page 33, a speaker needs a reason to deviate from the norm. Whenever a sentence is formed in a different way than would be the easiest for the speaker (i.e. the most common), there must be a reason for this behavior. This reason is usually to transport special meaning. Whenever there is no special meaning to transport, the speaker will most likely use an unmarked form.

Every example before this section, where special emphasis was put on a constituent, belongs to the group of marked sentences. Cleft sentences are examples for markedness in that they are usually marked syntactically as well as phonetically (in that the cleft influences stress and pauses) and distinctively define which element receives emphasis, even in their written form.[21] Callies (2009, p. 57) argues that this markedness exists on a pragmatic level, but that they are not informationally marked, precisely because they define the element to be emphasized unambiguously.

For the module I will adopt Callies' definition and explain it in a broader sense. The definition of markedness as "not the most simple form available" or "the standard-form" would suffice for most situations and would help the learner to build up knowledge quickly and effectively in the course of the module.

2.2.4 Focus

The idea of focus is closely related to the distinction between topic and comment. In contrast to the concept of dividing the sentence into two static parts, as in the concepts of topic and comment or theme and rheme, the phenomenon of focus is a more variable part of information structure. The word "focus" is sometimes used as a synonym for comment in linguistic literature; there is a correlation between the topic-comment structure and focus placement: In case of unmarked focus, it is placed toward the end of the sentence, and thus within the comment (Halliday and Matthiessen, 2004, p. 92).

Halliday (1967), who did not distinguish between topic and theme, describes the concept behind focus as one that is more connected to IS in his distinction between information structure and thematic structure;[22] while thematic structure — and thematization/topicalization as a phenomenon —- takes place in the realm of sentence structure and has the clause as unit, in-

[21] See section 2.1.4 "Clefts" on page 15

[22] He does not use the word information structure, but talks about "information systems" with "structural units".

formation structure works on the discourse level and its phenomena interact with the context of the discourse rather than just a single grammatical unit.

Following this idea of a structural difference between the notion of focus and that of topic or theme, I will adopt the theory-independent definition of focus that is used by Callies (2009, p. 20) and Miller (2006, pp. 129ff.), which states that focus is the part of the message, to which the listener's attention is intentionally drawn by the speaker: In other words, the highlighting of information that is emphasized for the addressee. The means by which the part is highlighted is not part of the definition and can be anything from phonological over syntactic to lexico-grammatical. This of course means that the definition is in itself not syntactic and falls into the realm of pragmatics, in that it can be almost freely placed in any given sentence by the speaker and does not belong to a binary opposition, as it would be when using the topic — focus (focus as synonym for comment) definition explained above.

What follows as an indirect effect from this definition — or might be seen as the practical reason for the existence of this definition — is the effect that focus always lies on new information.[23]

Opposing the use of focus as a synonym for comment, the definition in this work makes more finely grained distinctions available. Consider the following sentence:

$$\underbrace{\text{I}}_{\text{Topic}}\ \underbrace{\text{hit John with my car}}_{\text{Comment}}$$

One could argue that the comment is the focus of the sentence, since it is new information that is given to the addressee of the message. However, if we imagine a preceding question about John's accident and examine the answer to that question, it becomes clear that inside the comment there can be a focus on specific information:

> Who did you hit with your car?
> I hit **John** with my car.
>
> What did you hit John with?
> I hit John with **my car**.

By putting stress on a part of the sentence, it is possible to emphasize a specific piece of information. By defining this emphasized information as focus, we can use a much finer distinction and explain the phenomenon of emphasizing information as focus within a discourse on a more detailed level.

[23] I have explained this relationship in more detail in section 2.2.3 "Markedness" on page 23

In English, focus is usually marked prosodically, by using a pitch accent (Beaver and Clark, 2008; Krifka, 2008). This is comparable to the effect of changing word order.

1. I hit **John** with my car.
2. John, I hit with my car.

But we can also combine preposing (and thus topicalization) and focus through emphasis in one sentence. This is where the definitions of focus as synonym for comment and the definition used here directly oppose each other:

3 **John**, I hit with my car.

As we already saw when using the example above, the first sentence has a relatively clear distinction between topic and comment: The subject of the sentence is the topic while the predicate is the Comment. The third sentence on the other hand highlights the word "John" by putting it at the beginning of the sentence and emphasizes it by use of stress.[24]

This emphasis changes the sense of it as an answer, regardless of whether it was achieved by stress or reordering of the sentence. A question targeting anything else than "John" cannot be answered with a sentence that is marked in such a way:

1. Whom did you hit with your car?
   I hit **John** with my car.
   John, I hit with my car.

Question 1 can be answered in both ways while only changing the information slightly; "John" is highlighted in both answers, in the first one through a pitch accent and in the second one through left-dislocation. There is no difference between these two sentences from a purely technical perspective, both emphasize "John" and both use exactly the same words repeating part of the question.

2. What did you hit John with?
   I hit John with **my car**.
   * John, I hit with **my car**.

When the question is concerned with the other part of the statement, "John" cannot be put at the beginning of the sentence without changing the sense. When "John" is made the topic, he is automatically highlighted in addition to "my car", which does not seem like a valid answer to a question that already established "John" as given information.

This sentence would be comparable to the following one, which also highlights both:

[24] The second and third sentence is regarded by some linguists as a shortened version of a cleft-sentence: "[It was] John, [whom] I hit with my car."

* I hit **John** with **my car**.

At first glance, the highlighting of "John" is not a sensible way to answer the question about what hit him. This means that either the speaker made a mistake, or he tried to imply additional information with the use of this variant. In this case the implication could be somewhere along the lines of "There were several people that I hit with different things; in John's case I used my car."[25]

These questions indirectly show another property of focus: When asking "What did you hit John with?", we can infer from this that the person asking the question already has the information who John is. The information about John is given, so that the focus should be put on the new (not given) information. [26]

The fact that focus is placed on new information can lead to implications such as the one in the "odd" answer above. While the other examples above simply draw attention to a part of the comment, the placement of focus changed the context, in which it has to be interpreted.

Focus can even change the truth conditions of a sentence; it can be observed when ellipsis is involved (Rooth, 1992, pp. 22ff). The sentence stating "Mary calls me less often than Betty" can be interpreted in two ways:

1. Mary calls me less often than she calls Betty.
2. compactenum calls me less often than Betty calls me.

By placing the focus on different parts of the sentence, it is possible to distinguish between these two meanings unambiguously.

1. **Mary** calls me less often than Betty.
2. Mary calls **me** less often than Betty.

In version 1, "Mary" is in focus, which marks her as contrastive, while in 2 "me" is highlighted in the same manner as "Mary" in the sentence before. The focus placement switches our interpretation of the truth condition of the sentence. When "Mary" is emphasized, it is marked as the opposing element to the later subsequently mentioned "Betty". It cannot be interpreted as an element opposed to "me" because the comparison in the sentence is fixed to "Betty" by use of the word "than". In this case, stressing either of the two constituents would create explicit contrast with "Betty".

If we try formulating a sentence containing the same meaning using an it-cleft, we can make

[25] This interpretation of the answer becomes problematic in combination with the idea of the sentence being a shorter form of "It was John, whom I hit with my car.", which could not be used to imply that specific information. So in this case we have a difference in meaning between the long (cleft-) and the short version of the sentence, which is an argument against the idea that these sentences are actually the same.

[26] See section 2.2.2 "Given and New" on page 20

the contrastive meaning shift more obvious:[27]

1. It is **Mary**, who calls me less often than Betty.
2. It is **me**, whom Mary calls less often than Betty.

The example above shows another effect that is often associated with focus: contrast. Focus is often used to express contrasting alternatives — so often in fact that Rooth (1992) based his definition on it and describes focus as "indicat[ing] the presence of alternatives that are relevant for the interpretation of linguistic expressions".

This type of focus, contrastive focus, is only one of many types of focus that are described by linguists. Some linguists, such as Gussenhoven (2006, pp. 11ff) distinguish between at least seven different types of focus, while most linguists group them more generally. Kiss (1998, p. 245) for example defines two major types of focus: contrastive and presentational focus, which are also sometimes referred to as identificational and information focus or narrow and wide focus. This distinction is more useful for a learning environment, in that it does not overwhelm the learner with overly specific information. I will use the general term focus and explain the special case of contrast, but will leave out any further differentiations. Contrastive focus may be defined as a special type of focus, in which the alternatives are given (Féry and Krifka, 2008, pp. 5f). The other cases, in which no alternatives are given, but the speaker "marks out a part (which may be the whole) of a message block as that which he wishes to be interpreted as informative" (Halliday, 1967), is the presentational case. It is used when the speaker wants to emphasize a part of the sentence without putting it in opposition to anything, or as Halliday (1967) puts it, the "points of prominence within the message".

Focus Particles

The English language contains some words that can be used to place and influence focus in a sentence. When reading a sentence with one of these focus particles — also sometimes called "focusing words", "focusing modifiers" or "focalizers" (Hajičová et al., 1998, pp. 106ff; Huddleston and P., 2010, pp. 586 – 588) — in it, without any special highlighting, we automatically change our intonation pattern; focus particles allow a change in focus on a grammatical level and usually make us change the phonological focus pattern as well (Krifka, 1998). The combination of both effects causes them to have a very strong impact on a sentence.

If we take the sentence "I hit John with my car" and assign the focus particle "only", the semantic structure of the sentence does not change dramatically, but the message (including the implied meaning on the right) does.

[27] Clefts are discussed in 2.1.4 "Clefts" on page 15

1. I only hit John with my car. *(I did not run him over.)*
2. I hit only John with my car. *(I did not hit Mary.)*
3. I hit John only with my car. *(I did not use my tank.)*

The information conveyed by the sentence changes with a change of focus. The element in focus is the one that holds new information, which changes the implication of the sentence tremendously. In the first sentence the focus is on the verb "hit", which implies that there are other things that could have been done to John apart from hitting him with a car. This sentence could for example be followed by "I did not run him over".

In the second sentence the focus is on the object noun of the sentence, "John", which implies the possibility of hitting other people with the car. A possible sentence following this one could be "I missed Mary and William".

In the third sentence the focus is on the noun phrase "my car" of the prepositional phrase, which implies that there had been alternatives to the car that was used to hit John. A follow-up sentence to this would be "I could have used my tank".[28]

While the stress is usually placed on the constituent directly after the focus particle, the speaker can choose to put stress independently. This has an effect similar to placing the particle directly in front of the stressed constituent, adding further emphasis.

1. I only **hit** John with my car.
2. I only hit **John** with my car.
3. I only hit John with **my car**.

This effect works best when the focus particle is placed at the beginning of the comment. By using extra stress on a constituent within the comment, the focus particle is interpreted as a focal modifier for the entire comment. The stress on a single constituent then places an additional focus inside the focus domain (i.e. comment).

comment

1. I only [**hit** John with my car]$_f$
2. I only [hit **John** with my car]$_f$
3. I only [hit John with **my car**]$_f$

* I hit only [John with **my car**]$_f$

comment

Focus particles are also often referred to as focusing adverbs, because they all belong to the

[28] This sentence is of course highly unlikely to be heard in a real conversation, but it illustrates the change of meaning.

adverb class of words. They can be divided into several groups according to their semantic roles. Focusing adverbs can either have an additive semantic function, such as "also", or a limiting one, such as "only". See table 2 "Focus particles and their semantic groups" on page 31 for a more fine-grained division of particle roles.

Addition:	also, as well, even, too
Surprise:	even
Limitation:	alone, but, only, exactly, exclusively, just, merely, not only, precisely, purely, simply, solely
Partial Limitation:	at least, chiefly, especially, for the most part, in particular, mainly, mostly, notably, particularly, primarily
Negation:	neither / nor
Choice:	either

Table 2: Focus particles and their semantic groups

Emphatic Do

There is another popular way to assign focus, similar to focus particles listed above, but exclusively for actions. While not a focus adverb, "emphatic do" can modify verbs; it cannot be used to modify NPs.

The emphatic do differs from a normal "do", in that the emphatic do is inserted into a sentence when it is not needed grammatically. It serves to strengthen the meaning of the verb following immediately after it.

I brought out the trash this morning.
I did bring out the trash this morning.

Kate checked the data before it was presented to the client.
Kate did check the data before it was presented to the client.

The first sentence of each pair contains the unmarked version of the sentence; the second one contains the emphatic do construction. The inserted do moves the focus to the action directly following it; in the cases above the change in meaning can be compared to an insertion of another modifier like "really":

I did bring out the trash this morning.
I really brought out the trash this morning.

Kate did check the data before it was presented to the client.

Kate really checked the data before it was presented to the client.

Emphatic do constructions are formed by inserting the auxiliary verb "do" in front of the verb to be emphasized in the sentence. This extra auxiliary verb is needed when negating an action — as in "He did not go" — it serves the special purpose of amplifying the following verb in non-negating contexts — as in "He did go". Emphatic do is the auxiliary version of "to do" outside negation.

I did bring out the trash this morning.
I did not bring out the trash this morning.

Kate did check the data before it was presented to the client.
Kate did not check the data before it was presented to the client.

Emphatic do cannot emphasize auxiliary verbs; it must modify real actions, not states.

He teaches.
He does teach.
He is a teacher.
* He does be a teacher.

She looks happy.
She does look happy.
She is looking happy.
* She does be looking happy.

The use of emphatic do mainly serves to create two different forms of emphasis: contrastive and exclamatory (Quirk, 1993, pp. 133 – 134). The two examples above illustrate these two kinds of emphasis; the sentence "He does tech" emphasizes the action of teaching with the implied information that the alternative is not to teach. In a context where someone earlier in the discourse (for example) doubts the employment of the subject as a teacher, the reaction "He does teach" contains a contrastive emphasis. This contrastive emphasis is in the case of emphatic do also known as "emphatic positive", since it contrasts with a "negative proposition that has been expressed or implicated in the preceding discourse" (Huddleston and P., 2010, p. 98). The second example "She does look happy", may also be contrastive in a context where it was stated before that she did not. The sentence is more likely not to be uttered in such a context, where it is merely a statement of assertion. In that case "She does look happy" bears exclamatory emphasis compared to the unmarked "She looks happy".

2.3 Syntactic Weight

Syntactic weight is the last of the three dimensions of IS identified by Callies (2009, p. 9).[29] This dimension is arguably the most basic one as it seems to be rooted in human neurology and thus shaped the way, in which language has been constructed in all stages of language development throughout history.

According to Chafe (1986) there is a rule in English conversations, which states that in standard cases, the subject of a sentence contains given information; he calls this "light subject constraint", referring to the principle of syntactic weight in the ordering of clause constituents. This principle has been adopted for IS; it basically states that the longer and more complex a constituent of a sentence is, the more likely it will be found towards the end of a clause (Broderick, 1999; Callies, 2009, pp. 17ff).

English is a language with end-weight sentences; the heavier the element, the more likely it will be placed later on in the sentence. One could say that the unmarked form of a sentence is the one with the light constituents at the beginning and the heavier ones towards the end.

A different approach to explaining this phenomenon is the more pragmatic idea from the field of psycholinguistics, which states that heavier constituents are harder to comprehend and are therefore harder to formulate. In terms of human "computing power", it is easier to put constituents that require more (i.e. longer) computation, towards the end of a sentence in order to buy time for the speaker. While already uttering the previously formed part of the sentence, the speaker can continue to work on the rest of the sentence. Doing it the other way around would require the speaker to have the heavier constituent ready before beginning the sentence; this would lead to a pause before the speaker is able to start the sentence. From this perspective end-weight is, at least partly, an optimization of the timing of speech.

The problem with this optimization is that it violates another usually underlying agreement of conversation between speaker and listener: it increases the costs of parsing the information on the side of the listener. The more useful (in terms of discourse) information is available at the beginning of a sentence, the more obvious the sentence structure and the conclusion becomes earlier on. This again gives the listener more time to analyze the sentence and form a response (Callies, 2009, pp. 17ff).

Comparing two relatively simple sentences, containing the same information (although not containing any particularly heavy constituents), we can see the delay of parsing that must occur before the listener can know what the speaker is talking about. The arrows show the

[29] Sytactic weight is also sometimes referred to as syntactic complexity, cognitive complexity, clause complexity, linguistic complexity, structural complexity or grammatical weight.

part of the sentence that must be parsed before the topic of weather can be known:

1. Horrible weather we are heaving today, don't you think?
2. Today we are having horrible weather, don't you think?

Another theory suggests that end-weight is a result of the general human short-term memory structure. Tests have shown that short-term memory can store around seven (± two) items that are immediately available for cognitive processes (Miller, 1994, pp. 343ff).[30] Following this principle, it is less expensive in terms of cognitive processes to work on the smaller units (those containing less than seven items) at the beginning and treat the other items as abstract, which makes them appear as one item. After the smaller units have been processed, the abstract representations of the more complex units can be resolved and worked on. If the speaker put the more complex constituents in the front part of the sentence, the following, smaller items, would still have to be worked on after resolving the complex ones; which would require "more memory" that is not available, and thus more complex cognitive processes, to work around the seven item restraint.

Let's take the following two forms of sentences that have the same semantic content:[31]

1. Yesterday I worked on a farm with a large number of animals.
2. A large number of animals were on the farm that I worked at yesterday.

The first sentence will be divided into several chunks (or items) containing abstract information, in this case the chunks relate to *1.* when, *2.* who, *3.* what, *4.* where, and *5.* the additional information about the farm.

These five abstract chunks can be directly available in our short-term memory; as soon as we resolve one of the chunks into actual words, we will need more memory. Whenever a word has been uttered, it can be purged from our short-term memory and the "free space" can be used for something else.[32] In the case of sentence No. 1 the process of building the sentence with all the desired information would create roughly the following structures in the human mind. The underlined part has already uttered and is thus no longer kept in memory. The parts in brackets are the abstract chunks:

[30] The number of items varies for example with the length of used words.
[31] The difference of "with" vs. "were at" does not change the meaning enough to generally affect the semantic content, it is necessary to convert the sentence structure.
[32] This is of course highly simplified and in terms of neuroscience even wrong, but it is a sensible analogy for explaining the general problem of working with available memory.

[when]	[who]	[what]	[where]	[addition]	5
Yesterday	[who]	[what]	[where]	[addition]	5
Yesterday	I	[what]	[where]	[addition]	4
Yesterday	I	worked on	[where]	[addition]	4
Yesterday	I	worked on	a farm	[addition]	3
Yesterday	I	worked on	a farm	with a large number of animals	6

The speaker can fit the complete part of the sentence they are about to utter into the seven items available in his short-term memory. Compare this to version 2 of the sentence:

[addition]	[where]	[who]	[what]	[when]	5
A large number of animals were on	[where]	[who]	[what]	[when]	11
A large number of animals were on	the farm that	[who]	[what]	[when]	6
A large number of animals were on	the farm that	I	[what]	[when]	3
A large number of animals were on	the farm that	I	worked at	[when]	3
A large number of animals were on	the farm that	I	worked at	yesterday	1

As soon as the first chunk in the sentence has been resolved, the speaker has to use more complex cognitive mechanisms since they cannot keep all items in their short-term memory, which makes this sentence harder to process. The easier solution is generally preferred. This makes the second version marked, i.e. not the standard way of formulating the sentence. Since it requires more costly mental processes to construct, there is most likely a reason why the speaker chose to put in extra work and deviate from the standard, usually to express something special: The speaker assigns information status.

2.4 Contrastive Approach to IS in English and German

After the central aspects of IS have been explained in the previous sections, I will now give a brief overview concerning the relationship between German and English in this field. As the module will be aimed at German learners of English, it may help them to see the connection to their native language.

The contrastive comparison of IS in German and English could fill more than just one paper, in this thesis, as it is only a minor part of the module. The analysis of the two languages side by side in terms of information will concentrate on a few key phenomena. In the following it will be shown that English and German are indeed very comparable in terms of IS and where the major differences lie. The following division into similarities and differences is not as clear as it might seem; it mainly serves to separate the mostly similar from the mostly different phenomena.

Similarities

Topic — Comment (also: Theme — Rheme) is basically the same in English and German. One of the reasons this happens to be the case is that both languages typically start their sentences with the subject in simple, unmarked cases (Lehmann, 2012, pp. 188ff). This provides a statistical argument for these two languages: The probability that a sentence is about its subject is high. The probability that sentences start with the subject is high. We have a correlation between subject- and topic-position, from which we can infer that (it is likely that) the topic is placed at the beginning of a sentence.

Topicalization can be seen as a follow-up effect to the aforementioned topic-comment-structure. If the topic is placed at a specific location in the sentence, moving any constituent to that position makes it the topic. As will be described in the word-order-paragraph in the next section, German sentences can be analyzed as containing topological fields — topicalization means moving a constituent to the forefield.

Clefts are used in German almost exactly as they are in English. The difference lies in their frequency rather than their formulation. The main reason for this is the relatively fixed word order in English compared to German; German speakers have more possibilities for varying placement of sentence constituents and thus do not need cleft-constructions as much (Reichmann, 2005, pp. 55f).

Focus works almost identically in many languages (Lehmann, 2012). Except for languages that rely on stress as a distinctive criterion for heteronyms, stress is mostly used to express emphasis. Since the definition of focus is closely connected to the concept of emphasis, all languages that have this connection share a relatively identical realization of focus.

Focus particles are used in English and German for the same function in almost the same way; there are several examples in which focus particles can be translated one-to-one:

1. She is the only person in the room who can speak Spanish.
2. Sie ist die einzige Person im Raum, die Spanisch sprechen kann.

3. Even John knew the answer.
4. Sogar John wusste die Antwort.

However, there are differences in the use of the particles. German relies heavily on particles and can insert them in cases where a more complex construction is needed in English; as a

result of this intense use, German has more particles than English, which often results in a "one-to-many relationship between a given English particle and a set of German translational equivalents" (König and Gast, 2012, p. 301). In other words, when translating from English to German, focus particles can be directly translated, usually with a wide range of alternatives, while translations in the other direction often need to be reformulated.

Given Information is information that can be derived or is known from the preceding discourse, is placed at the beginning of a sentence as the standard method of distribution in many languages, including English and German, while new information tends to be placed towards the end. This principle, though valid in most languages, does not constitute a mandatory rule; some of the phenomena of IS, as described in the above sections of this chapter, are caused by violating this rule. (Callies, 2009, p. 14)

Syntactic weight as described in section 2.3 "Syntactic Weight" on page 33, can be explained by means of human psychology and neurological properties of the human brain. Since these properties do not vary between users of different languages, it is only logical that this principle applies to many languages, including German (Callies and Szczesniak, 2008, p. 168).

Differences

Word order in English is mostly SVO, while in German words can be placed with far fewer constraints — with SOV and SVO being the most productive strategies (König and Gast, 2012, pp. 193f).

English sentences are relatively strict in terms of word order, while in German the sentence constituents are placed according to topological fields. German sentences can be regarded as a three-part structure of fields — forefield, middle field and postfield. These fields are divided by verbal constructions: the forefield is separated from the middle field by a finite verb in main clauses; the non-finite verb, if the sentence contains one, is placed after the middle field, which can be followed by the post field, which usually contains the heavier constituents (König and Gast, 2012, pp. 195f.).[33]

Inversion is quite similar in the two languages; for example, in order to formulate questions, the verb can be placed at the front in English and German:[34]

[33] See "syntactic weight" in the section before, about the heavier constituents in the postfield.
[34] German does, however, require another change in word order compared to the unmarked sentence, as can be seen in example sentence two.

1. Have you seen Anna?
2. Hast Du Anna gesehen?

3. Isn't that nice?
4. Ist das nicht schön?

The main difference between this kind of inversion is that German can start the sentence with non-auxiliary verbs, while in English this has not been possible since Shakespeare's times (König and Gast, 2012, p. 199).

Kennst du das e-Learning Modul?
* Know you the e-learning module?
* Think you so, sir? [The Winter's Tale - Act IV. Scene 4.]

Emphatic do does not exist in German. In English negative sentences are formed by using the negated form of "to do" ("to do" + "not"), which leaves the normal (positive) do without a function. This gap was filled with the intensification function known as "emphatic do". In German, no form of "to do" is needed to negate a sentence; the same function is achieved by the word "nicht" ("not") in combination with the non-auxiliary verb.

I do not think that's appropriate.
I glaube nicht, dass das angemessen ist.
* I think not that's appropriate.

In order to express the same kind of intensification that can be achieved by the "emphatic do" in English, German speakers need to add intensifiers, like the modal particles "schon" and "wohl" (Bross, 2012, p. 183).

I do think that's appropriate.
I glaube (sehr) wohl, dass das angemessen ist.

Learning

Taking advantage of the learners' preexisting knowledge of their native language is the main reason for including the contrastive point of view in this work. The idea is to use the properties that do not differ between languages as a groundwork that does not need to be explained as thoroughly to the learner as the rest. This leaves room (that is: time to work on and explain) for the phenomena that are constructed differently in the foreign language (Lehmann, 2012).

The effect of the contrastive information on the learning success of the students should, how-

ever, not be overrated; most of the learners will not have extensive knowledge about the inner workings of their own language, as they learned to master it intuitively at a very early age and only have theoretical knowledge about it from secondary school (Medgyes, 2001, p. 437). Because relying on knowledge about the native language could lead to problems, contrastive explanations will be included as a minor part at the end of each lesson. Including this part leads to a repetition of the previously learned content and helps remembering it by connecting it to previously available knowledge. Even in case there is no previously available theoretical knowledge, the information can still be connected to the intuitively available ability to formulate correct sentences — which will arguably have a lesser effect than if there were linguistic knowledge, but still a positive one.

Chapter 3

E-Learning

According to the Oxford British and World English Dictionaries, e-learning is defined as "learning conducted via electronic media, typically on the Internet". According to this, e-learning is a category term describing everything and anything that has to do with learning and can be done with the help of computers, video- or audio-devices. There are several definitions of e-learning in the literature, which can all be summarized in a broad understanding like the one Rey (2009, p. 15) uses: E-learning is the sum of all ways to teach and learn using electronic media. Other definitions are more restrictive or focus on a specific type of e-learning. Holmes and Gardner (2006, p. 14) for example characterize e-learning solely in the sense of online learning and make constant availability to the learner a central property of its definition. Classic approaches also entail offline solutions like learning-DVDs which do not necessarily use the internet or any other means of electronic communication. The definitions of e-learning describing solutions that are not computer-aided have taken a back seat in the last years, a simple learning-audio-CD that does not include an interactive program is usually not included in modern definitions of the term.

As far back as the 1960s, computers were introduced as a technological aids in education. First computers were used to create a learning experience as similar to classic teaching methods as possible, it was only later that the specific differences of computer aided teaching were utilized to gain an advantage. It took 30 years for the first online based high school to be founded and even longer for e-learning to become an accepted tool in all areas of university teaching. Today e-learning is a way to make learning more efficient or save costs on usually very expensive trainings. Large companies have their own departments employing hundreds of people only for the sake of e-learning production and to save money.[1]

[1] As an example, the SAP AG has a large department called Knowledge Productization Services (KPS) that produces all kinds of e-learning material for internal use, partners and customers.

Not more than 15 years ago, e-learning was still seen as a craze by large parts of the academic world. Most universities relied on classic methods for presenting and delivering information to their students and even digital projectors were only seen in specialized IT-oriented departments. But even back then, many instructors dreamed of a time when they did not have to copy hundreds of pages in order to provide a class with just a few pieces of important information (Peters, 1997, pp. 190f). We have now reached the state that was dreamed of back then, at least in terms of technology. Most students today carry around a personal computer with internet connection in their pockets and even elementary school students use computers regularly — to communicate, to play and to learn. Learning with the help of electronic devices and the internet has become an important part of everyday life, slowly reaching schools as well as universities. Some universities even integrate specially designed mobile applications into their services and provide communication and feedback about lectures in real-time to their students.[2]

With the rise of information technology and the introduction of networked computers into nearly every household, electronic means of teaching have become available to teachers that are accessible to all students independent of time and place. While ten years ago, the classroom was almost the only interface between teachers and students to allow interaction, nowadays e-learning solutions allow for constant, asymmetric interchange — not only between student and teachers, but everyone who has access to the service thus allowing students to use their time more efficiently.

E-learning is used as a full solution without the need of a standard classroom, with dedicated teachers and support for the students, which is the case with some correspondence courses, for example at "Fernuniversität Hagen" or as an addition to classroom training. In our case, e-learning will be used to support university courses and is implemented as a result of tight finances.

The module implemented in this work will be designed for the narrow, online-centered definition of e-learning while keeping compatibility to the (slightly) broader one: The module will be available to the learners at all times on a web-server and at the same time be usable as an offline-version with slightly reduced functionality.[3] The aim of the module is to offer a resource for self-education, which results in one main problem: The absence of instructors who can assist the learners directly. It would be possible to offer teachers that are available by synchronous communication channels, like telephone or online chat, but since e-learning is usually implemented to either be an additional learning resource or as a means of lowering

[2] One of the German Universities providing such services can be seen at `http://mytu.tu-freiberg.de/`

[3] See section 4.2 "Technology" on page 72 for more details about the technology choices in the module implementation process.

costs, there is no financial margin for hiring additional human instructors.

In this chapter I will talk about what constitutes e-learning, which advantages it offers, what the disadvantages are and how the theories behind e-learning influence the implementation of the module. I will first give a short overview of how the human brain works in the case of learning and then give an insight to different learning models and how they can be used to aid electronic teaching. I will assess how these methods can be used in the module and what requirements it will have to meet. I will close the chapter with a brief insight into the specific environment this e-learning module will be used in at RWTH Aachen University.

3.1 Pedagogical and Didactic elements

E-learning began with trying to imitate classic learning approaches; the classroom was moved to the home of the learner. While initial e-learning solutions were nothing more than digitalized books that had the advantage of being automatically indexed and searchable, soon new forms of digital presentation, such as interconnected hypertexts and interactive exercises were developed.

3.1.1 Human Memory

The process of learning in human beings is basically a strategy to store correctly connected information in the neural structure of the brain. The problem with human memory, as opposed to binary computer memory, is that there are several types of memory that are not directly accessible to us. The Atkinson-Shiffrin model is one of the most popular but very simplistic approaches (Atkinson and Shiffrin, 1968). Research has shown that this model is too simple to explain phenomena observed in patients suffering from brain damage, but it seems to suffice for and has greatly influenced the way we teach, especially language; learning has become more efficient by incorporating rehearsal-exercises into the lessons (Frankland and Bontempi, 2005). The model explains the inner workings of human memory and has proven to be correct for practical purposes. The model states that there are three main categories of memory:

1. Sensory memory
2. Short-term memory (working memory)
3. Long-term memory

Sensory memory, or ultra-short-term memory, which is needed to connect stimuli that happen close to each other. This type of memory is needed to connect and comprehend simple pieces of information. When hearing a word, for example, we have to remember and combine

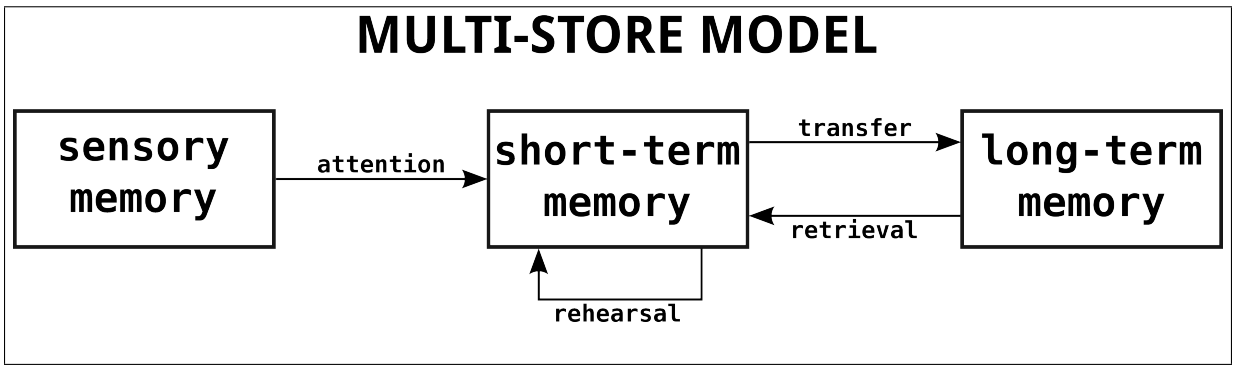

Figure 2: The Atkinson-Shiffrin model

the individual sounds to one unit that can be parsed and stored to the next memory category.

Short-term memory is used for information that has been parsed. "Useless" information, like background-noises or our immediate surroundings at every point in time, might be perceived but not committed to short term memory.[4] Short-term memory can also be easily observed in games, like the blatantly named "Memory"-game where the goal is to find two cards with the same picture on it: While healthy people have no problem "solving" the game, most of them will not remember the location of any of the cards when asked several days later.

Long-term memory is accessed through repetition and association of information that has previously been committed to short-term memory. The more often information is rehearsed, the higher the chance that it will be remembered at a later time. Information already in long-term memory can be strengthened by recapitulation. If the information has been in long-term memory for an extended period of time, the frequency of recapitulation exercises can be lower in order to keep it in memory (Mace, 1963). Recapitulation can be in the form of passive reflection or active (deliberate) recalling of the memory. Another way of committing information to long-term memory is association with emotion. Emotional stimuli increase the likelihood of consolidation (LaBar and Phelps, 1998). People remember highly emotionally laden situation even without active recall; the experience of the death of a close person is one example of memory that is usually not actively rehearsed — people often try actively not to recall the situation — but has an extremely high chance of remaining in long-term memory. This effect cannot be applied in learning to its fullest extent, but can be used for example by including humor into the lesson. The effectiveness of using humor is however debated, Whisonant (1998), for example, did not manage to find evidence for the positive influence of humor in computer based education environments, while studies by Isen et al. (1987) and Isen and Means (2001) showed a positive effect on critical thinking and problem solving, and Zill-

[4] Example: If we were asked to remember the background-noise that occurred a few moments ago, we will not succeed, there will only be a vague memory stating that it was "usual". But if we are asked to concentrate on the background-noise now and then are asked again, a short time later, to describe it, we will most probably have a clear memory about it; this means that this information was committed from sensory to short-term memory.

mann and Bryant (1983) showed that related humor can be an effective way to help students remember examples of content.

3.1.2 Learning Models

Several specialized models have been formulated to account for the learning processes in the human brain that lead to very similar conclusions regarding the implementation of e-learning solutions.

Rey (2009, pp. 22ff) devised a model to classify e-learning solutions according to the level of interaction provided to the user. According to his "taxonomy of interactivity", the module implemented in this work is between stage three and four. Stage three in that model is the approach to ask questions, stage 4 is the active modification of learning content by the user. The module will contain exercises and tests — which essentially are questions with an increased interactivity, as they demand a response from the learner. The content of the quizzes is changed if the learner fails to respond correctly on the first try, in that the failed question will be added to the next quiz.

The audiolingual method (listen and repeat) is the method of imitation that is thought to be closest to the natural way of language learning, as children learn their first language(s) this way. This method is widely used in second language acquisition as a behavioral means of teaching in the form of the pattern-drill-method, which also made its way into other fields of teaching outside language acquisition (Roche, 2005). The method was made especially popular in the 1940s and 50s by the US Military in order to train their soldiers for the quickly changing locations they were deployed to. This "army-method" is still in wide use today, prominently with almost all autonomous language learning products, like language-learning CDs, DVDs and computer-programs. This method will not be applicable to our content, as it is an approach to quickly learn information by heart, but not to comprehend logical relations.

Two Factors of Learning

Cognitive **L**oad **T**heory (CLT) defines learning as modification of long term memory. Like in the Atkinson-Shiffrin model above, working memory is the currently available information, sensory memory is the direct input. The theory distinguished between two kinds of knowledge: *1)* Primary biological knowledge. *2)* Secondary biological knowledge. Primary knowledge is not consciously learned, an example for this is native language. CLT is not concerned with this type of learning. The theory is centered around the notion of secondary knowledge, information that is actively learned, for example in school.

The theory is built around the existence of two main restrictions in the human mind: *1)* It

states that only about 2–4 elements can be processed (combined, contrasted or manipulated) in working memory at the same time, while previous research by Miller (1994, pp. 343ff) stated that around 7 items could be processed simultaneously (Sweller, 1994, pp. 306f).[5] *2)* The amount of time data can be kept in working memory is small. If it is not actively rehearsed, the information is lost 20–30 seconds after it was received (Kirschner et al., 2006).

Mayer (2005) defines the **C**ognitive **T**heory of **M**ultimedia **L**earning (CTML), which is similar to CLT but focuses on multimedia learning. There are three main assumptions that provide the basis for it: *1)* Two channels for information processing exist: Visual and verbal. *2)* The amount of data in working memory is limited for each channel.[6] *3)* Ordering the incoming information into a coherent mental representation in the learner's mind constitutes the main learning goal.

The central pragmatic conclusion from both theories (CLT and CTML) could be described as "less is more" in term of learning. The central goal of e-learning should be not to overburden the working memory, which leads to simpler structures and increased repetition in e-learning modules, compared to classic educational books. Another conclusion is that leading the learner towards discovering information on their own, in contrast to simply piling up information, leads to better content assimilation.

Jacobson and Spiro (1995) formulate an opposing approach in their **C**ognitive **F**lexibility **T**heory (CFT) to the first conclusion following from the two theories described above: a simplified version of information can influence the learning process negatively. The main argument here is, that the learner — as stated in CTML — constructs an internal model based on the learned information. The more simple that information is, the more possibilities there are to build an internally coherent model that is based on false assumptions (wrong logical connections). Several techniques are proposed to prevent this from happening while using the positive effects of a partially simplified explanation: Multiple forms of representation should be shown to the learner; the explanation should be repeated in different ways, using different analogies and examples. The learner can use these several perspectives to check his internal model and match it with different concepts. The potential number of misunderstandings is decreased significantly with the number of perspectives provided. The number of perspectives provided is, however, not proportional to the positive effect. After more than a few different views there are diminishing returns on the work invested into the learning material, not to mention the decrease of motivation in the learner if the explanations grow too long.

A balance must be found between easy learnability and adequate complexity. The learner

[5] See also section 2.3 "Syntactic Weight" on page 33 for an example of that principle working in language.

[6] As opposed to Miller (1994) and (Sweller, 1994), Mayer (2005) does not name specific numbers for the limits of working memory in CTML.

must be challenged without throwing too much information at them. Jacobson and Spiro (1995) propose to put a reference to the complex version of the explanation into the simple one as a minimal solution. It is meant to warn the learner about the complexity with the goal to keep them from skipping over the detailed exemplification in the belief that they understood the concept completely from the first version.

Following the above theories, sensory memory is basically irrelevant to this investigation, as we can assume, that all learners at least understood the words being used; after that the cognitive processes work outside the realms of sensory memory. The other two types of memory are what is important in learning theory, as the main goal of learning is moving information from short-term memory into a coherent model in long-term memory. First we have to formulate information in a way that can be parsed by the learner — they have to make sense of it — after that, a strategy has to be applied that ensures the transfer to long-term memory. This means that there are basically two main Goals for our e-learning module: Comprehensibility and Memorability.

Comprehensibility

The lesson content must be designed to be balanced according to the aforementioned complexity dilemma; comprehensibility can be achieved through dividing the content into multiple lessons as a means of simplification without removing complexity altogether (Jacobson and Spiro, 1995). As stated above, the reduction of complexity has to be kept in balance so that it does not impair the learning performance.

In the module implemented in this work, the complexity has been reduced by the limitation of topics and the use of "compatible" definitions, with a reference to more detailed explanations outside the module; this directly implements the instruction by Jacobson and Spiro (1995).[7]

Memorability

The content must be designed to be memorable; in order to get the information into long-term memory, the module design features three factors:

1. Interest and incentives.
2. Emotional stimuli.
3. Repetition and recollection.

(Rock, 1957; Chistianson, 1992, pp. 12ff, p. 105)

[7] See section 4.1 "" on page 71 for more details on the choice of definitions.

Interest and Incentives

The fact that students take the classes and use the e-learning modules because they have to, directly relates to low interest in the topic itself. While it is often argued that advanced students at universities choose their topics themselves and therefore must be interested in them, it is not possible to get a degree with just having visited enough of any type of courses. From this follows, that most, if not all, university students are at least sometimes not attending a class voluntarily. In order to arouse interest in the students, there are several factors to be considered. A detailed explanation of motivational factors is done in section 3.1.4 "Motivation" on page 51.

Emotional Stimuli

Generating emotional stimuli is a very complicated task even with direct personal contact to the learner in the classroom. Creating them is what is generally considered the distinctive feature of good teachers. A text based module cannot create an emotional connection to the learners, like a human teacher could, and must therefore always fall short of (good) classic teaching in this respect.

The main goal for the module in this area is to create a "friendly", familiar environment by using a non-formal type of language and a humorous style whenever appropriate (Rey, 2009, pp. 84f).

Repetition and Recollection

In order to keep information stored and accessible in long-term memory, the exercise has to be repeated. In order to maintain interest, it is not enough to make students do the same routine over and over again.[8] Repetition would however suffice if the students actually wanted to repeat the exercise themselves without external constraints; if we manage to create a learning-environment that is interesting/entertaining enough to motivate the students to use it repeatedly, the repetition-factor is automatically covered.

Recollection is basically the passive form of repetition, a simple recalling of the lecture. This might seem counter-intuitive, since the word "repetition" has the connotation of mindless work, but in the case of e-learning, repetition means actively taking part in (the same) exercises again, while recollection simply means remembering the lesson. The goal of the lecture must be to create as many situations outside the lecture that make the students remember the lecture. This might be achieved with electronic media, or a design of the lecture that uses real world examples in order to create association. Modern approaches to this include web 2.0 techniques of social interaction, like sending out a "classroom"-newsletter and connecting social media platforms or a twitter-account for the course (Dittler, 2003, pp. 127ff).

[8] See section 3.1.4 "Motivation" on page 51

3.1.3 Language

There are two terms of language that need to be separated:

1. Choice of language to encode information in, for example English or German.
2. Language style, the choice of words to encode messages.

Both factors are very important: Apart from the decision whether to address the learners in their native language or the target language when explaining the topic, the language style can be a major factor when it comes to understanding.

A strict and formal approach, using correct nomenclature and precise descriptions may describe the content of the lecture accurately but also decreases the learning success rate; colloquial texts generally lead to an increased learning effect (Robinson, 2004). This phenomenon is called the personalization principle. There are three theories about why this effect occurs:

1. A social reaction is provoked in the learner if the learning material "bonds" on the textual level by using a more "normal", non-academic language.
2. Self-reference-effect — the memorization rate correlates with the ability to connect to the topic. The more natural and familiar the learning material feels, the greater the connection.
3. As colloquial language is far more often used compared to academic language, even in the case of academic scholars, the learner is more familiar with it, which means that they have more practice in parsing this kind of language and thus need less cognitive resources to work with it.

(Rey, 2009, pp. 84f)

We can assume that students who learn about information structure in the English language have sufficient knowledge to understand lessons in English. Since every student of English Linguistics or English Literature Studies at RWTH Aachen University is required to have sufficient English knowledge to follow lectures when starting their studies and has to participate in mandatory language awareness courses during their basic studies, we can safely assume that our participants will understand enough to use the module successfully. Most — if not all — lectures the learners attended before visiting the module for the first time will have been in English and since the topic of the module is the English language, it is advisable to use English for the user interface in order avoid a break in the flow of the learning experience.

The module is aimed at German learners, which implies that every user will have at least as much linguistic competence in German as they have in English. The module will contain contrastive examples of information structure in German and English, which makes the use of German in the module necessary at least for the contrastive examples and exercises. Since

the module is specifically designed for German learners, German texts in the module are advisable in situations where clear and unambiguous instructions are more important than the learning effect created by using he language that is to be learned. The introduction will be kept in German in order to prepare the students for the course and filter out students without the necessary skills before they start working with the module. Following the same argument German has been chosen for the content of the help- and feedback-channels, as in case of problems it is more important to be precise than communicate in the target language.

A problem with keeping parts of the module in German only occurs when it is used by students who do not speak German as their native language. It is not the goal of this work to accommodate these students, but even when implementing the prototype, it must be kept in mind (on a technical level), that internationalization (i18n) is one of the first logical steps when extending the module. The implementation of this is realized by a language choice menu that lets the learner choose their preferred language from a list of available languages, whenever content is available in the chosen language, it will be displayed instead of the always available English version that will be shown otherwise.

The main language in the module will be English; for the technical aspects and the choice of programming languages see 4.2 "Technology" on page 72.

3.1.4 Motivation

As mentioned above, interest and incentives are an important factor for memorizing information. They are part of what constitutes the motivation to learn. Not only the effectiveness of storing information is influenced by these factors, also the learning performance in general is largely determined by motivation.

Motivation can be achieved on two levels: Inside and outside the module. The inside level is mainly concerned with motivating already participating learners, i.e. incentives to keep them from leaving the module before they finish it. The outside level mainly concerns communication among learners and with university instructors. Both levels are equally important and the success of the approach is difficult to measure. This section contains a description of the efforts implemented in the module as well as a proposals for the environment it is to be used in.

Inside the Module: Incentives

The main incentive for taking part in the module must come from outside; the learners will not be forced to use the module, which means that they have to be given a reason beforehand to even access it for the first time. From the inside perspective this is very fortunate, as we

can work with a comparably high level of motivation from the beginning; at the same time it will decrease the number of participants, changing this, however, is a task that must be accomplished before the learner has even seen the module.

The main incentive is, of course, learning something the user will need to know in future university courses — most other incentives will have to be generated. The main techniques used in the module to achieve this are: *a)* The module uses colloquial language to increase motivation as described in section 3.1.3 "Language" on page 50. *b)* The module is divided into small units that gradually increase complexity and reference each other, in order to improve the learning experience. *c)* Every lesson contains a short comparison with the German language in order to provide an additional familiar part and give the learner the possibility to connect the new content to previous knowledge. *d)* Every lesson ends with a small quiz, rehearsing the previously built knowledge. *e)* Every exercise in the quiz contains individualized responses to wrong as well as correct answers. The responses to wrong answers help the learner to recognize their mistake, responses to correct answers shortly explain the correct choice again, so the learner has the possibility to verify their reason for choosing the answer.

Outside the Module: Communication

When using e-learning, at least part of the course is removed from the restricted classroom environment, which make supervision and assistance more challenging tasks. There are many ways of communication between teacher and student, "classic" e-mail, forums, chats, web-messaging, texting and wikis can easily be integrated into almost any available online e-learning solution. From a technical perspective, all these methods of communication are available in a modularized form and can be created and linked to online-courses without requiring additional development. Actually making students communicate requires a different approach compared to direct, synchronous and vocal communication in the classroom; while a student has virtually no choice but to react to a direct inquiry in class, making them use interactive communication channels like forums or wikis requires special incentives and an active community.

The module implemented in this work will not include forums, wikis or any other kind of communication directly but I will recommend using them when appropriate. This is due to the restrictions of this rather theoretical work: The module implemented here will be designed to be as portable as possible in order to be deployable in different technical and organizational scenarios. The circumstances of module implementation dictate a model that does not rely on user generated content. The possibility to link to interactive platforms remains, but needs to be organized independently; while it is generally useful to let the students communicate freely, an unmoderated forum that contains all answers to the modules quizzes

might be counter productive.[9] An unmoderated forum might however boost the willingness of the students to participate online, and thereby benefit the online learning experience. Allowing anonymous participation in said forum might help further; although it increases the possibility of cyber-bullying to happen, students who feel intimidated by the idea that their teachers can read everything they ask and that it might influence their grades, may not have problems asking questions anonymously. This kind of unrestricted communication amongst students does however require an active moderation as well as a contact person that has the rights to delete and change user content.

3.2 Online Learning

Websites have more and more replaced the e-learning solutions that were distributed on physical storage units like CDs or DVDs. This is due to the ever increasing bandwidth available to the general population and the standardization of web programming and multimedia elements in the current web standards. Online learning is now the de-facto-standard for almost all learning solutions that do not rely heavily on video-content, and even those are getting fewer and fewer as video becomes a normal feature even on mobile data connections.[10] There are several peculiarities of online learning that arise from the combination of the electronic format of the content and the medium over which it is are transmitted; I will describe them in the following sections.

3.2.1 Availability and Freedom

The module assures the learners' freedom on two different levels:

- Constant availability of the content.
- Freedom to choose.

The key component of successful e-learning is availability; Holmes and Gardner (2006, pp. 14) define e-learning in this light as "Online access to learning resources, anywhere and anytime". This approach is also known as "**A**nytime **A**nywhere **L**earning (AAL)" (Schulmeister, 2006, p. 205). Learning can be done best if access to the material is possible whenever and wherever the student decides that they have the time and motivation to learn. For wage earners, parents and other part-time students with extracurricular commitments, this kind of freedom is especially important. This feature of e-learning is accomplished through purely technical means by creating the whole module as a web-application. The server on which the module is stored

[9] Students could post the correct answers right after they did the test. However, in the case of this module, it is an unlikely scenario as there are no rewards for passing the test.

[10] The rise of YouTube impressively demonstrates the potential of videos on the web and especially in the mobile sector.

answers to requests at any given time — the technology will be discussed in chapter 4 "Module Implementation" on page 69.

The freedom to choose what to learn is also important to ensure a good online learning performance. While it is needless to say that the topics which can be learned are predefined by the content that is available, the learner still has the freedom to choose for themselves what and in which order they want to learn. The module will therefore provide a structure, but not force the learner to take quizzes or learn in the predefined order. It is important that the learner can always change to a different lesson or skip a test if they think it is necessary. It is important to give learners the freedom to create and manage their own learning experience in order to achieve a high learning performance (Holmes and Gardner, 2006, pp. 93).

3.2.2 Web Based Learning

With the increased availability of private internet connections, the web based approach to learning gains more and more popularity (Robes, 2012; Statistisches Bundesamt, Destatis, 2011). Browser based solutions can be made available on almost all available platforms, regardless of hardware and operating system. Even mobile learning is possible, since all modern mobile devices feature a web browser that is compatible to modern standards. Learning "on the go" is now a viable option using this technology and can be implemented in the same steps as web based learning.

Apart from the advantage of unrestricted utilization, Dittler (2003, p. 154) emphasizes the didactic benefit of WBTs compared to CBTs:

> Der *methodisch-didaktische Vorteil* von Web-Based-Training liegt in den Möglichkeiten der Kooperation der Lernenden: Während CBTs meist von einem Lernenden selbstständig (oder [...] von einem Team gemeinsam vor einem PC) bearbeitet werden, ist es möglich und sinnvoll, WBTs so zu gestalten, dass mehrere Lernende — ortsunabhängig voneinander — gemeinsam lernen (*kooperatives Lernen*). [emphasis in the original]

While CBTs are used by one person (or a small team of learners in front of one computer), WBTs can be used by a large number of learners in parallel from one centralized source. This means that the source can include one or several channels of communication between the students, which simplifies location-independent cooperative learning.[11] CBTs could also be equipped with a link to online communication; this would increases the level of complexity since the learning solution has to be administrated separately from the training, which means that whenever something changes (for example the link to the forum) every training material that has been deployed before has to be updated separately. When using a **W**eb-**B**ased-**T**raining (WBT), the changes only have to be done in one place.

[11] Among these possible channels can be forums, chat-rooms, wikis etc.

Contrary to the before mentioned idea, that online learning can be used to connect learners, the opposite effect can occur when communication between the learners is not actively supported. Kerres and Jechle (2002, p. 268) explain the central dilemma of e-learning: The problem of (physical) distance. While the learners gain flexibility, they loose the direct contact channel: essentially, they learn alone. There are several strategies to counter this problem that can be employed for this module. In the following I will describe the different strategies and explain the individual assets and drawbacks.

3.2.3 External Sources

Not every student will know every linguistic term that will be used in the module lessons. Though they might be officially demanded to know most basic linguistic phenomena, it would be unrealistic to assume complete knowledge. The use of **H**yper**T**ext **M**arkup **L**anguage (HTML) gives us the possibility to enrich the text with links to explanations; we can connect all linguistic expression to websites containing their definition. While in a normal classroom students may hesitate to ask questions about things they are expected to know (or at least think they are), clicking a link in an online environment without supervision does not form the same obstacle (Frymier and Houser, 2000).

The most important part of linking to an explanation is to ensure that it is *a)* simple to understand, *b)* presented in a familiar and accessible way, and *c)* makes further learning available through references in case the learner wants to learn more. The best compromise of all three requirements is usually met by the Wikipedia-entries for the specific linguistic terms. While the descriptions might not be technically sufficient at all times, the students already know how to use Wikipedia, are acquainted with the assets and drawbacks of the platform and all sources are listed in the articles for further reading (Head and Eisenberg, 2010). Additionally most articles are also available in the native language of the learner with one click, which further increases the likelihood of understanding.

Wikipedia, while having one major flaw, that at the same time is the main reason for its popularity, may be one of the best online sources available. It is seen as an excellent source for explaining terms that are not understood. Holmes and Gardner (2006, Preface) for example explicitly recommends to use Wikipedia for this purpose.

From a functional perspective, Wikipedia articles have several advantages for the use as references in our module: *1.* They tend to get better over time. Apart from some highly debated, usually political or religious articles. *2.* The general quality of articles has been assessed as high in several independent studies. (See Wikipedia Reliability) *3.* Any teacher who does not agree with the content of an article is free to correct and extend the article in question. *4.* As stated

above, students already know how to use it - which includes being skeptical about the presented information. From a technical perspective there is one major advantage which makes it the best option to link to compared to other sites: The chances that Wikipedia stops existing or changes its link format during the lifetime of this module are virtually non-existent.[12] In the same time that several of the established publishers of encyclopedias changed their URL-schemata — which invalidated previously working links — or switched their business-model to only offering their full content to paying customers, Wikipedia articles stayed in their place and were steadily improved.

Whenever a Wikipedia-article is available for the given term, it will be linked using specially formatted text that does not stand out of the content as much as regular links and opens the article in a new window (or tab) so the module remains in the original one.

Since Wikipedia does not have sufficient articles on every topic mentioned in this module, I will implement a fallback-strategy for those terms that are not available. All learners who are able to use this module will most likely also have practical knowledge about internet search engines and know how to work with them in general. One of the most useful products for our task is a bibliographic database for example implemented in Google Scholar. Since the main goal of these specially formatted links is to make the learners educate themselves, the fact that they are (in the fallback-case) just a list of academic articles does not decrease their usefulness. The links are meant to motivate the learners to search through the list in order to fill their knowledge gaps — as an online-reassurance to the students meaning "it is OK not to know this, just look it up", even a link to a standard online-search for the term would serve our purpose.

In the long term, it might be useful to build up an internal dictionary with short explanations that were checked by university instructors and contain links to further articles. The advantage of this approach would be to satisfy the learners who just want to make sure they know the right definition by looking at the short text, as well as the ones who learn about the term for the first time and need to know more details.

One way of increasing the variety of explanations and thereby the likelihood of understanding at least one of them is to provide several different texts on the subject. Unfortunately, German/EU copyright law prevents us from making original texts or longer parts of them available to the students as part of the module. For every single book or article that were used in this way an extra license would be needed, which makes it almost impossible in practice.

[12] The fact that Wikipedia content changes must not necessarily lead to improvement, it could also lead to the problem of false definitions in articles that were correct before. If this turns out to be a realistic problem, the links can be altered to target a specific (validated) version of the article.

What we can do is refer to the original source. This interrupts the learning process, as the learner has to actually visit the library in most cases, but it is a viable fallback solution.[13] The main problem with this is that it requires a very high amount of motivation and autonomous learning from the student, if this was usually available the e-learning module would mostly be unnecessary; it is a catch-22-scenario: if the learner would be able and motivated to study the subject on their own, the e-learning module would not be necessary, if they are not able or motivated they will most likely not use the referenced external sources.

All users of this module will be students as RWTH Aachen University, which means that they can access the university library and most of them should even have regular access to campus and faculty infrastructure.[14] Relying on this conditions, it is possible to refer to external texts (such as those used when writing this thesis) to give the learners the possibility to either study the subject in more detail or read about it from a different perspective.

The main work that must be done in order to make the external texts useful for students without them having to read the whole text is to categorize extracts and order them according to the learners progress.

A single explanation without feedback from the learner can never cover all needs; it is hard enough to explain a subject to students when they are in the same room and can ask questions, teaching without a feedback channel is even more problematic. If there were an easy solution to this dilemma, there would only be one book (or website) for each subject that can be taught at a university and it would suffice; since this is never the case, the module implemented here will be no different. The goal is to reduce the amount of learners that will leave the module because it did not help their understanding, or leave the module without having learned much.

One way of ensuring a high chance of understanding is to use different techniques and explanations when describing a subject. Another is to create a feedback channel to emulate, and maybe even improve upon, classroom communication. Multiple sources can be used virtually at the same time, which leads to understanding on more levels, input data on more channels. Interactive elements like tests and quizzes with feedback increase learning performance even more (Schulmeister, 2006, pp. 206ff). Compared to a lesson, where only one person can answer an exercise, interactive quizzes can be completed by all learners (Schulmeister, 2006, pp. 251f).

In the following I will explain what techniques can be applied in e-learning, which will be used in the module and to what extend advanced ideas might be implemented in the future.

[13] Many texts are not available in a digital format, or — even though they are — cannot be accessed due to copyright restrictions.

[14] Even if the module would be made accessible to the general public, they could use the public services provided by their nearest library, though they might not be free to them.

3.2.4 Using Multimedia Content

With the ever increasing bandwidth of private internet connections, the use of multimedia content, be it audio or video, is not just a futuristic idea anymore, but a commonplace technique around the web today. The use of multimedia, especially audio, for language teaching is a proven method that has been successful even before computers were a common sight in private homes; learning tapes accompanied by books are one of the most basic forms of this concept.

With the recent standardization of HTML5, even web-applications can include audio and video content natively on modern devices, which decreases the technical complexity of implementing such solutions. However, the main work lies in producing multimedia content, as there is hardly any freely available video or audio content that could be incorporated into the module; the production of this type of content is time-consuming and expensive.

According to Najjar (1997, p.9), adding multimedia to the content mainly benefits low aptitude learners, which decreases the need for implementing it in a module for advanced learners on a university level even further.

It is not self-evident that multimedia advances learning by itself, Rietsch (2003, pp. 77 – 78) for example writes about the two most popular multimedia myths: The first myth is the assumption that a multimedia presentation stimulates several senses and thereby increases the effectiveness of the learning. She argues that research has shown that all stimuli that reach our sensory organs have the same quality when processed by our brains and therefore the number of different encodings chosen for the same information is irrelevant. She uses the word "quality" in the sense that all stimuli containing the same information, encoded in different forms (audio, video, text), are converted to information with the same priority in our brain, the only difference, according to her, being the part of the brain that decoded the input. The second myth is the assumption that the use of multimedia increases the learners motivation. The use of multimedia alone cannot generate incentives. A learner that is not interested in the subject will not start to learn just because the text is available in audio form. However, she immediately moderates her statement by recognizing that learners with a high motivation can benefit from the use of multimedia, since it can decrease the time they have to spend learning while achieving a comparable recollection rate.

Multimedia can be a viable tool for learning in online modules, especially with more and more devices supporting these formats, it will be a relatively simple way to provide additional content. For the moment, not all devices and browsers show sufficient support for these techniques and the creation of multimedia content is a time consuming process, which makes it an option for the expansion of the module in the future.

3.3 E-Learning Methods

The interactive nature of electronic learning solutions offers several ways to improve upon text based, non-interactive learning.

based on the research described above, electronic learning in this module should concentrate on two goals:

1. Knowledge acquisition
2. Knowledge memorization

This section describes examples of practical implementation of the theories described in section 3.1.2 "Learning Models" on page 45.

3.3.1 Knowledge Acquisition

Knowledge acquisition can be optimized by using classic didactic approaches. In addition to text and images, which are available in literature based learning, computers can also utilize video and audio as well as interactive media. In this case, practical reasons, explained in the section above, prevent the inclusion of video and audio. The creation of the concept and the implementation had to be finished in four months of work by one person; this means that while the resulting module can always be extended towards a more multimedia-oriented approach, the first version of the module — the one realized in this work — will refrain from using such content.

3.3.2 Knowledge Memorization

Knowledge memorization is the part of the module that can benefit most from modern techniques that are not covered by classic textbook-didactic. Memorization can be achieved by repetition of the learned content and connection of learned content with already known information. While connecting new content with already established information is a problematic task that does not get easier when using an approach that does neither allow direct observation of the learner, nor immediate response to their behavior, repetition is easily implementable in computer-based learning.

Repetition can be embedded in the e-learning as simple steps between sections of the lecture, or as a mandatory obstacle, in form of a test that has to be passed in order to get to the next section. The number of repetitions can be individually in- or decreased depending on the score a learner achieved in a test before. One could for example define a minimum and

maximum number of repetitions between each section of a lesson, each repeating and testing the knowledge of the sections before in the form of a quiz. If the exercises belonging to the first section were all answered correctly in test 1, they will be repeated the minimum number of times in test 2 — if none were answered correctly in test 1, the maximum number of repetitions is used in test 2.

The model in Figure A.1 "Automated exercise repetition based on previous exercise scores" on page 138 shows an example course consisting of three sections. The sections contain the knowledge acquisition part (see 1. above) of the course and are followed by the knowledge memorization part (see 2. above), a test that is generated from exercises in the associated exercise pool.

In this example "Test 1" is filled with a predefined number of exercises from the exercise pool "Exercises 1". Depending on the percentage of correctly answered exercises in "Test 1" a number of exercises from the first pool are added to the second one. If for example the first test was completed with 60% of the exercises answered correctly, it has an 40% error rate; this error percentage (e.g. 0.4 in case of 40% incorrect answers) is multiplied with a previously selected number of maximum question repetitions and put into the exercise pool for the next test.[15]

The same is done in the next step for the second pool (Exercises 2) and the second test (Test 2). In order to maximize efficiency of the repeated content it is advisable to keep scores for the exercises from each pool separately and choose new exercises from the original pool according to the error-percentage for the specific exercises in the last test.

Example:

1. Number of questions for a normal test is set to 10.
2. Repetition factor is set to 10.
3. For every new test, the number of questions set in 1. is randomly added from the according pool to the new test.
4. Test 1 now contains 10 questions from Exercises 1.
5. Test 1: The learner answers 7 of 10 questions correctly $\Rightarrow$ 3 out of 10 wrong questions means a multiplier of $\frac{3}{10} = 0.3$ (error-rate of 30%).
6. The error-rate is multiplied with the repetition factor to calculate the number of exercise from the first pool that will be added to the second test: $0.3 \cdot 10 = 3$
7. Test 2 now contains 10 questions from Exercises 2 and 3 questions from Exercises 1.
8. Test 2: The learner answers 4 of 10 questions from the normal questions and 2 out of 3

[15] As an alternative to this, the questions could also be put directly into the next test in addition to the questions from the second pool.

from the repeated Test 1 questions. Which means a $\frac{6}{10} = 0.6$ multiplier for Exercises 2 questions and a $\frac{1}{3} = 0.\overline{3}$ multiplier for Exercises 1 question.

9. The error-rates are multiplied with the repetition factor to calculate the number of exercise from the exercise pools that will be added to the third test: $0.\overline{3} \cdot 10 = 3.33 \approx 3$ for Exercises 1 and $0.6 \cdot 10 = 6$ for Exercises 2
10. Test 3 now contains 10 questions from Exercises 3, 6 questions from Exercises 2 and 3 questions from Exercises 1.

    [...]

This goes on until either the last test is reached or all questions are answered correctly. This behavior should be chosen carefully, since it could lead to never ending tests in case the learner is not able to answer all questions.

This repetition algorithm can be easily extended by incorporating additional factors, for example:

- Minimum and maximum numbers of repeated questions.
- A maximum number of questions in each test.
- An exercise-weight based on how often they occurred in tests.

  ...

The optimal settings for these values will have to be evaluated in practice, since there are only very rough values generally known to be suitable. The factors have to be chosen in order to balance between two negative effects:[16]

1. If the repetitions are not often enough, the memorization of the content will not be sufficient.
2. If the repetitions are too often or the quizzes become to long, the chance of the learner quitting without finishing the course rises.

In order to fine-tune these settings according to the target audience, it would be advisable to gather feedback from the users on finishing the module; while there is no way of keeping them from simply closing the browser window, this action could be logged and reported in a statistical report.

3.3.3 Learning Success Evaluation

The interactivity of e-learning makes methods available to improve the learning success of the individual learner without having to subject them to classic exams. This effect is achieved

[16] The second effect especially holds true in our case, since the course is optional to the learners.

in the module through quizzes. There are two main reasons why such tests are used in an e-learning solution:

1. Evaluation of the success of previously taught subjects.
2. Interactive repetition of previous exercises.

The evaluation of previously learned content in a quiz is one of the standard ways of using tests; multiple choice tests are one of the most often employed utilities to evaluate the knowledge of learners. While it is easily manageable to have quiz results of learners stored in a database or sent via e-mail to a contact-person, it is not advisable to do so in an e-learning module for data protection reasons.[17] It is however possible to store results in an anonymized format in order to create statistics at the end of a course or semester. Since this module will serve as an optional offer to students, there will be no immediate need to evaluate individual learners, which is why only a anonymized, statistical evaluation is planned. Quizzes are also one of the most easily usable tools for the rehearsal of exercises. When creating an e-learning module, quizzes can help to increase memorization of content when put directly after the content itself.

3.3.4 Blended Learning

One approach to combine the advantages of both worlds — e-learning and classic learning — is blended learning. Research has shown that the combination of offline and online learning, electronically aided learning and face-to-face education, leads to better learning performance than the individual forms of learning alone (Singh, 2003, pp. 57f).

The fields with grey background in the figure above are considered blended learning, as part of the process — either the learning and teaching, or the (community based) course preparation — is done electronically online.

The experience with e-learning gained in the last decade, shows that a single form of instruction cannot be as effective as a combined one (Singh, 2003, p. 51). Universities started to enhance their educational services by providing additional online accessible content to their students. Online learning solutions used in parallel to the course like L^{2}P at RWTH Aachen University have been successfully established to improve the learning experience over the last years.[18] These solutions provide an online community, where the participants of the course can communicate and are a prime example of what Singh (2003, p. 54) describes as a simple blended learning experience. Questions can be asked, homework can be assigned, and

[17] The legal state of such a procedure varies from country to country (and sometime even state to state), but for our first implementation in Germany, it would conflict with current data protection laws.
[18] The L^{2}P website can be found at `https://www.elearning.rwth-aachen.de/`

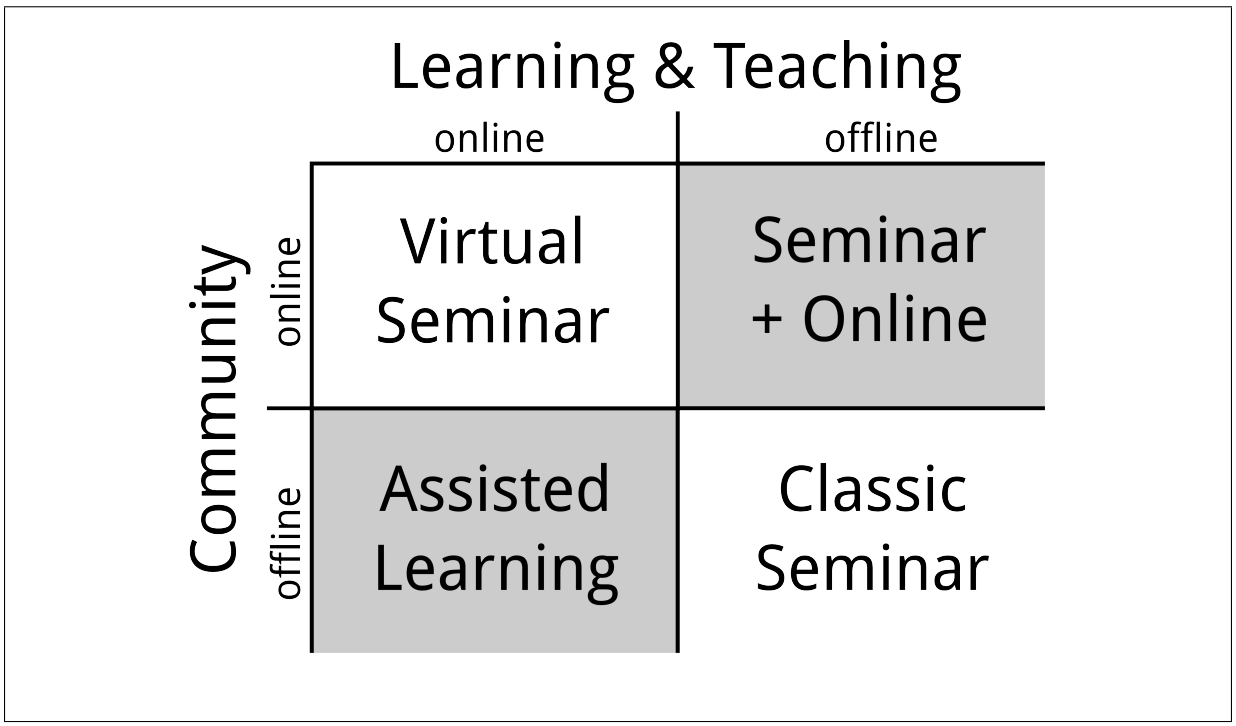

Figure 3: Categories of Learning Approaches (Schulmeister, 2006, p. 192)

course-material can be provided over this integrated solution.

Not only universities have started gathering experience with blended approaches. Wolpert-Gawron (2011) writes in an article about the combination of online and face-to-face education. She compares pure online learning with an approach to have an initial meeting with the group of learners before the course continues online and comes to the conclusion that only a single meeting increases the reliability of the participants.

Blended learning with a focus on online learning, having regular offline meetings, or even just one introductory meeting, might also be an option for the use of this module within the The **L**anguage **E**xpert's **A**dvanced **R**esources (LEAR) project as well, as it might increase the learning success with only slightly increased costs.[19]

3.4 Special Case: RWTH Aachen University, Lehrstuhl für Anglistische Sprachwissenschaft

The e-learning module implemented in this work will be used primarily at the "Lehrstuhl für Anglistische Sprachwissenschaft" at RWTH Aachen University. It will offer an optional course for advanced students of English linguistics as part of the The **L**anguage **E**xpert's **A**dvanced **R**esources (LEAR) project, an exploratory online teaching space.

[19] The infrastructure for offline learning is already available, the only additional costs would be for the instructor, which are roughly relative to the number of offline meetings.

LEAR has a focus on self-education and aims to develop several modules to help university students. The university requires students of English linguistics to have language skills comparable to CEFR level C1; with this requirement two main problems occur that are addressed by the module: *1)* Even though it is required, not all beginner students speak English on this level. As there is no budget for additional language instructors, some students have problems following the course material or are not able to participate at the high level that is demanded of them. *2)* There is a general lack of language courses above the C1 level. Students who possess the required language skills have problems finding sources, apart from classic academic literature, they can use to improve their skills. The modules contained in the LEAR project will address both issues by providing general language awareness courses, as well as more specialized modules covering topics "above" C1 level.

The special case, in which this module will be used has several peculiarities. Students cannot be forced to attend the module and no ECTS-credits will be given for the completion of the module; this makes it especially important to communicate the advantages of learning with this module and create a module that keeps its users motivated.

In this case, e-learning has the following important differences compared to the classic teaching approach currently in use at RWTH Aachen University:

1. Absence of lecturers/instructors.
2. No direct (physical) contact between learners.
3. No (regular) meetings.
4. No fixed dates and times.
5. No graded exams.[20]

Absence of a lecturers/instructors

When using the e-learning module, learners will have no direct contact with an instructor, which makes it necessary to create a technical way to manage feedback. It is currently unclear whether there will be a dedicated instructor who can act as a contact person for students who have problems understanding the subject or technical difficulties using the module. Even if, in this special case, a dedicated contact is assigned to the project, it is advisable to implement technical means for managing feedback for two reasons: *a)* The contact cannot be available at all times, while the learning-solution is available without any restriction; *b)* technical solutions can scale with the number of users with a one-time investment and even dynamically with cloud-services, human advisers have to be hired and payed continuously. While it is impossible to address or solve individual learner problems automatically, there are three main

[20] This is also sometimes the case with regular lectures. The module cannot offer graded exams because there is no way to prevent cheating in an online environment.

strategies to help with such problems in an automated way:

1. Consolidation of solutions.
2. Simplification and organization of learner exchange.
3. Collection and categorization of problems for manual response.

The easiest way of consolidating solutions is creating a knowledge-base of common problems and their solutions; this can be as simple as a list of question-answer pairs (**F**requently **A**sked **Q**estions (FAQ)) or a more complex indexed and searchable database (**K**nowledge **B**ase (KB)). This should be the first place for students encountering problems of any kind while using the module and thus be accessible from anywhere in the module.

The community-driven idea of problem solving through user interaction can be implemented easily by creating links to online communication software like chats or forums. Especially forums can be an efficient way to create a user support solution on a small scale; if an instructor frequents the forum and helps learners with their more complex questions and the user base is big enough to solve most of simple problems, a forum can replace a complete support solution.[21]

No direct (physical) contact between learners

During a regular university course, students meet each other physically on a regular basis; this is not possible when using an online learning approach. In addition to the location problem, that the learners might theoretically access the course from anywhere in the world, a timing problem also occurs since we cannot know when the course is being used. In our case the user base will be quite small, which further reduces the chances of several students accessing the course at the same time. This leads to the problem that synchronous communication between learners through the learning platform is almost impossible since chances of two students using the module at exactly the same time are very small. What the platform can provide, is asynchronous communication channels like forums, message-boards or a simple (e-mail-like) messaging system.[22] These can be tightly integrated into the support system and the module itself to increase usability.

No (regular) meetings

As said above, the users will not automatically have any contact with each other. In addition

[21] The effectiveness of forums as community driven support can be observed with many non-commercial software projects that have no budget to create other support solutions. In many cases this approach has proven to be working even on a very large scale, like for example the Ubuntu community support (`http://www.ubuntu.com/support/community`).

[22] Students who use other means of synchronous communication (for example chat solutions like icq, google talk, facebook messenger etc.) can exchange their contact information over these channels and then directly and synchronously communicate outside the module.

to this, unlike in ordinary courses, there is no (physical) place for the learners to meet. One approach to decrease the effects of this problem is to bind the use of the module to participation in a physical meeting at the beginning of the semester. This can also decrease the amount of needed support, as the meeting can be used to give a quick overview of the module and address some questions directly. The learners can get a unique access-code for the module at the meeting that is only valid for one semester.[23] Furthermore, this meeting can be used to promote exchange of contact data by the students. This minimal form of blended learning can help increase the effectiveness of the course.[24]

No fixed dates and times

We cannot know when the module will be used. While a regular course has a specific time slot, the constant availability of the online module makes it possible to attend it whenever the user has free time. This could mean that a majority of learners access the module outside the working hours of any instructor, or that they distribute themselves so that two learners are never online at the same time.

In the case of the module implemented in this work, the only date requirement for the learners is that they use the module after completing the basic courses and before they finish their studies, the use of the module will be optional; this means that there are no restrictions to the users at all that can help to plan communication. In addition, this module will not replace a complete university-course, but only be a short introduction into the topic of information structure. The module will at most take a few hours of the learners time, which is a very small window when it can be freely chosen in the time frame of at least one semester. This exacerbates the effects talked about in the sections before that makes the use of synchronous communication counterproductive. The effect could be reduced by creating "office hours", when it is guaranteed that an instructor will be available in chat or via phone.

No graded exams

Since the module only covers a relatively small area of linguistics taught at RWTH Aachen University, no ECTS-credits can be gained for completing the course and no graded certificate of achievements can be issued. Even an assessment at the end of the module in order to give out some other form of university-internal certificate is problematic, since it would require *a)* a possibility to identify the student using the module uniquely and without a doubt, which could mean technical as well as legal problems and *b)* a technical protection against cheating,

[23] This would make statistical analysis much easier as it makes learners uniquely identifiably while maintaining anonymity. This approach is already used at RWTH Aachen University to conduct teacher evaluation for regular courses at the end of the semester.

[24] See 3.3.4 "Blended Learning" on page 62 for more details on blended learning.

which would go beyond the scope of this work[25]

It would however be possible to offer an optional offline test about the contents of the module in the form of a classic written or oral examination, isolated from the module.

[25] It should also be noted, that it is technically impossible, with current technology, to create an online test that cannot be cheated.

Chapter 4

Module Implementation

Implementing the e-learning module can be divided into four main areas structure, technology, interaction and UI design, which can in turn be subdivided into smaller units.

1. **Technology**
   a) Front-end
   b) Back-end
2. **User interface design**
   a) Functional
   b) Visual
3. **Structure**
   a) Learning structure
   b) Lesson structure
4. **Interaction**
   a) Feedback
   b) Support

The technology part consists of *a)* the front-end, in this case the HTML and JavaScript implementation of the module, in other words, the part that is visible to the user *b)* the back-end, which is realized as a PHP-class that can forward messages to predefined contacts and gather statistical information.

The user interface design, which is concerned with the front-end of the first part mentioned above. It can again be subdivided into *a)* the functional design, dealing with how the user in-

teracts with the interface, and *b)* the visual design that is concerned with the visual appearance of the module.

The structural part is the most important one, it defines the heart of the module by describing *a)* the learning structure, which defines how the structured lesson content is shown to and rehearsed by the learner on the basis of the findings in chapter 3 "E-Learning" on page 41. *b)* the lesson structure, which is the main theoretical part of this work, covered in chapter 2 "Information Structure" on page 7.

The last part covers the communication between learners and support as well as the feedback channel. There is *a)* the direct feedback, which is the main way of official exchange concerning the learning experience, and *b)* the support facilities, which can either consist of direct assistance by university staff or community support through other learners.

4.1 General Considerations

Before getting too far into the details of how the module will be implemented, there are some general factors that have to be considered during all phases of module implementation. The fact that the modules of the LEAR project are a voluntary part of linguistic studies has a big influence on the module design, as it makes anti-cheating measures unnecessary. For obvious reasons, the selection of topics that are shown in the module is the groundwork for the design of the module content. Copyright is a factor that — while having nothing to do with the task itself — must be taken into consideration, as a lawsuit based on copyright of the software or content could outweigh the financial advantages of the e-learning approach in one fell swoop.

I will briefly explain these problems and how they will affect the implementation in the rest of this chapter.

Voluntariness

The module developed as part of this thesis will not be an obligatory part of English studies at RWTH Aachen University. This has two main implications: *a)* Not all students will take the e-learning course, and *b)* those students who use the module, are most likely motivated and eager to learn. Especially the second implication is very fortunate for the planning of the course content, since we can rely on the learner's autonomous behavior and do not have to control and verify their every move. This means that the module does not need to include a protection against cheating and the communication between learners can be encouraged and supported without any drawbacks.

Since the participants do not need to take the course and there are no ramifications for not

finishing it or "failing" the included tests, it is important to find a balance between relying on their preexisting motivation and keeping them motivated. One approach to tackle this problem is to make it as easy as possible for learners to look up missing knowledge, another is to create a responsive, aesthetically pleasing **G**raphical **U**ser **I**nterface (GUI), with smooth transitions and loading animations, yet another is to let them share their experience through the use of social media (Baird and Fisher, 2006, pp. 22f).

I will explain which strategies will be used in this module to enhance **U**ser e**X**perience (UX) and motivation in the specific sections below.

Content Selection and Definitions

As mentioned several times in chapter 2 "Information Structure" on page 7, several definitions are used in the field of information structure, that are different in key aspects and sometimes even contradictory. It is especially important to emphasize this problem in the module for all learners that either have already read literature about IS or use external sources in parallel to the module.

The module will contain specially formatted boxes that optically stick out from the surrounding text, which can be used to present important information to the user, such as a warning about diverging definitions.

Like Callies (2009), I will leave out the more fine grained differentiations of focus that are available in various theories for the sake of easy learning (and teaching). A more detailed analysis in the face of competing, overlapping and sometimes contradicting theories would only lead to an incomprehensible model as the basis for the e-learning module, which defeats the purpose entirely.

Copyright

Copyright considerations are a big problem, as they can lead to costly legal battles, especially since digital media makes copying of information easier than ever before. This module will be built from scratch and does not rely on any copyrighted material. The lesson content as well as the source code is written without using any third party components.

The software as well as the initial module content is licensed under the public domain. This means that the developer explicitly waives his copyright and anyone can use the content in any way imaginable, whether it is privately or as part of a commercial application, without risking a lawsuit. The clear advantage of this licensing for the use at RWTH Aachen University is, that the module and its contents can be hosted, modified, redistributed as a full solution or in parts without needing consent from the author.

4.2 Technology

The scope of this work is to design and implement an autonomous module that can be easily integrated into different web based solutions.

As of the beginning of this work, the specific implementation of the module environment is still uncertain. Moodle has been presented as the most viable option at this point in time, but there are other well-established e-learning solution already available at RWTH Aachen University. The one aspect of the solution that is absolutely certain, regardless of the precise implementation is the use of web-technology. All modules must be available to learners via browser, i.e. accessible online without the need for specialized software.

Since the use of a browser is the common denominator for most e-learning solutions and all of them provide the technical means to include external web-references[1], the module developed here will be made available as an HTML-based stand-alone solution that works in a standard browser and can be integrated into Moodle. With this technological choice the module keeps its compatibility with the Moodle environment, while it can be used at the same time in virtually any other online learning environment.[2] This choice will make sure the module can be integrated into Moodle, as well as into the L^{2}P online classroom as an addition to a university course in parallel to a lecture or seminar. Compatibility to mobile devices can be achieved as a side-effect of standard-compliant programming, which adds additional benefit to learners who are accustomed to mobile devices (Firtman, 2012).

The module is also designed to be a stand-alone solution in case there is no e-learning infrastructure as long as a web-server is available. The module uses as little server-side technology as possible in order to make it portable.[3] All server based features of the module are implemented as options and are automatically disabled by the module in case it is used without a back-end. This makes it possible to deploy the module without a server, for example on a CD/DVD or USB-stick. The back-end itself is implemented as a php-class with a defined interface and minimal **A**pplication **P**rogramming **I**nterface (API) so it can be replaced easily in case a different server-environment has to be chosen.[3]

The choice of terms when describing the technology as "back-end" vs. "front-end" is problematic in case of this module. While it is easy to split up into server-side and client-side, the client-side of our module will implement functionality that is traditionally part of the back-end. For the sake of clear distinctions, I will use the strictly technically based discrimination

[1] Implemented as websites of their own, included into the module via an HTML-iFrame-element.
[2] The choice of a stand-alone implementation capable of being integrated into any online environment creates a win-win situation.
[3] See section 4.2.2 "Back-End" on page 78.

and refer to the client-side as front-end and the server-side as back-end (Fischer and Hofer, 2010, p.314).

4.2.1 Front-End

Since the front-end of the module will be shown in a browser, it has to be implemented by means of a "web-technology". There are several alternative technologies that can be used in a browser window, which all have their respective advantages.

The table shows an overview of the available front-end technologies and their specific assets and drawbacks. I calculated a score for each technology based on the following properties:

- **Native**
  The technology is supported by the browser without the need to install additional plug-ins or extensions.
- **Available**
  There is a high chance that it is already available to the user without the need to install additional software.
- **Fast**
  It works on older, slower hardware.
- **Portable**
  The learner does not need to use special technology on his side, the technology works on (almost) all browsers and operating systems.
- **Secure**
  There are no (or only a few) known security issues with this technology
- **Time**
  The technology provides a helpful environment for implementing this project and thus reduces the time needed for development.
- **Costs**
  The technology is available without additional costs (for example license fees or software for developing)

Java was designed with portability as its main goal and can be deployed on virtually any operating system that is in use today.[4] In order to execute Java applications (called "applets") in a browser, a plug-in needs to be installed on the users system; this plug-in might be needed on other websites that require Java and might already be installed. According to StatOWL (2012b) a Java browser plug-in was installed by 73.49% of all users in the last year, with a downwards trend. Most mobile devices do not support Java as a browser plug-in. Java en-

[4] The exceptions being very exotic OS that are used by less than 0.1% of the population.

ables the developer to utilize a standard Java development environment to create the web application and offers access to many freely available libraries. The application is compiled to an intermediate code and runs in a virtual machine, this makes it theoretically faster than JavaScript, but due to optimizations in current JavaScript-compilers this advantage becomes smaller and smaller. At the same time the loading of Java applications needs some time which usually makes them slower compared to pure JavaScript applications as a whole.
Due to recent problems with unfixed security vulnerabilities in the **J**ava **V**irtual **M**achine (JVM), the official instruction by the "Bundesamt für Sicherheit und Informationstechnik" and experts like Secunia was to deactivate the Java plug-in entirely.[5]In light of these problems Java will get a negative rating for security.

JavaFX is based on Java technology, all above considerations apply also to JavaFX. The key difference between the two technologies — apart from language and style differences — is that JavaFX was created especially to support **R**ich **I**nternet **A**pplication (RIA) and would therefore be more helpful as a framework for the development of the user interface for an online module.

Flash is a technology that is included in browsers via a plug-in like Java but was created as a tool to support animations on web pages. It mainly uses vector based graphics which were not supported natively by any browser for many years. Like JavaFX it is optimized for creating RIA. The language called ActionScript, which is very closely related to JavaScript, is used to program Flash applications. According to StatOWL (2012a) the Flash plug-in is currently installed in 95.78% of all visitor systems. Like the Java plug-in, Flash is not available on many mobile devices; though the support is better than for Java applets, devices made by Apple and newer Android devices do not support Flash at all. Flash is also not supported officially for Linux based systems. Though there have not been as many unfixed security problems with Flash than with Java in the last months, Flash is generally considered to be insecure, compared to other solutions.[5] In contrast to all other solutions, Flash content can only be created with a special software that has to be purchased from Adobe.

Silverlight is a technology that is considered to be Microsoft's answer to Flash and all considerations for Flash also hold for Silverlight with the following differences: *1)* Silverlight is not supported on any operating systems other than Windows and MacOS, *2)* Silverlight can be developed using .NET languages in Visual Studio, this means that no additional software has to be purchased, but development is officially only supported under MS Windows. Silverlight is currently installed in 69.33% of all browsers according to StatOWL (2012c).

[5] For more details see: Bundesamt für Sicherheit in der Informationstechnik (2012), Secunia (2012), Heise Security (2012a) and Heise Security (2012b)

HTML/JavaScript is natively supported by any browser on the market, since browsers are essentially HTML parsers and renderers and JavaScript is the official scripting language of the web.[6] While users can choose to permanently disable JavaScript in their browsers or install special extensions to deactivate JavaScript, this is only done by users with a highly specialized knowledge and security concerns, which means that the chances of these users enabling any third-party plug-ins is even lower.

Technology	native	available	fast	port.	secure	time	costs	score
Java	-	0	-	+	-	0	+	-1
JavaFX	-	0	-	+	-	+	+	0
Flash	-	+	0	0	0	+	-	0
Silverlight	-	0	0	-	0	+	0	-1
HTML/JavaScript	+	+	+	+	+	-	+	5

Table 3: Comparison of available front-end technologies

After comparing all available solutions there is a clear winner in terms of overall score: HTML/JavaScript

The only negative aspect of a HTML based solution is the fact that the ecosystem around HTML based RIAs is not as large as for the other solutions, which is mainly due to the current global shift from proprietary technologies (like Flash and Silverlight) to standardized, open solutions like HTML and JavaScript.[7] With the standardization of HTML5, the combination of HTML and JavaScript is deemed to be the main future solution for the development of RIAs; at this point we are still in the transitional phase and frameworks based on HTML5 slowly start appearing, they are however not even close to the usability and helpfulness of linear editors that are currently available for the proprietary solutions (especially Flash and Silverlight).

Program Libraries

There are quite a few libraries available that support the development of JavaScript based applications, most of them aim towards realizing very basic tasks, like manipulating content or changing visual properties of website-elements (like replacing text or fading in parts of the page). These libraries are also licensed in several different ways, which makes it hard to chose which one can be used without problems in a university-environment without the help of a

[6] Which essentially means that compared to all statistics above, HTML/JavaScript is available on 100% of all visitor systems.

[7] Java is technically an open and standardized solution, but the recent lawsuits by Oracle (the owner of Java technology) against Google on grounds of copyright violations created doubts about the practical realization of this openness.

legal expert. Since the visual design has a lower priority in this module and can always be extended later on, in case the module will be used in a broader solution. A completely new approach that includes writing all libraries from scratch was chosen in order to avoid licensing issues.

MiLearn

The MiLearn-Library is the main software framework for the module. This library renders the module from information that is stored in JSON based configuration files. The Library parses these files and renders the module contents according to the data in these files.

MiLearn needs to be given at least two values in order to work correctly:

- The container-element in which the module should be rendered.
- The configuration-path which contains the information about the content structure.

Additionally, if a back-end-url is given, the module automatically uses back-end features, like sending anonymous statistical data about questions that were answered incorrectly and showing a feedback-button.

This framework controls everything that is visible on screen, from the navigation to the quizzes. All data that is sent from the server to the user or the other way around is filtered through the module. MiLearn has an integrated macro-replacement functionality which enables the use of complex expressions in the content.[8]

MiQuiz

MiQuiz is a compact, extensible library to dynamically create minimalistic quizzes, with the option to respond to individual answers or give statistical feedback at the end of a quiz.

The library consists of six classes:

- Quiz
- QuizElement
- QuizFactory
- Exercise
- MultipleChoiceExercise
- Answer

Quizzes can be automatically created from JSON files by use of the QuizFactory class, which enables the use of external data files without having to change actual source code in order to add quizzes to a website.

[8] The digital version of this work and all corresponding data can be accessed via Himmelrath (2012).

The current version of the library supports simple questions that are either of the type "multiple choice" (one correct answer out of many) or "multiple response" (several possibly correct answers). Quizzes can be added to almost any element of a web page.[8]

MiNiLib

The library called MiNiLib is a lightweight (minimal, hence the name) replacement for typical JavaScript frameworks that help developers manipulate website content. Since the library covers elementary task that are required for, but not semantically connected to, creating an interactive module with quizzes, I will not describe the functionality of the Library in detail here.[8]

Messagebox

The Messagebox library is a small GUI component that enables the module to show content "windows" in front of the actual module content, this is used in the help- and feedback-features.[8]

Content Format

The content of the lessons as well as the quizzes can be edited in simple text based files that are stored in a separate, configurable path on the web server. In order to make the content human readable — to be editable by non technical staff — and automatically parsable by the application, the choice of data format is between the two main alternatives that are natively supported by current browsers (Sporny, 2010):

- XML
- JSON

Both have their respective advantages and drawbacks. The advantage of XML is the tag based approach known from SGML and HTML that is easily readable by minimally technically educated people. The main disadvantages are the larger size of XML formatted content compared to other forms of storage and the need to convert/interpret the data before it is accessible to the application.

The advantage of JSON is the direct implementation in JavaScript, which means that it can be used like a JavaScript-variable without having to interpret the values. The main disadvantage is the slightly harder to read format that requires slightly more technical skills from the person editing the files.

When comparing the data-structure of a simple quiz with one exercise, we can see that while being slightly more readable, the XML structure in figure A.3 "Data structure of a simple quiz

in XML" on page 140 is bigger than its JSON-counterpart in figure A.2 "Data structure of a simple quiz in JSON" on page 139. While the size of the data does not really matter compared to other elements such as images, audio or video on the web, it can decrease human readability when dealing with larger structures; in combination with the simpler implementation, this is a convincing argument to chose the JSON format for storing module elements over XML.

4.2.2 Back-End

For the back-end there were more choices available in terms of programming languages than for the front-end. While the front-end language is basically chosen for the developer by the users (because of their choice of software, see above), the back-end is completely in the hands of the developer and can be anything from a C-Program to a Java Server Application.

The factors that influenced the decision of back-end technology were:

- **Available**
  The technology is available on many architectures and is either often already used or very easy to use.
- **Portable**
  The back-end can be hosted on many different operating systems and architectures without changes to the source code.
- **Changeable**
  The back-end can be modified and extended easily and fast.
- **Low costs**
  No software has to be bought and no license fees have to be paid for using the technology.
- **Helpful**
  The technology is oriented towards web-development and provides useful tools.
- **Known**
  The knowledge how to write an application employing this technology is already available.

While it would be technically possible to use any technology for the server back-end, this module should be able to run on any university web server without much need of configuration and technical administration. Additionally, in case the module will be extended later, the back-end should be easily changeable as well. In order to ensure a completion of the module in the given time, the factor of available knowledge is also of great importance. In the following table these three factor will have double weight (indicated by an asterisk *).

By using this weighted comparison, PHP comes out as the winner. Though PHP is not

Technology	available*	portable	change.*	costs	helpful	known*	score
C/C++ (CGI)	+	+	-	+	-	+	3
Java	+	+	-	+	+	+	5
.NET	-	-	-	-	+	+	-3
Ruby	0	+	+	+	+	-	4
Python	+	+	+	+	+	-	5
PHP	+	+	+	+	+	+	9

Table 4: Comparison of available back-end technologies

known to be the "cleanest" programming language, it is very popular in web development, which means that in case the module will be extended it will be easier to find a developer who already knows the technology. An additional factor is the fact that the proposed e-learning environment, of which this module will be a part, is also based on PHP.

Functionality

The back-end should be called from the front-end as rarely as possible. Whenever the module communicates with its back-end in order to provide certain functionality, this functionality cannot be made available offline. Currently the module back-end only provides the following functions:

- Returning an "alive" signal, to make sure the back-end is available.
- Automatically generating the module content configuration. This functionality is deactivated by default and replaced with a static configuration in order to ensure offline compatibility.
- Send Feedback to a configured email contact.
- Send Evaluation (Questionnaire) results to a configured email contact.
- Receive statistical data from the module. (Currently, that information is not stored)

API

The back-end API is kept as simple as possible. The back-end can be called via its **U**niform **R**esource **L**ocator (URL) and is told which functionality to provide via the "action" parameter. All needed data for the desired action must be provided in additional request-parameters.

Development

The module development was conducted with the Eclipse IDE including JavaScript support and tested on an Apache 2 web-server running Debian Linux with PHP 5.3.

The development of the front-end as well as the back-end follows object-oriented design standards to ensure a maximum level of extensibility (Brügge and Dutoit, 2004).

4.3 Design (UI)

4.3.1 Functional Design

The primary function of the module is to transport knowledge. In order to achieve this goal, the content has been split up into lessons and must be rehearsed by the user. The module facilitates immediate rehearsal by implementing a two part functional structure as laid out in section 3.3 "E-Learning Methods" on page 59: Lesson — Quiz.

Each lesson ends with a quiz that rehearses the previously learned content. For this, the MiLearn-Library displays the learning content in three parts:

1. Lesson content.
2. Lesson rehearsal (quiz).
3. Module controls (GUI).[9]

Each lesson consists of the main learning content, divided into several smaller parts to enhance the learning experience of the user. This way different topics are explained, each in their own clearly separated section to simplify without reducing overall complexity, as described in section 3.1.2 "Learning Models" on page 45.

The lesson rehearsal will be realized in a quiz recapitulating the previously learned knowledge in the form of a few exercises. Quizzes are shown on the same page as the lesson so the learner can reread sections of the lesson without having to start over the whole quiz, in case an exercise cannot be answered directly.

Quizzes can be in two different forms:

1. Rehearsal quizzes (unrated).
2. Knowledge tests (rated).

Rehearsal quizzes give direct responses when an answer is selected for an exercise in the form of either a hint (in case the wrong answer has been selected) or an explanation to reinforce understanding (in case the correct answer has been selected). This kind of quiz will be used for the standard lesson rehearsal. As an additional function, exercises that were answered incorrectly the first time are stored by the module and will be shown again in the next quiz to increase rehearsal of problematic content.

[9] This topic will be given more attention in section 4.3.2 "Visual Design" on page 83.

Knowledge tests are quizzes that do not show direct responses to the answers, but count the number of correct answers in order to show a final analysis at the end of the quiz. This will only be used in the final quiz, which will contain exercises from all rehearsal quizzes and display a final "score" to the user. This quiz will contain a configurable number of randomized questions from the previous quizzes and display a final result in the form of a percentage value (for example: "80% answered correctly").

The module uses ajax technology to improve UX and create easily extendable, configurable content without the need for additional server side technology (Garrett, 2005).

Types of Questions

The quizzes will be able to contain two types of questions in the initial version of the module. The module can be extended to support more types at any time by expanding the MiQuiz Library. The type of question can either be determined automatically by the module (multiple response if there is more than one correct answer, multiple choice otherwise), or set explicitly in the definition of the question. This can be useful if it is important to the exercise not to be apparent that only one answer is correct.

Multiple Choice

Multiple choice questions have one correct answer. The user can only choose one out of the available options. Whenever they click on a different option, the check-sign is removed from all others.

Example:

Select the answer with the most appropriate focus.

Question: What did Mary do?

- ○ **Mary** went for a walk.
- ○ Mary **went** for a walk.
- ○ Mary went **for** a walk.
- ◉ Mary went for **a walk**.

Figure 4: Multiple choice exercise example

Multiple Response

Multiple response exercises can have more than one correct answer. Whenever the user clicks on an option, it changes its state (checked/unchecked). All options can be checked or unchecked individually.

Example:

Select the answers (one or more) with an appropriate focus.

Question: What about Count Dracula? Where was he born?

- ☒ **He** was born in Transylvania.
- ☐ He **was** born in Transylvania.
- ☐ He was **born** in Transylvania.
- ☐ He was born **in** Transylvania.
- ☒ He was born in **Transylvania**.
- ☒ **He** was born in **Transylvania**.

Figure 5: Multiple response exercise example

Extensibility

The module is designed with extendability in mind in order for it to provide a basis for a large variety of different e-learning solutions in the future. It should be easily extendable in two ways:

1. It should be easy for teachers to add new content, even if they do not have a technical background.
2. The source code should be modularized so that new types of exercises can be easily integrated and current exercises can be used outside the module.[10]

Creating new exercises is very important since it serves two purposes:

1. A quiz that changes is more interesting in the long run.
2. If there are only a handful of exercises for each lesson — which will be the case with the initial version of the module — there is a high chance students will use this to "cheat" the module. If the learners can collaborate for example via forums or e-mail, one of them could provide the answers to all exercises for all others without too many problems.

While it might be acceptable to make teachers deliver their content in a machine-readable form like XML or JSON, they cannot be expected to write actual code in a computer language. Because of this it is of high importance to implement the module in a way that accepts exercise data from an external source in a predefined text-based format. They will have to use a template and replace the template-values with their content. At a later point an exercise-editor could be implemented to replace the use of templates - but even in that case it makes

[10] For example in other modules or directly in class.

implementing the editor much easier to have a defined format for exercises. A JSON based quiz template can be found in appendix A.3 "Quiz Template (JSON)" on page 175.

4.3.2 Visual Design

The visual design concerns everything that is in direct contact with the user. From website layout to button design and animations.

GUI Design

While **U**ser e**X**perience **D**esign (UXD) is an important part of an e-learning solution, the main focus for the development of this module lies in completing the content and technical infrastructure of the module. The four month window available for research and implementation does not leave enough time for a complete **U**ser e**X**perience (UX) analysis and design phase. However, the module follows UX standards and will be evaluated by a UX-specialist; problems found in that initial evaluation will be analyzed and their solutions incorporated into the module before initial release. Furthermore, the design has been modularized on a technical level, so that it can be changed individually without having to make many changes to the source code of the module.

Some of the more specific UX optimizations that are usually applied directly in the application source code will not be necessary, since they are only applied if low performance operations need to be "hidden" from the user. This module will be loaded and executed in a virtual machine that is completely on the client side and only needs a relatively low level of computing power.[11] The module is split into two main technical components: server- and client-implementation. Since the server-implementation is only minimal and the client implementation is loaded completely by the browser before execution of the application, loading times are confined to the beginning of the module. All further communication between server and client which could be slowed down by external factors are eliminated (except for the feedback-solution, which does not influence the module operation and can therefore be done in the background while the user can continue to use the module) and will therefore never suffer from performance problems. If performance problems occur, the whole client system would suffer from them, which would make it impossible to implement UXD choices to conceal these issues, since they do not improve performance, but only hide them from the user by using additional client-side computing power. An example for this is the typical loading-animation in place of large images, which do not reduce loading times, but decrease

[11] The computing power needed for displaying the module without delays is very low. Even the tests on a 5 year old smartphone (Nokia 5800) showed no problems in terms of performance. For more details on the choice of front-end technology, see 4.2

the perceived time between action (e.g. a click) and response (displaying the image). Also, the module has been tested on computer models that are older than the usual computer used to surf the web and on mobile devices that are less powerful than the current low-end smartphones to be on the safe side.

The module will be designed with a minimalist approach. Decorative images, borders etc. will not be used in order to minimize the negative effect that cognitive resources are bound when parsing unneeded information; even a simple photograph used as background image can have a negative effect on the learning performance (Mayer, 2005). As the module teaches about language, using images or photographs might make the module look better, but would negatively effect module performance.[12]

4.4 Structure

The structural part of the module implementation is concerned with ordering the topics of chapter 2 "Information Structure" on page 7. The lesson content has been carefully chosen to create an understandable and didactically optimized structure. Some of the evaluation testers have didactic and pedagogic backgrounds and provided useful feedback that has been integrated into the lessons. This will be described in chapter ?? "??" on page ??.

4.4.1 Learning Structure

The learning structure of the module is oriented towards aligning with the model described in 3.3 "E-Learning Methods" on page 59. The module is divided into several lessons (knowledge acquisition), as described above, which are followed by short quizzes (knowledge memorization).

4.4.2 Lesson Structure

The content of the module is subdivided in several lessons, which are designed to enhance the learning effect of the one before. The goal was to start with the learners' available knowledge, use familiar terms and increase the information steadily. In order to achieve this, the logical structure of categories created in chapter 2 "Information Structure" on page 7 had to be broken up. The module starts with an introduction to information structure and assumes a general knowledge of the terms "emphasis" and "stress" — the terms are linked to explanations as well as discussed in more depth in an extra lesson afterwards. The lessons then gradually increase the provided information and build up on the knowledge acquired in the lessons before.

[12] In both senses of the word performance, as the loading times of the web page would increase as well.

Lesson Content

The content of the module will follow the arguments laid out in chapter 2 "Information Structure" on page 7. The texts used in the module are derived from, but not copies of, the texts in that chapter. In addition to the explanatory texts, there will be repetition/memorization and testing exercises which mainly consist of examples of the phenomena described in the text before. For more information on the concept of splitting the learning process into knowledge acquisition and memorization, see section 3.3 "E-Learning Methods" on page 59.

The module will be divided into the following parts:

1. Introduction
2. Information Structure
3. Sentence Structure
4. Emphasis and Stress
5. Sentence Structure Change
6. Focus — Markedness
7. Focus — Given and New
8. Focus particles
9. Final test
10. Summary

This structure can be easily changed in the future by editing the data files of the module with a simple text-editor. The content as well as the number and arrangement of the lessons can be changed in central configuration files.[13]

Introduction

The first lesson does not contain any exercises, it gives a rough overview over the contents of the following lessons, provides a general introduction to the subject and explains how to handle the module. The introduction is mainly meant to show the learner what kind of knowledge is expected of them to successfully use the module. Additionally the introduction serves as a guide for the module.

As described in section 3.1.3 "Language" on page 50, the introduction will also be available in German as well, since the module is specifically designed for advanced German learners of English.

The lesson texts in German and English are available in appendix A.2.1 "Lesson 1 - Einführung" on page 146 and A.2.2 "Lesson 1 - Introduction" on page 148.

[13] This also allows the module to be used for completely different topics by simply exchanging the data-folder for a different one.

Information structure

This part will deal with the question "what is information structure?", summarize the basic concepts and give an introduction to the phenomena that will be addressed in the module. As mentioned before, this part is the only one using previous knowledge about terms that are redefined later in the module. The lesson text is available in appendix A.2.3 "Lesson 2 - Information Structure" on page 151.

Sentence structure

The third lesson covers the three main ways of dividing a sentence in terms of IS:

Topic — Comment
Theme — Rheme
Focus — Background

The lesson text is available in appendix A.2.4 "Lesson 3 - Sentence structure" on page 153.

Emphasis and Stress

Lesson four comes back to the two terms already used in lesson 2 and explains how focus is achieved through the use of stress in a sentence. The lesson text is available in appendix A.2.5 "Lesson 4 - Emphasis and stress" on page 157.

Sentence Structure Change

The fifth lesson explains how changes in sentence structure lead to changes in information structure. Topicalization through clefts and dislocation is explained and examples of inversion are shown. The lesson text is available in appendix A.2.6 "Lesson 5 - Sentence Structure Change" on page 159.

Focus — Markedness

Lesson six goes deeper into the concept of focus, which was already introduced in lesson four. The concept of marked and unmarked focus is explained and the general concept of markedness is discussed. The lesson text is available in appendix A.2.7 "Lesson 6 - Focus — Markedness" on page 163.

Focus — Given and New

The concept of information status is taught in this lesson. After a general example of why emphasis is placed on the important information, the concept of given and new information is explained. The lesson text is available in appendix A.2.8 "Lesson 7 - Focus — Given and New" on page 167.

Focus particles

Lesson eight deals with focus adverbs and emphatic do. It explains how focus particles interact with their surroundings in the sentences they are used in and how emphatic do works in the English language. The lesson text is available in appendix A.2.9 "Lesson 8 - Focus particles" on page 171.

Final test

The final quiz is a voluntary self-assessment, the results are not shared or stored (except as statistical values), they are meant to show the learner how successful his learning experience was in a relatively objective matter.

Summary

The summary shows the results of the final test (if the learner navigated to the summary by finishing it)[14] and gives an overview over the literature the learner could use to gain more knowledge on a specific subject.

4.5 Interaction

The user interacts with the module by using it. This section does not cover the interactive elements of the module, they are described in section 4.3 "Design (UI)" on page 80. Instead this part is about the interaction between the user and the module provider, i.e. instructors, support and university staff.

4.5.1 Feedback

The module contains a feedback-mechanism that can be used when the back-end is available. When the back-end is not available, or it fails to respond, the buttons for giving module feedback or rating the individual lessons is hidden from the user. The implemented feedback can be divided into two categories:

1. Evaluation
2. Help

Every user can choose to evaluate the module as is described in section 5.3 "Quantitative Evaluation" on page 112, by clicking the global feedback-button and filling out the displayed form. In addition to that the users can leave their remarks for every lesson by clicking on the rate-button. The information gathered in the forms is send to the back-end and can either be forwarded to a contact-person via email, or stored in a database for statistical purposes.[15]

[14] As described in section 3.2 "Online Learning" on page 53, the freedom of the learner to choose their own pace as well as order also applies to directly navigating to the summary. In this case not results for the final test are available.

[15] Currently the data is forwarded to the contact configured in the back-end.

4.5.2 Support

The support of the module lies outside the implementation of this work. Within this thesis a theoretical model has been suggested that describes how to handle support in the future online learning environment. Links to forums or support contacts can be added at any time as soon as an external support structure us available. The module can be extended without having to change the source code to contain additional links and even contact forms to get in touch with available help.

Chapter 5

Evaluation

According to the Oxford Advanced Learner's Dictionary (Hornby, 1989, p. 411) "to evaluate" is defined as: "find out or form an idea of the amount of value of (sb/sth)", in other words: Evaluation deals with establishing the value of a given unit through several forms of analysis (Worthen and Sanders, 1988, p. 22). In usual cases, evaluations are conducted in order to reflect the performance of a solution at achieving a predefined goal and to assess prospects of improvement (Hegner, 2003, p. 7).

The evaluation must be done from the very beginning of the implementation in order to prevent general problems early in the process that can only be fixed by changing basic properties of the implementation model. This mostly applies to the technical perspective, as measurement of factors such as UX can not be conducted before the technical basis is available and the module can be used.

The evaluation of the module will be done from these two different perspectives:

1. Technical
2. Manual

The Technical evaluation must be done in parallel to the development process, while first round of manual evaluations can only start once the technical structure is advanced enough to provide an almost finished module. The technical evaluation must practically be finished by the time the first manual evaluation has begun, except for bugs that are found by manual testers (Whittaker, 2000).

5.1 Technical Evaluation

A technical evaluation is commonly known as "software testing", which Myers et al. (2004, p. 6) defines as "the process of executing a program or system with the intent of finding errors".

On a purely technical level it means to verify that the program produces the correct output upon receiving a predefined input.[1] For the purpose of this module, the predefined input equals the activity of the user — which means navigating through the module and participating in the quizzes.

I will subdivide technical problems that might occur into the following categories:

1. Browser Incompatibility
2. Content Problems
3. Bugs
4. Design Flaws
5. Missing Functionality

Browser Incompatibility

Even though HTML and JavaScript are defined as technical standards the different browser manufacturers do not implements them entirely consistently. Several browsers (most notably Microsoft **I**nternet **E**xplorer (IE) before version 8) interpret some features of these languages differently or interpreted parts of the standard in a different way. These problems were exacerbated by the fact that the final standard of a language version is usually established long after its features are already widely used.[2] From this arises the main technical concern when dealing with browser-based software. Since this module is written in natively supported HTML/JavaScript and does not rely on any third party plug-ins, it must be tested in every single browser in order to verify its functionality.[3] This is the main drawback of choosing a native technology — a third party plug-in would behave the same way across all browsers, while the native implementation uses the browsers parsing and rendering engine, which can differ considerably between programs.

Content Problems

The definition of content determines whether these kinds of problems belong to the realm of technical problems or not. Content can be defined technically as the data that is transmitted by the software and is not part of the software itself, i.e. not source code. The classic definition of content as the information that is transmitted to the user, i.e. the text in the lessons, is not dependent on technical factors. If the faulty behavior has technical reasons, such as file system rights or content-type problems, it can be caught by a technical testing process; if the problem lies within the (textual and logical) content itself, it can only be caught in the manual

[1] Software testing that contains partially non-predefined input is part of the manual process.
[2] HTML5, which allows the use of multimedia-elements and has been used in practice for several years, is still under development as of writing this thesis and has the status of "working draft" (Berjon et al., 2012).
[3] See section 4.2 "Technology" on page 72 for a detailed analysis of available technologies.

evaluation process that will be described in the next section.

Bugs

The most often used term for errors in software is "bug". They are the most common category of technical problems and can be caught by thorough technical testing as well as manual testing (Li et al., 2006, pp. 26ff). Even though the word is used in every-day speech to mean any unanticipated software behavior, bugs are defined as problems that have no other reason than an error in the source code. Whenever a problem is not caused by an error in the source code, it must be intentional and can thus be characterized as a design flaw rather than a bug.

Missing Functionality

As the basic blueprint for the module was developed relatively early in the process of writing this thesis, the problem of missing features can only occur in case a planned function has not been implemented due to technical constraints or could not be finished in time for the handover. Since in this case there are no strict specifications for module implementation, only additional functionality might not be added to the module. The technical evaluation will start after all basic functionality has been developed and thus cannot report any problems in this category.

Design Flaws

Problems can also arise if the problem behaves exactly as the developer intended it to, but failed to consider specific circumstances in which the application should behave differently. These flaws in application design have to be identified during feature implementation and cannot directly be tested for. Design in this sense does not mean graphical, but technical and functional design as in the definition of software-interfaces, APIs and work-flows. Design flaws have the characteristic of not being found until the program is tested in special cases or has to be extended. By creating a modularized application design, many of the typical design problems can be avoided in the first place, but still some may be caught during later development stages. Like the missing functionality these types of problems cannot be detected by a purely technical evaluation, instead the process of finding them had to be incorporated into the development process from the beginning and the feedback functionality after deployment.

In the following sections I will first describe browser compatibility considerations and the results of the evaluation for that specific part, followed by a short summary of other problems that came up during the technical evaluation phase along with their solutions.

Browser Compatibility Guidelines

A certain degree of browser incompatibility is acceptable for the module, as it would be irrational to insist on correct rendering on browsers that are more than 10 years old and do not support JavaScript, they are not practically used by anyone today.[4] In order to support as many users as possible, while keeping the time and effort within the limits of this thesis, a grouping system for browser compatibility was devised, it will be described in the following paragraphs.

A support for browsers that are actually used by more than 1% of the users at the current time was chosen. The decision about whether or not a browser is currently "in use" was based on the statistical data gathered by StatCounter Global Stats between June and November 2012. As browser compatibility testing it is one of the final practical parts of this thesis, the data for November was completely available.

As we can see in figure A.4 "Browser Versions active in Germany — June to November 2012" on page 141, while IE 9 is the browser with the highest market share in Germany, only two versions of IE (8 and 9) are in the top 12 of browsers, in the same range, five Firefox and four Chrome versions make up most of the list, with Safari 5 being the only other browser.

Even though these browsers make up for most of the market share, all other browsers together make up almost 20%, which cannot be safely ignored. The solution is to combine versions of the same browser that are comparable in functionality. Another factor that has to be weighted in is the automatic update functionality of some browsers. All Chrome versions as well as all Firefox versions starting from version 5 automatically update themselves. Following from this, whenever one of those versions is installed, the user will receive a newer version automatically, increasing the browsers security as well as functionality (Duebendorfer and Frei, 2009, pp. 3f).[5] Internet Explorer 8 and 9 have a higher compatibility to web standards than previous versions and are compatible to all features that are needed to implement the module (Hachamovitch, 2007). Safari supports the needed standards at least since version four (Morrison, 2009).[6] The Opera Browser supports all needed features since version nine (Wilton-Jones, 2012).

[4] In fact most of them would not even work on most operating systems created in the last decade.

[5] Exception being users who use these browsers professionally (for testing websites) and disabled the updating mechanism, or users that are in a tightly managed corporate IT environment. Both are clearly outside the target group for the module implemented here.

[6] The mobile safari is grouped with Safari ≥ 4, since it supports all needed features.

Following from this, the statistical combination of browsers has to consist of the following groups:

Firefox ≥ 5

Firefox < 5

Internet Explorer ≥ 8

Internet Explorer < 8

Safari ≥ 4

Safari < 4

Opera ≥ 9

Opera < 9

Chrome

Others

The information in figure A.5 "Combined Browser Versions Germany — June to November 2012" on page 142 can be analyzed for our purposes, which results in the values shown in table A.1 "Browser versions combined (Germany)" on page 144.

When looking at our results of the the combined browser statistics for Germany in the analyzed period, we can see that the incompatible browser groups (IE < 8 and Firefox < 5) have a combined share of 3.09 %, with an additional 1.15 % of browsers, which might be incompatible.

Less representative statistics that are closer to our target group can be taken from the access statistics of the RWTH fIT-Team Homepage.[7] The fIT-Team is a student organized instructor group that holds lectures and helps students to improve their IT-knowledge, which is needed during their studies. The statistics can be seen in table A.2 "Browser verions combined (RWTH)" on page 144 and closely resemble the German average with a difference of under 1% in our compatibility-grouped analysis.

An estimated 95% compatibility to all browsers used by the potential users of this module can be achieved within the short implementation time. The other 5% of configurations do not necessarily use incompatible browsers; if they are using incompatible browser version, they might be outside the target groups of out module (as argued above) or have an additional browser installed on their system, which decreases the number of incompatible configurations even further.

[7] The fIT homepage can befound under `http://fit.rwth-aachen.de/`.

5.1.1 Browser Fallback Strategy

The module will be available online and displayed in a browser that is chosen by the learner, which means that the technical tests have to make sure it works with all leading browsers and all major versions of the browsers.

Whenever a user chooses to access the module with a browser that is untested or unknown, the application has to provide a fallback strategy. In case of an online module like the one implemented here, this strategy can be one of the following:

- **Deny access**
  A warning is displayed, explaining why the module cannot be accessed combined with a list of compatible browsers. The user is prevented from accessing the module with the browser he is using and has to change to a different, compatible version before visiting the module page again.
- **Show constant warning**
  A message is constantly shown, informing about the untested browser they are using. The message should again contain further information along with a list of supported browsers.
- **Show warning**
  In contrast to the constant warning approach, the message is only shown once, at the beginning of the module, and does not stay visible throughout its use. The warning should contain a link to a detailed explanation along with a list of supported browsers.
- **Log access**
  Not displaying any special messages, the server logs the combination of browser and operating system being used in the background. The administrator and/or developer is alerted about an unknown browser accessing the module. This information can then be used to do further testing.
- **Do nothing**
  The module is shown to the user without any additional actions.

The deny-access-strategy is the most user-unfriendly version, which should only be adopted in case a completely incompatible browser accesses the page. Old browsers may provoke this kind of scenario as they might not completely support the needed JavaScript or advanced HTML elements. This strategy is often used in combination with a browser-blacklist, only blocking access to the module for browsers that are definitely known to be incompatible in a way that makes the module unusable to the learner.

The show-warning-approach is most suitable for browsers that are incompatible in a way that only affects non-vital parts of the module, but allows a successful module experience nonetheless.[8] Generally speaking, this approach — which in itself lowers the user experience of the module — should only be used when the occurring problems lead to major inconveniences.[9]

The logging-approach is most beneficial if combined with browser filtering: The Browser "Mozilla Firefox 15" is completely compatible with our module, chances are high that version 16 will display the same level of compatibility (as newer versions of browsers have to be backwards compatible), in contrast, there is only a smaller chance of a lower version being completely compatible as well. In this case we can take advantage of the logging-approach for higher versions of compatible browsers, while showing a warning message for lower (older) version.

The do-nothing-approach might not sound like a viable strategy, but it may be necessary depending on the workload created by newly released browser versions. Just like the logging approach, this approach can be enhanced with filtering: Since we can be quite sure that the next few versions of a compatible browser will also be compatible, a rule could be defined excluding the next X browser-versions from logging. The X must be set in relation to the number-schema used by the browser manufacturer and the number of new versions that come out in a defined time frame. While for example Microsoft's Internet Explorer only changed from version 8 to 9 between 2010 and 2012, Google's Chrome went from version 4 to 23 in the same time (Wikipedia, 2012a,c).

5.1.2 Browser Compatibility Testing

The module has been tested with the configurations listed in table A.3 "Browser compatibility test results" on page 145. The examinations have been conducted on several different systems (varying in browsers and operating systems) and in virtual machines with the configuration described in the table.

The development system has been chosen as the reference configuration for all other systems to be compared to. As it is the configuration on which every change in source code is immediately tested during the development process. This system (highlighted in bold in the browser compatibility test table) serves as reference in functionality as well as design. Every use-pattern analyzed on the reference system must be applicable to every other tested system.[10] The rendering of the module page on every test system is compared to the reference-

[8] Non vital parts are for example visual effects, element composition and placement and UI-design.

[9] If there is just a drop-shadow missing from an UI-element, this would not be considered the correct approach, but for example in case the user has to scroll horizontally and vertically in order to fill out the exercises, which would not be the case in a compatible browser, such a warning would be adequate.

[10] If for example a button does not behave in exactly the same way as on the reference-system, this is considered a

rendering. By using screen-shots of the main system the graphics can be compared side by side. One exception to this rule are mobile devices with a considerably lower screen-resolution (smart-phones), in their case a difference in graphics rendering is not seen as an incompatibility as long as the functionality remains unaffected by the change.

The finding of a technical test can be one of three different results:

1. **OK**
2. **Usable**
3. **Not compatible**

OK means that the test has shown no signs of incompatibility. The software is completely usable and apart from minor visual differences — such as slightly different spacing between elements or minor text rendering discrepancies that do not affect legibility — looks and behaves the same as on the reference configuration.

Usable rates a rendering that allows using the module, but it might look different on the reference system. For example, when the module appears distorted or the text only occupies half of the available width. Learners are not encouraged to access the module with a configuration that only has the "usable" rating, but will not be denied access to the module.

Not compatible is the rating given to configurations that make it impossible to use all module functionality. This is the case if the navigation- or quiz-buttons do not work correctly or parts of the module text are not readable.

See table A.3 "Browser compatibility test results" on page 145 for the results of the tests.

5.1.3 Other Technical Problems

The module has been tested in a small technical pre-evaluation with 10 test subjects without any testing guidelines before the module content was ready and the evaluation criteria head been worked out. The main focus of this evaluation was to remove any fatal bugs and get a general feedback on module usability and structure. A fatal bug will be defined as a problem occurring during the use of the software that either prevents the learner from continuing with the lesson or leads to learning something wrong.[11]

This short pre-evaluation has been done by sending the module-url to 10 volunteers and asking them to respond with all problems that occurred. The evaluation was conducted by

mayor flaw.

[11] The classic definition of "fatal error" includes the termination of the program. This cannot occur in the case of the module as the program visible to the user is the browser, which cannot be closed by website code. The result of web-application termination is missing information on the web page.

phone, chat[12] or e-mail in a non-formal manner. The testers were asked to go through the complete module and write down what they thought about it. Among the volunteers were several software developers, a UX-designer, three people with an academic background in linguistics and a few testers with no technical or linguistic background. The testers were asked to focus on:

1. Errors — problems that keep them from using the module.
2. Problems that disrupt the learning experience.
3. Anything they disliked personally.

The evaluation has been done in two steps, changes implemented after the first cycle were already available to testers in the second one. The list items are prefixed with the cycle number. Not all of the testers input lead to changes in the module, if no changes have been made, the reason for not addressing the issue is stated next to the reported problem.

The following list consists of their grouped and paraphrased input followed by a description of implemented corrections as a result of the feedback.

Content problems

1 The answer to exercise 2 in lesson 4 is shown as correct while being wrong.

Re-checked all quiz exercises. Two wrong correct-flags were changed.

2 Lesson 5, Quiz exercise 3 allows several items to be selected even though only one is correct.

This behavior was implemented intentionally as part of the quiz design. It is meant to increase the challenge and thus make the learners think more about the exercises.

Bugs

1 On longer pages the fade-over-white-animation does not work.

Animation positioning has been changed from an absolute to fixed coordinate system.

1 Lesson numbering does not change. (Always "Lesson 1")

Bug has been fixed.

[12] Different IM solutions like Skype, Google Talk and ICQ were used for this.

1 The vertical scroll-bar is only visible when the content is longer than the browser window height, which makes the language-selectors "jump".

Scroll-bar is now forced regardless of content-height.

2 Lesson navigation button "next" has wrong mouse-over info.

Title attribute of button has been changed.

2 When navigating back from the last lessons, the next button stays inactive. The same happens when navigating from the first to the second lesson.

Button-status bug has been fixed.

2 Lesson-Bookmark only changes/appears when starting-URL has one.

Bug fixed.

2 Lesson chooser (navigation) always shows the German title of the lesson

Bug fixed.

2 Lesson navigation buttons "jump" with changing length of lesson title.

Changed lesson title space in navigation to fixed width.

1/2 Several typographical errors found

Fixed.

Design flaws

1 When clicking on "previous" in first lesson or "next" in the last one, that same lesson is loaded again.

The behavior was changed. Buttons are now in a "disabled" state when navigation in the specific direction is not possible.

1 The distinction between module and lesson is optically unclear.

Module-header, lesson and quiz are now separated by horizontal dividers.

1 The navigation looks "inorganic", like it is not part of the page.

The design of the navigation has been changed to seamlessly connect to the page using a transparent background gradient.

2 Lesson numbering starting with `0` is counter-intuitive.

Lesson numbers increased by 1.

2 When changing the lesson-number in the URL by hand and pressing enter, the lesson does not change until clicking reload.

A function has been implemented to detect manual URL-changes. Browsers supporting HTML5 (Berjon et al., 2012) will support this feature, in older browsers the page will have to be reloaded manually.

2 Lesson chooser does not pre-choose the current lesson, which is at odds with the title "Current Lesson"

The current lesson will now also be selected in the drop-down field.

2 The legibility of the lesson text suffers from the choice of font.

Font has been changed to sans-serif for optimized screen-legibility (Poole, 2008; Weisenmiller, 1999) In order to assure availability of the font on all clients, the web-font "Droid Sans" provided by Google with "Verdana" as fallback has been chosen.

2 The structure of the quiz-texts (heading, text, subheading, text) looks bumpy and distracting.

Quiz content changed to one headline with one description text (the technical possibility to use both still remains in the quiz-module).

2 A different color scheme would be preferred.

This is a matter of personal preference. There is no consensus among the testers about whether and what kind of change in color scheme would be an improvement.

Missing functionality

1 When reloading the page (for example because the browser has been closed), it always starts at the first lesson again.

A JavaScript based "deep link" system has been implemented. Lessons can now be addressed by using the value of the URL after the hash-symbol (#).

2 Quiz answers cannot be selected by clicking the answer text.

Added clickable answer-text for item selection.

2 You have to click X times to get to the last lesson. Lessons should be selectable directly.

Implemented a feature that shows a drop-down menu when clicking the lesson title in the navigation.

2 The language selector should only be visible when there actually is a language choice.

The individual language buttons will be grayed out in case that specific language is not available for the current content.

In case only one language is available, the language selectors will be hidden entirely.

5.2 Qualitative Evaluation

After the technical evaluation has been completed, we can be sure that all testers will be able to use the module and we can instruct them in case their system has any incompatibility issues. In case any additional, previously undiscovered technical problems occur during the manual test, they will be put back into the technical evaluation procedure and dealt with accordingly.[13]

5.2.1 Preparation

Evaluation Criteria

It is necessary to establish three types of criteria that will be applied during the evaluation process:

1. Criteria for the analysis of the module, i.e. questions to ask the testers.
2. Criteria for the performance of the module, i.e. the goals of the module.
3. Comparability criteria, i.e. how does the module perform with respect to the aforementioned criteria compared to other solutions.

Type 1 — General analysis:

This part of the evaluation is composed of questions to the testers that help to assess the main evaluative problems: "How good is the module?" and "What needs to be improved?" (Hegner, 2003; Holz auf der Heide, 1993, p. 9)

Type 2 — Performance analysis:

The main goal of the module is to help the learner educate themselves. As a complete evaluation of the users' learning performance cannot be conducted without a large group of learners, this part will have to be done in a second step. The included "final test" in the module can help with this evaluation throughout the lifetime of the module as we can gather statistical data about the performance of the learners. Additionally, gathering anonymous information about the lesson-quizzes and how they were answered is possible, which can help to further improve analyzing the learning success and enhance the module structure. In the first step, we can collect a small but thorough amount of statistical data in combination with the subjective impression of the testers about their own learning experience. This data will help to

[13] In this sense the technical evaluation is never "completed", but an ongoing procedure with the number of newly discovered issues (hopefully) approaching zero.

find problems in the module design, provide valuable data and lay the groundwork for further large scale evaluations in the final learning environment.

Type 3 — Comparative analysis:

In a last step, the module should be compared to other available solutions in respect to the main goals. This step has to compare the type 2 criteria in combination with external factors such as monetary resources or availability of personnel. An example for this kind of evaluation would be to compare two different e-learning solutions, a blended learning approach and one classic one over the course of at least one semester.

The first two types of evaluation can be conducted before the module prototype will be handed over; the third type will have to be conducted within the final learning environment.

The criteria selected for this first evaluation will reflect the value of the implementation and possibly uncover necessary changes that will improve the module (Baumgartner, 2000, p. 1). The evaluation will base the factors for analysis on Oppermann and Reiterer (1994, p. 337): The user interacts with the computer in order to handle a specific task. In this thesis the user is an advanced student of the English language who is using a software module on a computer to learn about and understand in detail the concept of information structure in the English language. See figure A.6 "Evaluation criteria model according to Baumgartner (2000)" on page 143 for a visual representation of Baumgartner's model.

Evaluation Components

Based on the concept described in the preceding section, the following evaluation components have been devised:

Tester background:

This component will help to evaluate the testers answers with regards to their background. Background factors that influence the quantification of the testers feedback can be negative or positive (in respect to quantification, not their attitude). A negative influence on the quantifier has to decrease the rating given by the tester, while a positive one increases it. Examples for positive influences are a negative attitude towards technology in general, or a general dislike of online learning. Negative quantifier influences can be, for example, a previous experience with online learning or with the subject itself. Additionally, a previously established preference for an existing type of e-learning solution might lead to positive quantifier influence, as familiarization with the UI of a different product might lower the ratings for this one, irrespective of objective UX properties.

E-Learning:

This component is mainly used to evaluate the special case of a topic presented inside an e-learning solution. While all testers will be familiar with the general case of text-based learning, the special circumstances of WBT might not be known to all of them. If a correlation exists between the tester's attitude towards e-learning and their experience of the module, their response has to be dealt with differently than that of someone who is used to online learning. A criticism of the module because of this mandatory construct might lead to wrong conclusions and thus lower the quality of the module, if it is changed as a result of it. The analysis of these correlating factors helps to sort out (as in weight lower) the nonconstructive responses.

Didactic:

One of the main parts of the questionnaire wants to find out about the value provided by the module and identify weaknesses, strengths and opportunities with regards to the provided content and learning matter. This is the aforementioned small-scale version of the type 2 criteria analysis. All answers given in this part have to be regarded as personal impressions and are highly subjective.

Technical:

Apart from the technical evaluation — feature- and compatibility-testing — done during the development of the module, the testers are encouraged to find hidden flaws in the software. In addition to purely technical factors, this component will also be used to examine technical performance[14] and handling, which are part of the UX, but only influenced by technical factors such as loading speed and website performance on different client configurations.

Design:

The design is a huge part of the UX when learning via a web-based module. This part of the questionnaire is determined to find out how the user evaluates the usability of the module and identify weaknesses, strengths and opportunities.

General:

The general section at the end of the questionnaire is one of the most important components when dealing with a small group of specialized and motivated testers. It provides an opportunity to gain feedback on factors that have either not been incorporated into the evaluation, or can provide correctional information about information the tester gave as response to the questions before.

[14] Performance in this respect means page loading speeds and reaction times to user input such as clicking a button.

Research Methods

Hegner (2003, p. 8) describes two kinds of evaluative research: Qualitative and quantitative. As the e-learning module developed in this thesis is build from scratch and thus completely new, it would be desirable to apply both evaluation methods to benefit from the advantages of each one. Even in the small scale-evaluation, both methods will be adopted. Quantitative data is gathered by means of the module's feedback mechanism and the evaluation questionnaire. Qualitative data is collected by using the classic interview method in conjunction with the static questionnaire. This combination will help to further improve the evaluation process and identify potential weaknesses (Hegner, 2003, p. 7).

Since the designer/developer of the software cannot be used as a tester for obvious reasons, a group of qualified software testers has to be selected carefully. The qualification of the tester is relative to the field of analysis that is to be achieved. A UX expert will for example be useful in assessing the quality of the interface, an e-learning expert can judge the learning potential of the module while advanced German students of English can represent the final target group. In order to get a diversified response to the module, the initial testing group will include of at least one test with one of the following backgrounds as they have been identified as a target groups that are able to provide useful feedback:

- (German) Advanced students of the English language
- (German) Beginner students of the English language
- E-learning software experts
- UX or Design experts

For this evaluation, questions with predefined answers were preferred over free text in order to facilitate the analysis of the results (Bortz and Döring, 1995, p. 232f). In order to achieve this, the testers will be given questions that have to be rated on a scale. According to Bortz and Döring (1995), this method has advantages over free text, because the tester is required to think about the question and has to weight their responses, which makes it possible to get differentiated information.

The first questions have to be relatively general and easy to answer in order to get the tester to fill the questionnaire; an already partly filled form makes it more likely for the tester to finish the whole evaluation as the already invested work creates a cognitive dissonance that increases the motivation to finish — the effect is known in economics and decision theory as "sunk cost" (Arkes and Blumer, 1985, p. 137). Subsequent elements in the questionnaire can be more complex and specialized.

Another important factor is the choice and formulation of questions. The order of the questions has to be chosen, so that the previous questions do not influence the response to the current one, it is especially important not to use suggestive phrasing (Bortz and Döring, 1995, p. 234). Negative and ambiguous forms have to be avoided; simple and explicit questions have to be checked for their intention and purpose, repetitive questions should only be used to increase reliability in complex cases (Bortz and Döring, 1995, p. 224f).

In order to gain a differentiated result, questions have to be avoided that are likely to be answered identically by most of the testers. For the same reasons, explicit inclusions or exclusions (like "always", "never", "everyone", "nobody", "all") have to be avoided (Bortz and Döring, 1995, p. 233f).

The graded multiple choice questions that do not belong to the category of binary questions (yes/no, true/false, good/bad), are chosen to have an even number of response options in order to avoid the behavior of testers to choose the middle option by default (Clark and Watson, 1995, p. 9).

Questionnaire Structure

The questionnaire starts with an introduction explaining the evaluation. It contains information about *a)* the person in charge of the evaluation *b)* a short explanation of the reasons for the evaluation *c)* mentions the environment in which the module is about to be used and *d)* an explanation of the importance of the module (Bortz and Döring, 1995, p. 235f). It will be emphasized, that the module and this evaluation are part of a university thesis.

The first part of the questionnaire will be composed of general questions about personal data, as they are especially easy to answer for every test subject (Bortz and Döring, 1995, p. 234). As the questionnaire is created to provide anonymous feedback, there are no personal questions that make the tester directly identifiable, personal details like name, age etc. will be left out.

In the qualitative evaluation the testers are contacted directly and the evaluation process uses the questionnaire as a general guideline. Using this approach the feedback is not anonymous, but gathered during direct contact between the tester and the person conducting the interview.

Questions

The Questions are divided into the six groups explained in section 5.2.1 "Evaluation Components" on page 101. Every question containing answers that cannot be completely assessed using the multiple choice approach has a free text field that is shown in case one of the non-self-explanatory options is chosen by the tester. For example the question "Do you have expe-

rience in the field of e-learning" can be adequately answered by choosing the option "None", but needs more explanation in case of choosing "Some" or "A lot", as we need to know which kind of e-learning is known to the tester; a tester that has a lot of experience with CD-Rom based learning but has never used a learning website before will choose the same option as someone who never used offline learning solutions — but their experience of the module will differ significantly.

Some questions like "Do you think that it is a good idea to use e-learning modules at university?" only have two options, but in case the tester answers with "No", we need more information about the reasons. One reason might be that they generally thinks e-learning can never replace traditional teaching, another that they think that e-learning should be offered by a separate institution; in the first case this has an effect on their rating of the module itself, while the second case is simply an administrative issue which has no influence on the evaluation of this module.

Several questions ask the testers to rate their experience on a scale. Two of the options are positive, the other two are negative. The two negative options "neutral"[15] and "the module confused me" offer a free text field to explain the rating in more detail.

All questions have to be filled out in order to send the form, while the free text fields are always optional. The questions do not have a default value, the tester has to consciously choose one option for each question and cannot just keep a predefined answer.

For a printable version of the questionnaire, see appendix A.4 "Evaluation Questionnaire" on page 176.

5.2.2 Expert Interviews

A predefined group of testers was chosen in order to cover the fields or experience described in section 5.2.1 "Research Methods" on page 103. These testers were contacted in person and the evaluation of the module was done in the presence of the person conducting the interview. The tester did not get the evaluation form as such; the module was shown to the tester who was given time to use it completely. Feedback from the tester during this phase was written down categorized by the sections mentioned above. After the tester completed the module, their general feedback was written down. Only after the completion of this phase, questions were actively asked by the interviewer to assess information from categories that the tester did not mention on their own.

[15] It is labeled as neutral, but due to politeness, people tend to choose this option if they are not satisfied.

Three of the main advantages of this approach are:

1. The interviewer can ask for additional explanation on feedback that is either not detailed enough or ambiguous.

2. The interviewee will more likely increase the extent of their feedback, as the "work" of writing (especially: formulating in written style) is done by the interviewer.

3. Testers can be more flexible in their response, as they are not bound to categories or predefined questions.

(Sewell, 1998)

The feedback of each tester was analyzed and incorporated into the module before the next tester was interviewed and shown the module. By using this approach, it is made sure that changes made from the evaluation feedback are evaluated again from a different perspective.

Results and Interpretation

In the following sections I will summarize the results of the expert evaluations and explain in how far the feedback has been incorporated into the module.

UX Expert Analysis

Tester background:

The tester has worked as head of UX for international companies, he managed several projects in the field of UX and product evaluation. He used primitive e-learning solutions during his studies at university and advanced ones in his company. He uses computers and the internet on a daily basis for work and in his private life. He has no background in linguistics but speaks English at a near-native level due to using it as primary language at work in several European countries.

E-Learning:

The tester is open minded about e-learning solutions at universities. He reported a very good learning experience and a good success of learning through use of the module. Check questions about the content were answered correctly except for minor details.

Didactic:

- The approach to use short vs. long answers in lesson 2 is a good concept, but the short answer has to be kept really short in order to achieve the desired effect.

  The short version has been cut to the minimum and additional explanatory content was added to the longer version.

- Quiz 2, Exercise 3 simply states "Correct" and does not give an explanation like the other exercises do. That is inconsistent.

  An explanation was added to the correct-response.

- The topic — comment explanation should leave out the two concepts (aboutness and familiarity) as they are confusing.

  It is important for learners who study linguistics to know about the two concepts regardless of learnability-decrease. The text has been changed to simplify the explanation.

- The connection between stress and markedness is not clear.

  Additional explanations have been added to the text of the lesson.

- More of the linguistic terms should be linked to Wikipedia

  Several links were added.

- The module contains too much text.

  Since the topic of the module is an academic one, the learner is expected to be able to read and understand long texts. As it deals with language, explaining the phenomena graphically is not as easy as in many other academic fields.

Technical:

- When answering a quiz question the page does not change, only the quiz content — this might confuse the user.

  The questions stay on the same page, so that the user can reread the sections in which the phenomena are explained. A counter has been added to the quiz in order to show progress.

- The window title always shows the same text, regardless of the current lesson.

  The browser window title is now dynamically generated.

Design:

- The first quiz is unnecessary as it does not contain a meaningful question.

  The quiz has to be kept in order to keep a consistent design and due to the technical structure of the module (one quiz per lesson, continue by filling out the quiz). The question has been changed from a formal question to a more casual approach.

- Quiz buttons: "Finish" is ambiguous.

  Implemented configurable button labels and changed button text to "Finish Lesson".

- The "wizard"-style quiz does not behave as expected (changing the lesson).
  This behavior is needed to keep all questions on the same page as the lesson. The alternative would be to display the quiz exercises all at once, which looks worse. No changes have been implemented.

- The navigation on the bottom is counter-intuitive.
  Navigation and language selection has been moved to the top of the page.

General:

- Several typographical errors.
  Errors have been fixed.

- Lesson 3, Quiz exercise 3 contains an incorrectly underlined answer.
  Typographical error in text formatting has been fixed.

E-Learning Expert Analysis

Tester background:

The tester is CEO of an e-learning production company and has worked as e-learning production specialist for an international company for several years. He regularly holds seminars about current e-learning solutions and implementation of e-learning platforms. He uses computers and the internet on a daily basis for work and in his private life. He does not have a background in linguistics but speaks it fluently at an advanced level due to using English at work. He studied German philology at Heidelberg University, but does not have an academic knowledge of English. He considers himself to be on the level of "Advanced Learner" in English.

E-Learning:

The tester has a specialized background of e-learning, he knows, uses and teaches about several e-learning solutions as part of his daily job. He mostly works with "Adobe Captivate", "Articulate Studio" and "SAP Producer" to create e-learning content, but is also trained in several other programs. He thinks that e-learning should be an integral part of the courses offered at universities. He reported a very good learning experience and a very good success of learning through use of the module. Check questions about the content were all answered correctly.

- A final "graded" test should be implemented, so the students can measure their perdormance.

  A final test featuring all topics of the module will be implemented.

- Social media could be used to increase motivation and spread the word about the module.

  The module will be used RWTH-internally, it is not the goal to advertise the module outside.

Didactic:

- Lesson 3, Quiz exercise 3 is ambiguously formulated.

  The question as well as the possible answers were changed to be more clear.

- Quizzes do not report meaningful responses to wrong answers.

  Quiz-Module was extended to use individual exercise hints.

Technical:

No technical problems were found.

Design:

- The design is to minimalistic. Graphics and animations might make some parts easier to comprehend.

  According to Mayer (2005), a minimalist approach helps to increase learning success because fewer cognitive resources have to be used to parse the environment, thus more resources are available for working on the content. Najjar (1997, p. 9) came to similar results in test that only showed an increase in learning performance when graphics were used to learn verbal information in low aptitude learners. If the practical evaluation shows that specific parts are not well understood by the learners, the dual-coding approach described by Roche (2005) could be implemented by adding descriptive graphics.

General:

- Lesson 3, Quiz exercise 3 is ambiguously formulated.

  The question as well as the possible answers were changed to be more clear.

Advanced German Student of Linguistics Analysis

Tester background:

The tester is an advanced student of linguistics at Mannheim University and works part-time as a Graphics-Designer for a large German IT-company. She has a background in e-learning, as she worked on several e-learning projects as a Designer and uses e-learning solutions at work. She uses computers and the internet on a daily basis for work as well as private matters. She has finished her basic studies and is currently on her way to a M.A. degree.

E-Learning:

- The introduction page contains to much information. It should be split up into several pages in order to increase clarity.

  The introduction is not an important part of the module and should therefore not span more than one "lesson". The division of the introduction has been changed in order to make it more understandable.

Didactic:

- The amount of information in the module is just right. However, it might the learners to finish the module too quickly, which could decrease learning success.

  A solution to this might be to split up the lessons into smaller parts, divided by quizzes — this can be implemented later, if the problem occurs.

Technical:

No technical problems were found.

Design:

- The design is to minimalistic. Graphics and animations might make some parts easier to comprehend.

  See the response to the same request made by the e-learning expert on page 109

General:

No general problems were found.

Beginner German Student of Linguistics Analysis

Tester background:

The tester is an beginner student of linguistics before entering university with no background knowledge of linguistics apart from the knowledge gained at school. She has no background in e-learning, but uses the computer and internet sources in her private life and explicitly mentioned learning online for her qualification for university entrance.

E-Learning:

She reported a good learning experience and a good success of learning through use of the module. Most check questions about the content were answered correctly.

Didactic:

- The use of the German words for example "Topik" sounds strange. There is no need to translate the word into German as the module is about the English language. The original English words should be used.

  The advantage of using the German words is, that the learners can use a search engine if they need information about the topic in German, without having to look for the translation beforehand. If later feedback shoes that this decreases understandability, the words will be replaced with the English versions.

- While the idea to link Wikipedia articles is generally a good one, most learners just want a short and concise definition. A short module-internal definition with a link to the article would be more convenient for the users.

  Creating an internal "dictionary" of linguistic terms that could be used in the module is one of the ideas for extending the module.

- The word "present" is not a good example to show the shift in stress, as the pronunciation of the first syllable also changes — /prɪ'zent/ vs. /'preznt/.

  The example has been changed to "object", which has only a minor change in pronunciation.

Technical:

No technical problems were found.

Design:

- In the quizzes, the responses should immediately show whether the answer was correct more evidently in combination with the currently shown text. Icons like "green check

mark" or "red x" would improve the visual response.

A message-box window has been implemented that now contains the proposed graphics.

General:

- Lesson 2 uses the heading "the long answer" twice.

  The heading of the short answer has been corrected.

- Lesson 3, in the part about the topic-familiarity-concept, familiar information is called "unknown".

  The sentence has been changed and now describes it correctly as "known".

- In lesson 7, the German part contains a sentence where "gefahren" is highlighted, although from the context it seems that "John" should be highlighted.

  The highlighting of the sentence has been corrected.

- Typographical errors were found.

  The errors were corrected.

Positive Feedback:

- The lessons are comprehensible and the used language feels more natural than most learning texts.

- The quiz responses for every question helped to either find the right choice or understand the correct choice specifically.

- The Shakespeare reference in lesson 5 made the whole section more interesting.

- The humorous quiz in the introduction helped to provide a friendly atmosphere.

5.3 Quantitative Evaluation

The quantitative approach is the classic version of a mass survey. In this case we cannot reach a representative number of testers before the initial development will be finished, it is therefore advisable to leave the evaluation option active after the deployment of the solution in order to get better results.

5.3.1 Preparation

For this type of evaluation, the questionnaire created for the qualitative evaluation was converted into an online form, that can be accessed by the testers as part of the module. The main difference is, that the questions are directly shown to the testers and no individual check-questions can be asked.

While the feedback might not be representative, it is still very useful for the first evaluation step, as even the testers in this approach have been picked according to their background. The following groups of testers will be represented by at least one participant:

- German Beginner Students of English
- German Advanced Students of English
- Language professionals (translator, teacher, etc.)
- Design experts (UX professionals)
- E-learning experts

Due to the nature of the anonymous survey it is not possible to weight in the same way as in the manual interviews; however, the design of the questionnaire still allows weighting according to individual factors as explained in 5.2.1 "Evaluation Components" on page 101.

5.3.2 Results and Interpretation

In the following section the results of the anonymous evaluations will be summarized and it will be explained in how far the feedback has been incorporated into the module.

Twelve testers anonymously filled out the feedback-form in addition to the people interviewed before.

Tester Background

The linguistic background of the testers was $1.\overline{3}$ on a scale from 0 (none) to 3 (expert). Only three testers considered themselves experts.

The testers reported to have some experience in the field of e-learning on average — 1 on a scale from 0 (none) to 2 (a lot). The different levels of experience were evenly distributed between the testers.

Unanimous Feedback

All twelve testers reported

- to use computers and the internet every day, which corresponds to the general problem of finding German testers with a sufficient knowledge of English that do not have daily experience with computers.
- to have a positive attitude towards e-learning and think that universities should offer more such modules to their students.
- the quiz-exercises to be appropriate.
- that they found the module well structured and understandable.
- that they did not feel the need of additional help resources throughout using the module.
- no technical problems.
- a smoothly working navigation function.
- performance of the module in therms of speed to be very good.
- that they liked the design of the module.
- their learning experience as well as their learning success as either good or very good.

Differences in Feedback

Three out of twelve testers reported that they did not understand everything that was discussed in the module, but only one of them used the additional free-text field to comment on it. The tester described that the difference between the terms "topic and comment" and "theme and rheme" was not clear to them. As a response to this criticism, the sentence structure lesson was changed and the explanatory part was expanded to include an additional explanation of the two topic-concepts.

The explanations in the module were graded as "good" or "very good" by most users. The lowest rating for the explanations was "sufficient". The users who gave a sufficient rating all reported having no background in linguistics, which explains the slight discontent with the amount of explanations. As the module was developed for advanced learners, and even those testers who considered themselves beginners reported at least a good understanding of the explanations, this did not lead to any changes in the module content.

The navigation of the module was graded either "good" or "very good" by all testers expect one of the testers who was among the first people to evaluate the module. After the first evaluation cycle, the navigation-drop-down-menu that appears when the title of the lesson is clicked was added to the module. In the following evaluations, the navigation functionality received high grades from all testers.

Two of the testers did not recognize the links to further explanations of linguistic terms, one of them reported that they did not even notice that there were any. As a result, the color of the links was changed from light grey to a slightly darker tone in order to increase contrast

with the white background.

Only four testers used the free-text fields to report additional information. Of those four only two used it to communicate negative feedback about the module: One reported a dislike for the "fuzziness" of the topic of information structure in general, the other one was irritated by the asterisk symbol in front of some sentences. Both of them reported having no background in linguistics. The other free remarks complimented the typesetting and choice of font, the layout and the Shakespeare reference in lesson five.

Chapter 6

Further Possibilities and Conclusion

Online learning has opened up an exiting new world for teachers and learners alike. While the main technological advance seems to be driven mainly by games and entertainment, the principles used to deliver that kind of content are no others than those used in e-learning. In addition to the ever increasing availability of technology, the number of users rises as well. While ten years ago many people refused to use mobile phones, today in the relevant target group (14–29 years old), only 6% do not own such a device. In 2011 alone, 11.8 million smart phones — devices that support applications and can be utilized for education — were sold in Germany (Deutsche Telekom, 2012). Mobile learning — learning with smart phones, tablets or other forms of mobile computers — clearly is the next step in e-learning.

6.1 Further Possibilities

The principles of entertainment and games can mostly be used to improve and promote e-learning. Videos and audio recordings of native speakers could show a more interesting view of the topic and improve the memorability of the exercises. Gamification is one of the hotly debated topics in education and the IT industry in general. Adding playful factors such as achievements to activities and thus making a game out of them can help to improve productivity and learning. In the case of the module implemented here, the quizzes could be further improved to feature game elements like a high-score table, badges that are awarded to learners who score high at the final test or hidden elements that must be found by solving clues in the texts and thus give incentives to reread them.

Games and multimedia are not the only ways that technology can help in education. Creating communities among the students and facilitate their communication with each other can improve the learning success. Just like learning groups in the offline world, forums, chat-rooms, wikis and even blogs can be provided to students to facilitate learning in a social

university-network. When electronic teaching will be fully embraced by educational institutions, dedicated instructors that help students in the online environment might be the way to ensure efficient, networked collaborative online learning (Rey, 2009, pp. 183ff).

Until that day comes, there are other options available for implementation. More and more diverse content — especially in the interactive parts of the modules — can improve the motivation of the learners and create a more interesting learning experience. Accessible help solutions, like FAQs, KBs and forums can be set up already today and connected to the forums. This could be the starting point for the communities mentioned before. One repeated feedback from the evaluation expressed the need for an internal dictionary of linguistic terms that could be used in addition to the informational links in the module. The general idea of linking to explanations of even well established terms was well received, but the fear of using definitions that are not accepted by the university was present. This internal dictionary could be the starting point for further research and the point of reference for students reading outside material.

The advances in technology do not only apply to the delivery medium and the devices that display the content. Research in learning and computer sciences has brought up new technologies that can help to improve the learning experience further. One of these approaches that might be a feasible option for learning modules at RWTH Aachen University is adaptive learning (Rey, 2009, pp. 179ff). The currently already available quiz-module could be used to assess the learning performance of the student and the following content could be adapted to the knowledge available to the learner. Based on the statistical data gathered through constant measuring of quiz-answers and reading speed, the complexity of the presented texts could be increased or decreased, sections might be skipped or additional explanatory content inserted (Chen et al., 2005, pp. 239ff).

Even if it is not possible to provide cutting edge information technology to analyze the students personal performance, helping them to help each other is a task that modern technology can fulfill. Students can be teachers at the same time and interactively correct their exercises, without the need of a dedicated teacher. They can even be motivated to create exercises themselves if for example a point based achievement system is in place. A possible system for this kind of automation could be:

- Exercises can be created by high point scoring students.
- These exercises are checked other high scoring students or an instructor before they are given to the rest of the learners.
- Learners can be awarded additional points for creating exercises.

The fields of linguistic research and applied computer science can work hand in hand to pro-

vide examples and exercises automatically from existing linguistics databases. There are several projects that apply annotations of information structure to linguistics corpora (Calhoun et al., 2005). Some of them can even be used to provide an analysis between German and English in terms of IS (Baumann et al., 2004a,b). Such projects could establish a groundwork for creating interactive examples to be used in online learning or new exercises. In combination with artificial intelligence approaches from the field of computer science, new possibilities are available to get closer to autonomous electronic teaching.

6.2 Conclusion

In this work, the theoretical background of information structure has been researched and ordered into an optimal structure for the purpose of teaching. The elemental theories of e-learning, especially in light of the module implementation, have been picked afterward. With the groundwork laid out in the chapters before, the next step was to find the optimal technical solution to implement these findings in an online application. After the actual web-application had been developed as a working module, it had to be tested and evaluated to make sure it was suitable for the task of teaching information structure to advanced German learners of English.

For the research of the linguistic background, an in-depth literature research was done in order to find answers to the questions: What is information structure? How can the phenomena of information structure be organized? Which phenomena are the most important ones to teach to German Learners? Callies (2009) was used as a starting point and his division of IS into three dimensions arose as the best approach to structure the chapter.

The methods and approaches to e-learning and teaching available today were researched in chapter three with a focus on topics that can aid the implementation of an online module. The most influential factors on the actual implementation were the concept of simplification in CTML in combination with the, at first sight opposing, approach of keeping a high level of complexity as described in CFT. AAL and freedom of choice for the learner were two further factors that led to the testing of the module on mobile devices and the relaxation of the navigation structure to ensure that learners can choose to ignore the provided order of lessons.

With the content being researched in the second chapter and the structure in the third, the technical basis for creating AAL-conformant web-applications had to be investigated. Based on practical knowledge in the field of software development and the technical environment of the e-learning platform at RWTH Aachen University, the technology was chosen, a user interface designed, the structure of the software defined and recommendations were made for

implementing a support infrastructure.

Based on the three theoretical chapters, the module was implemented from scratch as a web-application that is compatible to offline use and prepared for initial testing.

The final part of the thesis dealt with testing and evaluating the newly created software. The evaluation had to be done in three separate steps: The first step ensured that the module was free of errors that might prevent any tester from evaluating it. The second step obtained specialist feedback for the important parts of module creation and the relevant target groups. The last step ensured an impartial perspective through feedback from anonymous users. The results of this evaluation were incorporated into the module. Although the response rate of the anonymous evaluation was only approximately 16%, the evaluation is suited for assessing the current situation and showing potential for future works.[1] 100% of anonymous testers, regardless of their background, described their learning success and experience as either "good" or "very good". What was surprising at first sight was that also 100% of participants reported their use of computers and the internet as "every day", which turned out to be a flaw in the quantitative evaluation design: The questionnaire was sent over e-mail to reach as many members of the desired target groups as possible, and thereby virtually excluded every tester without this characteristic from participating. One of the next important steps would therefore be to conduct a qualitative evaluation with actual students in a controlled environment like a linguistics course at RWTH Aachen University.

Another important finding was that many parts of the theoretical background are controversial in linguistic circles. Building a solid basis for further research must be a very important part of every e-learning solution geared towards student self-education. Future approaches more directed toward learner communication can take advantage of this basis and provide a structure to help the students help themselves.

In conclusion, a complete solution including lesson content on the topic of IS has been developed. Based on the results of the evaluations, the module is well suited for the task of educating learners. Additionally, the module has been developed in such a way that it can be used as a framework and the lesson content as well as the quizzes can be exchanged independently of the module code, which makes it possible to create modules for other topics without further development.

E-learning at German Universities has the potential of changing the way students learn and provide a better learning experience than ever before while simultaneously not increasing costs. This work presents a fully functional solution an can additionally be used as a guide to implementing e-learning solutions. Not only does it present methods and didactic concepts,

[1] Specialist literature describes response rates between 10% and 90% (Bortz and Döring, 1995).

it also shows viable ways of using new technologies that learners and teachers alike are confronted with. This is achieved by means of a thorough theoretical, technological and practical assessment of the involved topics and the creation of an extendable, standards-conformant and solid application.

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Glossary

AAL **A**nytime **A**nywhere **L**earning.

API **A**pplication **P**rogramming **I**nterface.

Application Programming Interface A defined way to access a service. The use of a defined API makes it possible to use the service with third-party programs and to replace the service if necessary with a compatible one (using the same API) without having to change the programs using it.

CBT **C**omputer-**B**ased-**T**raining.

CFT **C**ognitive **F**lexibility **T**heory.

CLT **C**ognitive **L**oad **T**heory.

Computer-Based-Training Also known as CBL (Computer-Based-Learning). Training that is conducted exclusively via digital means. Usually the learning content is deployed via a data storage medium or via download. A special form of CBT is WBT, which does not deploy the content completely but serves it piece by piece (on the fly) by use of a web server. When referring to CBTs in this document, I exclude WBTs in order to create a distinction between centralized (WBT) and distributed (CBT) learning solutions.

CTML **C**ognitive **T**heory of **M**ultimedia **L**earning.

Extensible Markup Language A text based, human-readable standard for data interchange, derived from earlier SGML languages.

FAQ **F**requently **A**sked **Q**estions.

Frequently Asked Questions A list of question and answer pairs, that consists of the most frequently encountered problems. It is usually created to reduce the workload of the support-staff. In many cases contact to support directly is only possible after the FAQ has been searched by the user. See also KB.

Graphical User Interface The interface between computer and humans that is used to operate computer programs. GUIs are shown on a screen and use graphical elements, in contrast to text based interfaces..

GUI **G**raphical **U**ser **I**nterface.

HTML **H**yper**T**ext **M**arkup **L**anguage.

Hypertext Markup Language The text based language that is used to create web sites. The language is parsed and rendered by a browser. HTML is based on SGML and works by combining plain text with "tags" that are written in angle brackets and are interpreted by the browser in a special way. Example: Text in between opening and closing b-tags ("" and "") is rendered as bold.

i18n internationalization.

IE Microsoft **I**nternet **E**xplorer.

interface A set of rules in a programming language that describes a category of objects. All objects belonging to this category mus follow these rules (implement the interface). The rules define which functionality the object has to implement externally in order to belong to the category.

internationalization (i18n). The support of multiple languages and/or locales in Software development, i.e. the preparation of software for translation and use in different languages. Also known as localization ("l10n") or multilingualization ("m17n").

IS **I**nformation **S**tructure.

Java Virtual Machine The core component of the Java Runtime Environment. An application that can interpret and run compiled Java applications separated from other processes in the operating system. The virtual machine concept is used in order to be able to run the same compiled code on different hardware without the need of recompiling the application.

JavaScript A programming language based on ECMAScript. The standardized scripting language for use in Websites interpreted by Web-Browsers without additional plug-ins.

Javascript Object Notation A text based, human-readable standard for data interchange, based on the object declaration syntax used in JavaScript.

JSON **J**avascript **O**bject **N**otation.

JVM **J**ava **V**irtual **M**achine.

KB Knowledge **B**ase.

Knowledge Base A database consisting of problem descriptions and their respective solutions. A knowledge base is usually searchable by the user and its entries are tagged (indexed and connected to related terms). It is often used to create a self-support system for the users that is more extensive that an FAQ.

LEAR The **L**anguage **E**xpert's **A**dvanced **R**esources.

quiz A Quiz is a number of exercises that are shown to the user as a group. The quiz is also a unit for evaluation; questions belonging to a specific subject can be grouped together in a quiz and the ratio of correct answers in the quiz is considered the success-rate for the subject. Quiz is used as a synonym for "test" in this work.

RIA Rich **I**nternet **A**pplication.

Rich Internet Application A web application that shares many properties of desktop applications instead of being pure hypertext. Most RIA are written in Flash, JavaFX, Silverlight (via plug-in) or HTML5 (native browser support).

SOV See Word order.

SVO See Word order.

URL Uniform **R**esource **L**ocator.

User Experience ISO standard 9241-210 defines User Experience as: "a person's perceptions and responses that result from the use or anticipated use of a product, system or service", influenced by system, user and context of use.

User Experience Design A category term from the field of human-computer interaction, including visual design, information architecture, interaction design and usability. The goal of UXD is the optimal use of a product by the user.

UX User e**X**perience.

UXD User e**X**perience **D**esign.

WBT Web-**B**ased-**T**raining.

Web-Based-Training Like CBT but (usually exclusively) online. The training is accessed via a Browser and all learning units are stored on an HTTP-Server (Webserver).

Word order The order in which words are usually structured within a language. English for example uses mainly SVO, i.e. sentences are formulated in the order Subject — Verb — Object..

XML e**X**tensible **M**arkup **L**anguage.

ERKLÄRUNG

Hiermit erkläre ich, dass ich die vorgelegte

Magisterarbeit

selbständig verfasst und - einschließlich eventuell beigefügter Abbildungen und Skizzen - keine anderen als die im Literaturverzeichnis angegebenen Quellen, Darstellungen und Hilfsmittel benutzt habe. Dies gilt in gleicher Weise für gedruckte Quellen wie für Quellen aus dem Internet.

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Außerdem erkläre ich, dass die vorgelegte Arbeit zuvor weder von mir noch - soweit mir bekannt ist - von einer anderen Person an dieser oder einer anderen Universität eingereicht wurde.

Mir ist bekannt, dass Zuwiderhandlungen gegen diese Erklärung eine Benotung der Arbeit mit der Note "nicht ausreichend" zur Folge haben. Ich weiß, dass Verletzungen des Urheberrechts sowie Betrugsversuche strafrechtlich verfolgt werden können und dass, wer vorsätzlich gegen eine die Täuschung betreffende Regelung verstößt, ordnungswidrig handelt. Die Ordnungswidrigkeit kann mit einer Geldbuße bis zu 50.000 Euro geahndet werden. Im Falle eines mehrfachen oder sonstigen schwerwiegenden Täuschungsversuches kann außerdem eine Exmatrikulation erfolgen.

Heidelberg, den 19.12.2012 _____

Jens Himmelrath

Appendix A

Appendix

A.1 Figures and Tables

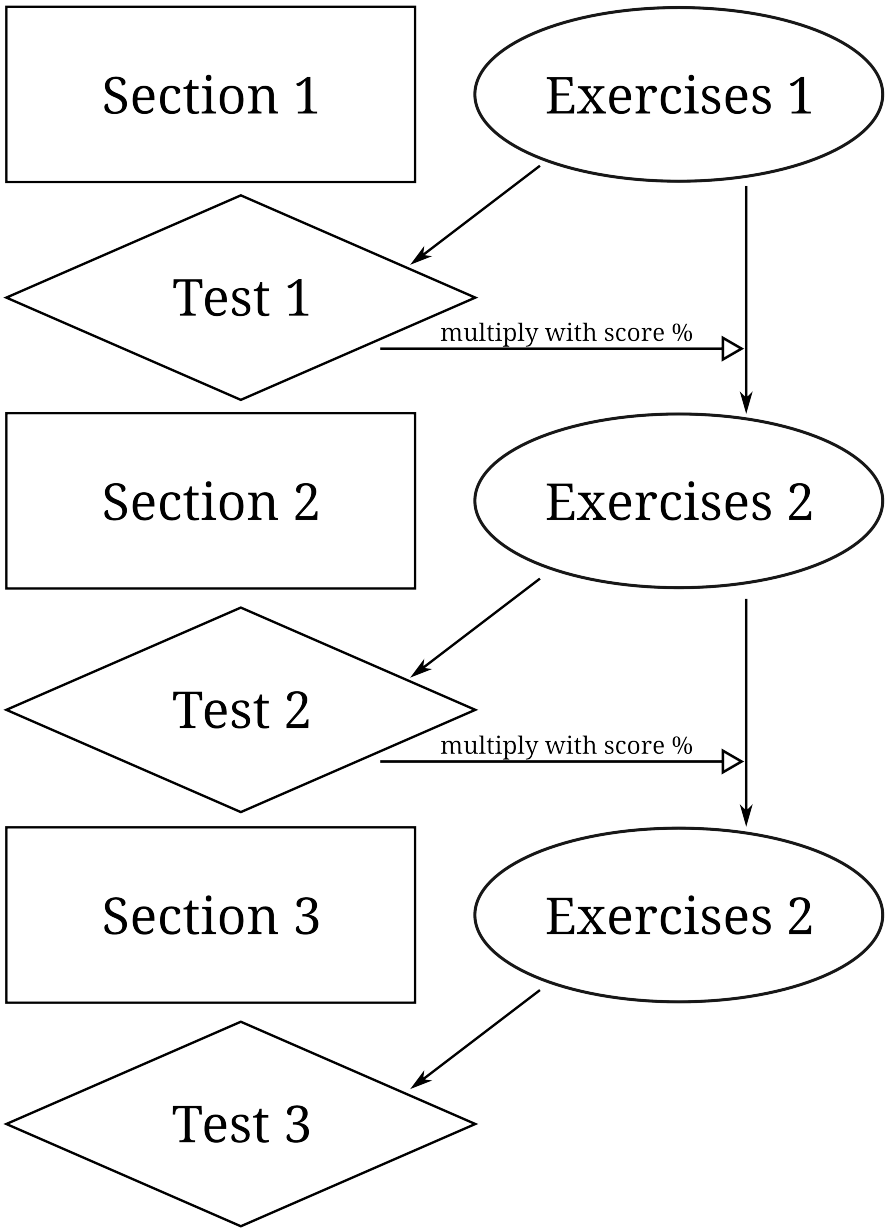

Figure A.1: Automated exercise repetition based on previous exercise scores

Figure A.2: Data structure of a simple quiz in JSON

```
{
    title : "Example Quiz",
    text  : "This is an example quiz, showing the data structure " +
            "needed for the storage of quizzes...",
    exercises : [{
      type    : "mc",
      title   : "Which is the unmarked focus?",
      text    : "Please select the sentence that has unmarked focus.",
      answers : [{
          text    : "We visited <b>the cinema yesterday</b>.",
          correct : true
      }, {
          text    : "We visited <b>the cinema</b> yesterday.",
          correct : false
      }, {
          text    : "<b>We</b> visited the cinema yesterday.",
          correct : false
      }],
      response : {
          wrong   : "Wrong. The unmarked variant is the one with " +
                    "either no discernible emphasis or emphasis on " +
                    "the last constituents.",
          correct : "Correct. The unmarked variant emphasizes the end " +
                    "of the sentence slightly."
      }
    }]
}
```

Figure A.3: Data structure of a simple quiz in XML

```
<?xml version="1.0" encoding="UTF-8" ?>
<quiz>
    <title>Example Quiz</title>
    <text>
        This is an example quiz, showing the data structure needed
        for the storage of quizzes...
    </text>
    <exercises>
        <exercise>
            <type>mc</type>
            <title>Which is the unmarked focus?</title>
            <text>
                Please select the sentence that has unmarked focus.
            </text>
            <answers>
                <answer>
                    <text>We visited <b>the cinema yesterday</b>.</text>
                    <correct>true</correct>
                </answer>
                <answer>
                    <text>We visited <b>the cinema</b> yesterday.</text>
                    <correct>false</correct>
                </answer>
                <answer>
                    <text><b>We</b> visited the cinema yesterday.</text>
                    <correct>false</correct>
                </answer>
            </answers>
            <response>
                <wrong>
                    Wrong. The unmarked variant is the one with either no
                    discernible emphasis or emphasis on the last
                    constituents.
                </wrong>
                <correct>
                    Correct. The unmarked variant emphasizes the end of
                    the sentence slightly.
                </correct>
            </response>
        </exercise>
    </exercises>
</quiz>
```

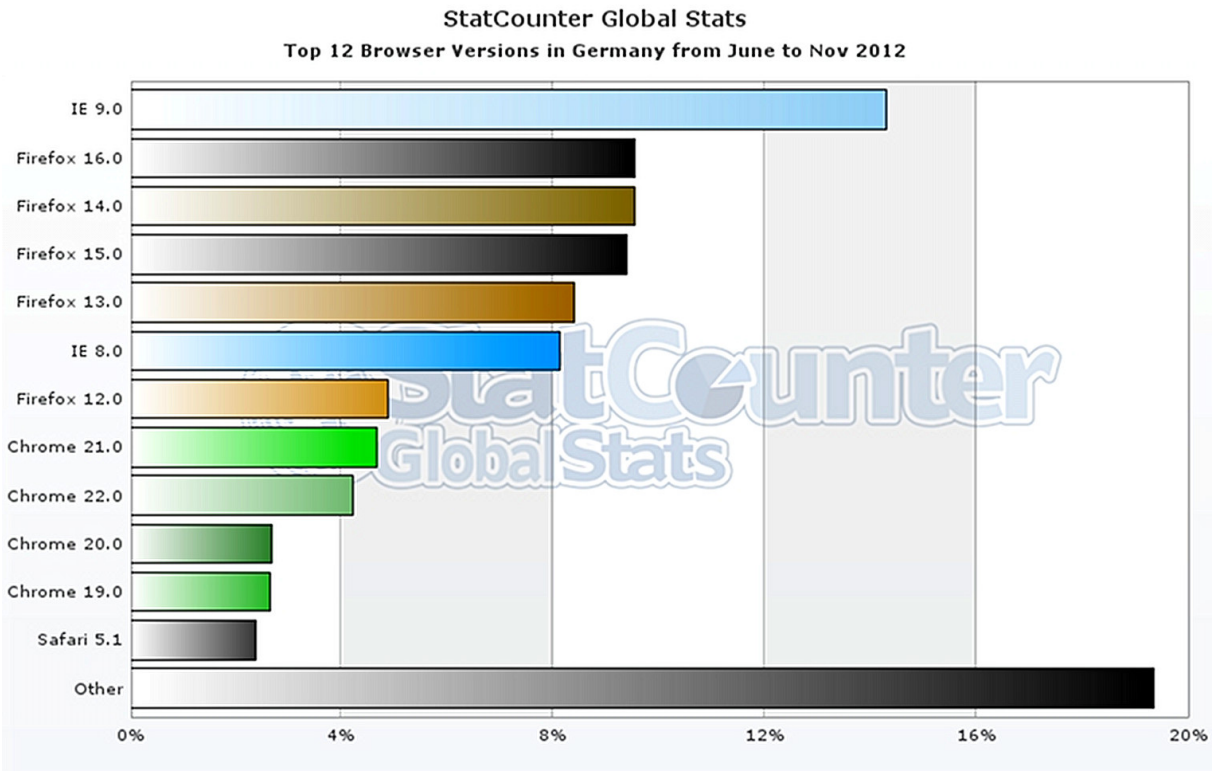

Figure A.4: Browser Versions active in Germany — June to November 2012

(Source: StatCounter Global Stats, 2012b)

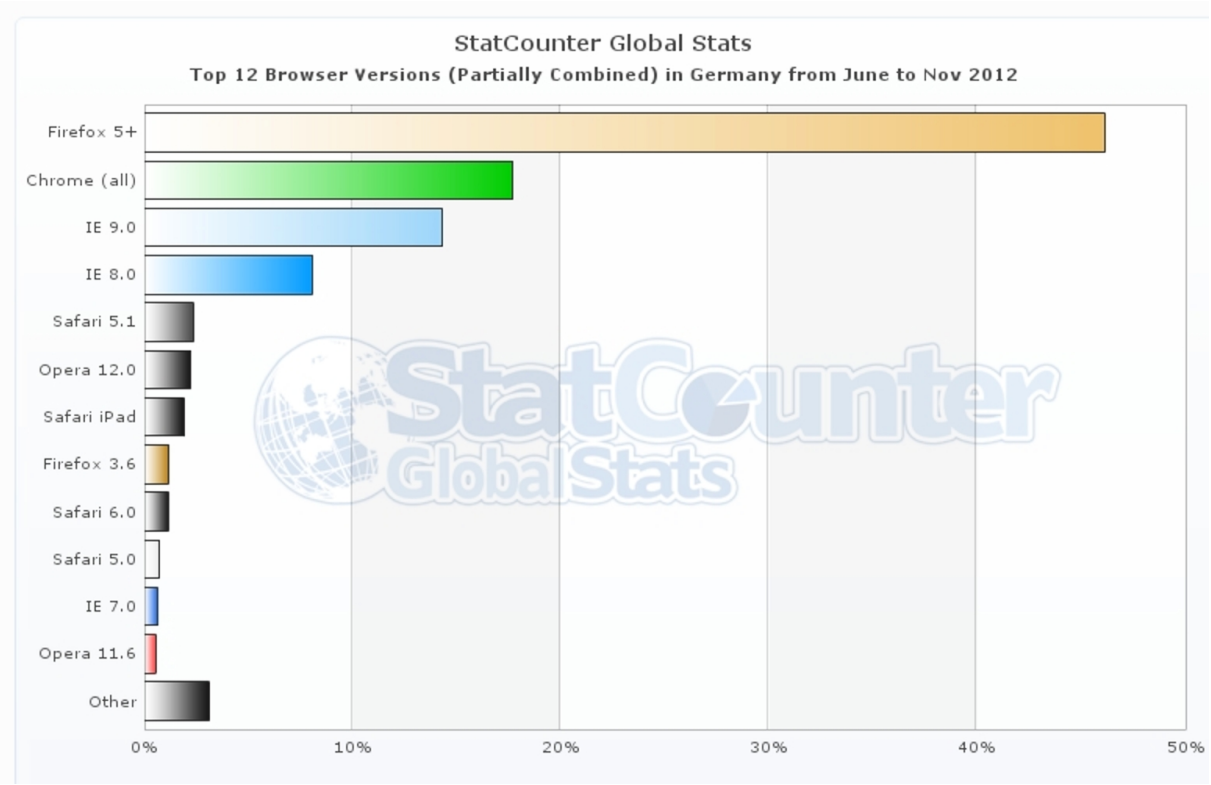

Figure A.5: Combined Browser Versions Germany — June to November 2012

(Source: StatCounter Global Stats, 2012b)

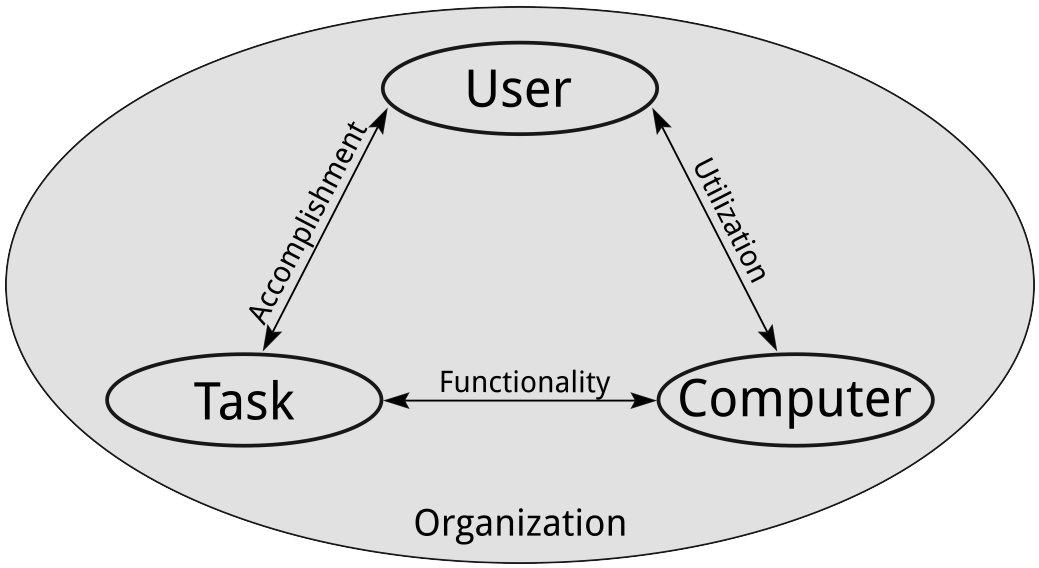

Figure A.6: Evaluation criteria model according to Baumgartner (2000)

Combined browser share Germany — June to November 2012

Table A.1: Germany*

Browser group	Share %
Firefox ≥ 5	46.14
Firefox < 5	1.88
Internet Explorer ≥ 8	22.40
Internet Explorer < 8	0.79
Safari ≥ 4	6.29
Safari < 4	0.03
Opera ≥ 9	3.12
Opera < 9	0.03
Chrome	17.81
Others	1.15
Compatible	95.76
Incompatible	3.09
Unknown	1.51

Table A.2: RWTH**

Browser group	Share %
Firefox ≥ 5	54.52
Firefox < 5	1.75
Internet Explorer ≥ 8	12.02
Internet Explorer < 8	1.03
Safari ≥ 4	9.50
Safari < 4	0.00
Opera ≥ 9	3.20
Opera < 9	0.00
Chrome	15.72
Others	2.28
Compatible	94.96
Incompatible	2.76
Unknown	2.28

* (Source: StatCounter Global Stats, 2012b)

** (Source: fIT-Website)

Table A.3: Browser compatibility test results

Browser	Version	Operating System or Device	Result
Desktop Browsers:			
Google Chrome	21	Linux 3.2.0	OK
Google Chrome	22	Linux 3.2.0	OK
Google Chrome	23	Linux 3.2.0	OK
Internet Explorer	8	Windows XP	OK
Mozilla Firefox	13	Windows XP	OK
Mozilla Firefox	14	Windows XP	OK
Mozilla Firefox	15	Linux 3.2.0	OK
Mozilla Firefox	15	Windows XP	OK
Mozilla Firefox	16	Linux 3.2.0	OK
Mozilla Firefox	16	Windows XP	OK
Mozilla Firefox	16	Windows 7	OK
Mozilla Firefox	17	Windows 7	OK
Mozilla Firefox	**17**	**Linux 3.2.0**	OK
Mozilla Firefox	17	Windows XP	OK
Opera	11.64	Windows XP	OK
Opera	12.11	Windows XP	OK
Mobile Browsers:			
Nokia BrowserNG	7.2	Nokia 5800	Usable
Android Browser	4.0	Asus Transformer Prime	OK
Android Browser	4.0	HP Touchpad	OK
Android Browser	4.0	Samsung Galaxy S II	Usable
Chrome Mobile	17	Asus Transformer Prime	OK
Chrome Mobile	17	HP Touchpad	OK
Chrome Mobile	18	Asus Transformer Prime	OK
Chrome Mobile	18	HP Touchpad	OK
Chrome Mobile	18	Samsung Galaxy S II	OK
Firefox Mobile	17	Asus Transformer Prime	OK
Firefox Mobile	17	HP Touchpad	OK
Firefox Mobile	17	Samsung Galaxy S II	OK
Safari Mobile	6.0	iPad II	OK

A.2 Module Lesson Texts

A.2.1 Lesson 1 - Einführung

Information Structure e-learning Modul

Willkommen beim "Information Structure" e-learning Modul des Instituts für Anglistik der RWTH Aachen. Im folgenden Modul geht es um das Thema Informations-Struktur in der englischen Sprache. Das Modul ist für fortgeschrittene Studierende gedacht und sollte erst dann benutzt werden, wenn sowohl die nötigen Sprachkenntnisse zur Verfügung stehen, als auch die Sprachkurse des Grundstudiums und die Grundkurse im Bereich anglistische Sprachwissenschaft absolviert wurden.

Es handelt sich um ein vollständig freiwilliges Modul. Für die Teilnahme werden keinerlei Zertifikate oder ETCS-Credits vergeben, es dient ausschließlich der Vorbereitung auf das Hauptstudium bzw. der Vertiefung im Bereich Informations-Struktur.

Themen

Das Modul ist (bis auf diese Einführung) vollständig auf Englisch und beschäftigt sich mit den folgenden Themengebieten in jeweils einer eigenen Lektion:

Information structure

Sentence structure

Information status

Emphasis and stress

Sentence structure change

Focus and markedness

Given and new

Focussing words

Zu jedem Themengebiet gibt es eine Lektion, auf die Übungen in Form eines Online-Quiz folgen. Diese Übungen werden nicht bewertet und die Ergebnisse bleiben geheim. Darüber hinaus sind Sie als Teilnehmer bei der Benutzung des Moduls vollständig anonym. Es werden ausschließlich anonyme statistische Informationen über die Anzahl der Teilnehmer und die Benutzungszeiten gespeichert (Derzeitig ist selbst diese Aufzeichnung nicht aktiv).

Benutzung des Moduls

Am oberen Rand der Seite ist eine Leiste mit Bedienelementen und Informationen. Hier können Sie sehen, wo Sie sich gerade im Modul befinden und zwischen den einzelnen Lektionen des Moduls navigieren. Wenn Sie zu einer bestimmten Lektion springen wollen, klicken Sie einfach auf den Lektionstitel in der Mitte der Leiste und wählen sie die Lektion aus dem dort erscheinenden Menü. Wenn Sie z.B. in einem späteren Teil des Kurses feststellen, dass Sie etwas nicht ganz verstanden haben, können Sie durch einen Klick auf das entsprechende Symbol zurück zur vorherigen Lektion wechseln.

Hilfe

Sie können überall, wo das folgende Symbol zu sehen ist, auf dieses klicken um Hilfe für die jeweilige Stelle zu erhalten:

Fachliche Hilfe gibt es für alle grau unterstrichenen Wörter durch einen Link auf die Definition. Sollten Sie so gekennzeichnetes Wort nicht kennen, klicken Sie einfach darauf und es öffnet sich ein neues Fenster mit einer Webseite, die den Begriff erklärt (z.B. Wikipedia). Sollten Sie ein Wort entdecken, dass Sie nicht kennen, welches aber nicht verlinkt ist, würde wir uns freuen, wenn Sie uns dies über ein anonymes Feedback mitteilen könnten, damit wir das Wort in Zukunft mit seiner Erklärung verlinken können.

Sollten Sie Probleme bei der Benutzung des Moduls haben, können Sie an folgenden Orten Hilfe bekommen:

Das LEAR-Projekt	Projekt-Webseite (Zugriff nur innerhalb des RWTH-Netzes möglich)
Ansprechpartner am Lehrstuhl:	Univ.-Prof. Dr.phil. Stella Neumann
Technischer Ansprechpartner: (Modulentwicklung)	Jens Himmelrath

Feedback

Damit wir das Modul immer weiter verbessern können, würden wir gerne von Ihnen wissen wie gut das Lernen mit dem Modul geklappt hat. Dafür gibt es am Ende des Moduls eine kurze, freiwillige Umfrage.

Zusätzlich gibt es am Ende jeder Lektion die Möglichkeit Feedback zu geben. Wenn Sie etwas nicht verstanden haben, klicken Sie auf das Feedback-Symbol in der Lektion und schreiben Sie Ihre Frage in das erscheinende Textfeld. Sie könne auch allgemeines Feedback über das gleiche Symbol oben rechts abgeben.

Sie können wählen, ob Sie das Feedback anonym abgeben wollen oder ob sie eine Antwortadresse eingeben, um eine individuelle Antwort zu erhalten. Anonymes Feedback kann von uns genutzt werden um das Modul zu verbessern oder - falls das Modul als Teil eines Kurses genutzt wurde - als Basis für eine Besprechung in einer der nächsten Unterrichtsstunden dienen.

Das Quiz

Jede Lektion endet mit einem kurzen Quiz, in dem Fragen zur Lektion gestelt werden. Quizze können überprungen werden indem man auf den Button klickt der zur nächsten Lektion führt. Wenn man eine Frage nicht korrekt beantwortet, merkt sich das Modul die Frage und stellt sie im nächsten Quiz erneut um einen Wiederholungseffekt zu erzielen. Die Speicherung der "falschen" antworten bleibt nur so lange bestehen bis der Browser geschlossen oder die Seite neu geladen wird und wird nicht gespeichert.

A.2.2 Lesson 1 - Introduction

Information Structure E-Learning Module

Welcome to the "Information Structure" e-learning module of the Institute for English Linguistics at RWTH Aachen University This module is about information structure of the English language. The module was created to suit advanced (German) learners of English and should be used when the appropriate language skills are available as well as the courses of the basic study period have been successfully completed.

The use of this module is completely voluntary — no certificates or ETCS-credits will be

made available for participating. The module can be used to prepare for the advanced study period and deepen the knowledge of information structure.

Topics

The Module will be completely in English (apart from this introduction, which is also available in German) and will cover the following topics:

Information structure

Sentence structure

Information status

Emphasis and stress

Sentence structure change

Focus and markedness

Given and new

Focussing words

There will be a lesson for every one of the above topics that will be followed by a small quiz. The quiz will not be graded and is completely anonymous. You as participant of this module are completely anonymous as well. We plan to collect anonymous statistical data about module use in the future (currently nothing apart from the feedback is being logged.)

Use of the module

At the top of the page, there is a bar which contains the controls and information about the current lesson. You can navigate to a specific lesson by clicking on the lesson title, or jump between the lessons by clicking on the previous and next buttons. If you want to navigate to a specific page, just click the page title in the middle of the navigation bar and choose the lesson you want to switch to in the drop-down menu. In case you did not understand and need to reread a lesson, you can always switch back to it later.

Help

Wherever you see the following symbol, help is available. Click on the symbol to get more information about the module.

Information concerning the terms used in this module are available via links that are underlined in grey. Whenever you do not know a word that is underlined in grey, click on it and a new window will open with a website containing the information. We tried to choose the most easy to use websites for this part and mainly rely on wikipedia — which we are sure you are familiar with. If you happen to find a term that you do not know that is not linked to an explanatory article, please send us an anonymous message containing the term in question so we can add an explanation to the module.

Should you encounter any problems while using the module, you can get help here:

The LEAR-Project	Project-Website (Access only allowed from inside the RWTH-Network)
Contact at the department of linguistics:	Univ.-Prof. Dr.phil. Stella Neumann
Technical contact: (module-development)	Jens Himmelrath

Feedback

In order for us to improve the module further, we would like to know about your learning-experience with this module. If you would like to help us, you can fill out a short survey at the end of the module.

Additionally, you can send us your feedback at the end of every lesson by clicking on the feedback-symbol. Just enter your question or suggestions into the field and press send. In case you want us to answer, you can choose to fill in your name and contact information. But even anonymous feedback helps us to improve the module. In case the module is used as part of a regular course, your anonymous feedback will be used as basis for discussion in the next normal lesson.

Quizzes

Every lesson ends with a short quiz, containing questions about the topic of that lesson. You can always skip a quiz by clicking on the "next lesson" button at the top of the page. If you do

not answer a question correctly the first time, the module remembers that question and asks it again in the next quiz in order to rehearse it. The information about which answers were correctly answered are only saved until the browser window is closed or the page is reloaded — the data is not saved anywhere else.

A.2.3 Lesson 2 - Information Structure

Information structure

This lesson will cover the basic ideas behind information structure and give an overview over the several phenomena that can influence the structure of information in sentences.

What does information structure mean? The short answer

The ways in which additional information, apart from the words used, is packaged into human language is called "information structure".

The long answer

Information structure is the sum of all linguistic phenomena that influence the packaging of information in human language. Whenever a sentence is uttered there are several ways in which and how it can be said. You can transport the same meaning using several different ways of forming a sentence. Even when using the same words in the same order, you can imply different meanings by changing stress and articulation.

There are grammatical and prosodic ways to change information status without changing the used vocabulary.

Whenever a word is written in **bold** in the examples, it means that the part is emphasized (or: stressed) by the speaker.

Let's take the following example sentence: "John bought two apples."
The meaning transported by this sentence can be expressed in several different ways. The information structure changes with each one of them - the sentence is on the left, a possible implied meaning on the right:

Utterance	Implied meaning
"John bought two apples"	(No special implication)
"**John** bought two apples"	"Not Mary, but John bought them"
"John **bought** two apples"	"He did not steal them"
"John bought **two** apples"	"He did not buy just one apple"
"John bought two **apples**"	"He did not buy oranges"
"It was John, who bought two apples"	"Not Mary, but John bought them"
"Two apples were bought by John"	(Speaker wants to talk about the apples, not about John)
"**Two** apples were bought by John"	(Speaker wants to talk about the apples, and their number is important)
"Two **apples** were bought by John"	(Speaker wants to talk about the apples, and it is important that they were apples)

The examples above use two main strategies to assign information status to parts of the sentence (also called "sentence constituents"):

- Emphasis (by stressing the words)
- Changing the word order

We can directly see how this uses two simple phenomena in the English language:

1. Whatever **is stressed** is important and
2. whatever **comes first** is important.

Essentially, that is what information structure is all about: **Assigning importance to parts of the message** and the implications that arise from that.

Comparison with German

Information structure is something that all languages have, this of course includes German. The examples above can be translated into German almost word for word.

- John hat zwei Äpfel gekauft
- **John** hat zwei Äpfel gekauft

- John hat **zwei** Äpfel gekauft
- John hat zwei **Äpfel** gekauft
- John hat zwei Äpfel **gekauft**
- Es war John, der zwei Äpfel gekauft hat.

There are differences between the two languages, though. We will tell you at the end of each lesson about the realization in German.

A.2.4 Lesson 3 - Sentence structure

Sentence structure

This lesson will cover the ways to divide sentences or clauses into two parts that describe their status in a sentence.

When talking about "sentences" and "clauses", we often mean the same. The difference is that "clause" is the grammatical unit: A sentence can consist of several clauses, but a clause can never contain several sentences.
Simple sentences, like most sentences used in our examples, only contain one clause - in that case we use the words "clause" and "sentence" to refer to the same text.

Sentence division

There are three popular ways to divide sentences in two parts:

Theme ⇔ Rheme
Topic ⇔ Comment
Focus ⇔ Background

Although these may overlap at times, they describe different roles that sentence constituents have in the discourse.

When you search for the above terms on the Internet or in the library you will most likely find differing and sometimes conflicting definitions. This shows that it is a relatively young and very active field of linguistics and not everyone in the academic community agrees on the theories behind information structure.

We can only explain one way of defining these terms in this module, but if you understand one definition, it will be much easier to understand the other ways of looking at the subject. Just remember when searching for it: Not everyone talks about exactly the same. Make sure you know which definition is used before jumping to conclusions.

Theme ⇔ Rheme

One of the first linguists to famously write about information structure was Michael Halliday, who called it "information packaging" in his articles "Notes on transitivity and theme in English", which were published in the Journal of Linguistics in 1967.

Halliday defines theme as the part of the sentence that comes first, the rest is the rheme. The constituent in the "initial position" is the one that defines the theme of the sentence, or in other words: What the speaker talks about. The rest of the sentence - whatever is not the theme - is called the rheme and contains what is being said about the theme. The concept is almost intuitive when thinking in terms of division into two opposing concepts: Whenever a sentence is uttered, it must be about something. In order to produce a meaningful message, something must be said about that. So whenever a theme exists, there must also be a rheme and it has to be be the rest of the sentence (or you encounter the next theme with its own rheme, in case of some complex sentences).

Topic ⇔ Comment

The distinction between topic and comment is very similar to that of theme and rheme. There are many different nuances between the definitions used when linguistic literature talks about topic and comment, which are all close to each other. Two main definitions are most important:

> **Familiarity concept:** The element that contains information that is familiar (known) the the discourse.
>
> **Aboutness concept:** The element that the sentence is about.

One could say that topic and comment are practically the same as theme and rheme in English — but their theoretical background differs significantly.
The familiarity concept works on a different level, the level of context with the abstract notion of available (known, familiar) information. The aboutness concept is much closer to

what we usually mean when using the word topic.
For now, we will use the word topic in the more intuitive way. In a later lesson we will talk about "new" and "given" information, which is basically what the familiarity idea is about.

Background ⇔ Focus

While the above two definitions are pretty fixed within the structure of the sentence — you cannot put the theme/topic anywhere but in the beginning of the sentence — focus and background have almost no such restrictions. Essentially, focus is the part of the sentence where the center of interest lies. Again, everything that is not focus is background. The speaker can place focus on almost any part of the sentence that he wants to emphasize (or, in other words: put into focus), either by stressing it or by changing the sentence structure to put it in a more prominent place. The speaker can even sometimes choose to put focus on more than one constituent in the same sentence, and even the same clause.
(Dont't worry if you have trouble grasping the concept now, we will explain focus in more detail in the next lessons.)

The sentence examples in the last lesson that only differed in respect to sentence stress provided perfect examples of focus use. By placing emphasis on a different constituent (a single word in this case), the speaker shifts the focus of the sentence:

- "**John** bought two apples"
- "John **bought** two apples"
- "John bought **two** apples"
- "John bought two **apples**"

While the other one basically changed the topic/theme by rearranging the words in the sentence so that "two apples" come first. Now they are the topic/theme instead of "John".

- "Two apples were bought by John"

The last two examples use both at the same time: They change topic/theme and assign focus. (Of course they could also have assigned focus to a different constituent.)

- "**Two** apples were bought by John"
- "Two **apples** were bought by John"

Different definitions

As mentioned in the grey box above, there are several views and opinions in the academic world, which can be very confusing at times. Often, as for example in this Wikipedia-Entry, the definitions are mixed and the different terms used as synonyms. In this case the authors make no distinction between "topic" and "theme" and the terms "comment", "rheme" and "focus". This is especially confusing since in this module, we define "focus" in a different way.

There is a very strong overlap between the definitions of "topic/comment" and "theme/-rheme". In practice the different ways of assignment usually lead to the same constituents in the sentence being identified as "topic" and "theme".

In the case of "focus", the definition used in this module is very different from the one in the above entry. While Wikipedia seems to define "focus" as a synonym for "comment", we will use a different and more variable definition. Focus is where the speaker puts the emphasis in the message.
The difference in definition: Focus can be freely placed in theory; in practice, it usually lies within the comment, but it does not have to be the entire comment it could also be just one small part thereof. Also: Sometimes there is more than one "focused" element in the sentence.

Knowing these differences is especially important when reading original literature about this subject; always keep in mind that a slightly different definition might be used when reading about it.

Comparison with German

Even though in German the word order is not as static as in English, the sentence structure with regard to Information structure is remarkably similar. While in German linguistics the terms theme and rheme ("Thema und Rhema") are the most popular ones, there is still a distinction between the different views. For our purposes, there are no differences between German and English in this respect.

John hat zwei Äpfel gekauft
Topik Kommentar

John hat **zwei** Äpfel gekauft
Fokus

A.2.5 Lesson 4 - Emphasis and stress

Emphasis and stress

The easiest, most simple way to emphasize a part of a sentence in spoken English, is to put stress on it. Stress is realized in English mostly through pitch accent - just try emphasizing a single word like in the following sentence - you will use pitch accent:

- "You want me to do **what**?"
- "Are you sure **Jenny** was at the beach yesterday?"

By using stress in a sentence, we can (of course) not change the sentence structure. Topic/-theme and comment/rheme stay the same when changing emphasis, the thing we can change this way is focus.

We already used this kind of highlighting throughout the module, since it is a very intuitive way to highlight information in spoken language. It works the same way in English as in German; this is why you most probably already know how to use it. This lesson will explain it a bit more - if you learn something completely new, consider going through the earlier lessons again afterwards.

Focus through stress

Imagine for example the following sentence with stress on the word in bold:

- "The guy was **really** angry at me."

If you read it out aloud and try to imitate the stress on "really", you will hear the difference. Now try reading the same sentence twice, once without stress and once with:

- "The guy was really angry at me."

- "The guy was **really** angry at me."

You will most likely know the difference in meaning between the two sentences from your experience with the English language: The first one could be followed by something like "but it wasn't a big deal", while that would be unlikely with the second one.
By putting the emphasis on "really", the speaker basically says that "really" is the most important part of the sentence information and thereby carries special meaning.
The following dialog shows how this might be implemented in actual speech:

- A: "The guy was really angry at me."
- B: "But he won't bear a grudge."
- A: "No, he will. The guy was **really** angry at me."

The word "really" is the important part, in this case it is the contrastive focus of the sentence: Speaker A wants to correct the impression in speaker B that the anger is not a big deal, he uses focus to highlight the information that contrasts the information that is available to speaker B in the discourse. (This is also sometimes called "corrective focus", since a previously available, wrong information is corrected.)

Focus placement

Focus is usually placed towards the end of a sentence, that's why some linguists tend to use "comment" and "focus" interchangeably in some situations. By putting emphasis on a different constituent than the last one, we can shift the focus.

In the examples, we will use square brackets to mark groups, and put the following markers to the right of the group to describe it:

- "**t**" for topic, "**c**" for comment,
- "**th**" for theme, "**r**" for rheme,
- "**f**" for focus, "**b**" for background.
- "**s**" for subject

Sarah **t** [went to the hardware store]**c, f**.

Sarah **t** [went to the [**hardware**]**f** store]**c**.

Sarah t, f [went to the hardware store]**c**.

In sentence 1, "Sarah" is the topic, while the rest of the sentence is the comment as well as the focus. In sentences that are not especially emphasized, the focus is naturally placed towards the end. In sentence 2, "Sarah" is the topic and we emphasized the word "hardware", which shifted the focus, while the comment stayed the same (the comment can now be referred to as the "focus domain"). This has the effect that the sentence now implies, that the important part of the message is the type of store Sarah went to. In sentence 3, "Sarah" is the topic, but because of the emphasis, she can also be seen as the focus. Now the implication is, that the important part of the message is the person who went to the hardware store.

The third sentence is a special case that is debated among linguists: The comment does not change compared to the first sentence, does that mean that it is a second focus? Does it lose its focus? Make sure to check the further reading section if you want to learn more about this.

Comparison with German

Even at this point, English is remarkably close to German. We use the same kind of stress in German to place focus, and we can use the same rules to emphasize any constituent we like.

- Du willst, dass ich **was** tue?
- Der Typ war **wirklich** ärgerlich auf mich.

Sarah t, f [ist zum Baumarkt gegangen]**c**.

-

A.2.6 Lesson 5 - Sentence Structure Change

Sentence structure change

We already know from the last lesson, that a sentence can be divided into different parts that have different information status. Let's try this with the distinction between "topic" (what is talked about) and "comment" (what is said about the topic):

If we take the sentence "Mary went to the beach", the structure is clear:

Mary **t** [went to the beach]**c**

"Mary" is the topic of the sentence — in other words, the sentence is about Mary. If we want to make the sentence about the beach, we will have to change the sentence structure so that the beach becomes the topic:

The beach **t** [is where Mary went]**c**

As you can see, the sentence still transports the same semantic content, but we now talk about the beach instead of Mary.

But why is it important to have this kind of distinction? Compare the following sentence pairs:

The circus **t** [was at the beach]**c**

It **t** [was the most beautiful thing I've ever seen]**c**.

The beach **t** [is were the circus was]**c**.

It **t** [was the most beautiful thing I've ever seen]**c**.

Now ask yourself what did the speaker describe as beautiful? In the first example, he is talking about the circus, so the reference "it" in the second sentence points to "the circus". Since "it" is the topic of the second sentence, they must refer to "the circus" when describing it as beautiful. In the second example "the beach" is the topic of the sentence, that is referred to by "it" in the second one. This time they talk about the beach being beautiful.

Topic and subject

You might have noticed, that the above examples not only changed the topic of the sentence, but also the (grammatical) subject. The topic, however, does not need to be the subject of the sentence. Let's use a really simple example:

Mary **t, s** [saw John]**c**

The word "Mary" is the topic as well as the subject of the sentence. In order to make John the topic of the sentence, we can put him to the front like we did before:

John **t, s** [was seen by Mary]**c**

"John" is now the topic and the subject — but we can also change the sentence so that he becomes the topic while keeping Mary as the subject:

As for John **t**, [[Mary]**s** saw him]**c**

Cleft sentences

A very productive way to change the information status of a sentence constituent in English is to create a cleft-sentence. The most used cleft-constructions in English are it- and wh-clefts, named after the words they start with. It-clefts begin with the word "it" followed by a form of to be — as in "It was John who called yesterday"; wh-clefts start with "what", "who", "where", "when" or "why" followed by a verb, describing an action — as in "What Amy bought yesterday was a car."

Compare the following sentences:

- William was caught stealing from the register.
- It was William, who was caught stealing from the register.
- It was the register, that William was caught stealing from.
- It was stealing from the register, that William was caught doing.

By using an it-cleft, we can move almost any constituent. We can do the same with actions using a wh-cleft:

- What happened to William, was being caught stealing from the register.
- What William was caught doing, was stealing from the register.

It is also possible to use wh-clefts in reverse:

- Being caught stealing from the register, is what happened to William.
- Stealing from the register, is what William was caught doing.

There are more ways to create clefts, like the all-cleft and the there-cleft, but they are not as common as it- and wh-clefts:

- All William did, was steal from the register.
- And then there's the stealing William did.

Inversion and dislocation

Inversion works almost like cleft sentences, except that no special clause is needed to move the constituent. Inversion means, like the name suggests, that two constituents are exchanged, turned around or inverted. It is especially popular with questions:

- Peter will go.
- Will Peter go?
- Meg has finished it.
- What has Meg finished?

This works great with auxilliary verbs but not with others:

- Brian drank beer.
- * What drank Brian?

Dislocation means putting a constituent somewhere else — moving it from its original location. This works almost like an it-cleft.

- I love chocolate.
- Chocolate, I love.

- He said Thelma was a great teacher.
- Thelma, he said, was a gread teacher

Comparison with German

Finally! We found something that actually works differently in English than it does in German. Not much, though.

While in English we can only use **inversion** when working with auxiliary words, we can use full verbs in German as well.

- Are you Anna?
- Bist Du Anna?
- Kennst Du das e-Learning Modul?
- * Know you the e-learning module?

We cannot use inversion on full verbs, we will end up adding a full verb, and then it's not inverted anymore: "Do you know [...]".

Btw: English didn't always have this restriction — Shakespeare used the non-auxilliary inversion in a few of his plays. But using it is considered wrong today.

- * Think you so, sir? [The Winter's Tale - Act IV. Scene 4.]

A.2.7 Lesson 6 - Focus — Markedness

Focus - Markedness

This is the central lesson of the module. While the concepts of topic and theme are relatively static, focus is a much more dynamic aspect of language.

What is focus?

Focus literally means "fireplace" (in Latin), which is the point where it is the hottest, figuratively speaking the place where things are happening, the point with the most attention. In

linguistics this means the part of the sentence where attention is drawn to by the speaker - the emphasized part.

How is focus achieved?

Again: The definition of focus used here may not be the same as in the literature you read. Please keep that in mind.

Emphasizing a part of a sentence can be done in several different ways. These different ways and how they affect the message transported by the sentence will be the subject of the rest of this module.

Markedness

The main principle behind conveying special information is the idea that there is a standard way of saying things. Whenever a speaker applies a non-standard way, there must be a reason. This reason can be, that he wanted his sentence to be more beautiful, but outside of poetry (in real world conversations), this is usually not the main purpose.

Linguists call the standard-form "unmarked" and everything else "marked".
The basic idea is: The unmarked form is the most common, most known and therefore most familiar form of a sentence. Whenever a speaker puts "extra work" into building a sentence differently, there must be a reasons. That reason usually is a difference in (implied) meaning.

Marking through stress

In the case of focus in English, unmarked focus is at the end of a sentence. This means that if you read a sentence out loud and try not to place any (unusual) stress on it, the stress falls on the last constituent. When you highlight a different constituent by stressing it, this makes the sentence/focus marked.
So in practice the following sentence pairs should not differ much: (At least if you do not go over the top with the stressing of the bold parts.)

- I am leaving my current job next month.
- I am leaving my current job **next month**.
- Mary is a very intelligent woman.
- Mary is a **very intelligent woman**.

Another way to see if a sentence is marked is to look at it in different contexts. The sentence with unmarked focus can be used in several different contexts, for example as different questions:

- What are you currently doing?
- I am currently writing my first book.
- When did you write your first book?
- I am currently writing my first book.
- How many books have you written?
- I am currently writing my first book.

Now compare that to a variant with marked focus:

- What are you currently doing?
- I am **currently** writing my first book.
- When did you write your first book?
- I am **currently** writing my first book.
- How many books have you written?
- * I am **currently** writing my first book.

As you can see, the marked version of the sentence above can not be used in as many contexts as the unmarked one. The emphasis on "currently" makes this variant only usable in situations where communicating the information about the time of writing is the primary goal, in all other cases it would at least be strange to answer in that way.

Marking through sentence change

Stressing a constituent is not the only way a sentence can be marked and focus can be assigned. Here are some examples of unmarked sentences and their marked counterparts. When analyzing them in a formal way, both basically transport the same semantic content, though in practice they can mean quite different things:

- John stole the car.
- It was John, who stole the car.
- Samantha worked really hard last year.
- As for Samantha, she worked really hard last year.
- Donna drank too much last night.
- Donna did drink too much last night.

As you can see, without adding any words with additional semantic value, we can highlight certain aspects of the message. "John stole the car" does not only imply but directly means that "it was John", who stole the car - but actually using this construction in the sentence adds information to the sentence; in this case the extra information is most likely, that it was not someone else. This principle also applies in the second example.

The same works for the added "did" in the last sentence (it is called "emphatic do"): "Donna drank" literally means that she did something in the past and that was to drink. But putting the "do" in front of the actual verb describing the action, emphasizes it, marks it as important.

To summarize:

1. Unmarked focus is the standard form.
2. Unmarked focus is end-focus.
3. Sentences can be marked by stressing a constituent.
4. Sentences can be marked by changing the position of a constituent.

Comparison with German

And back again to being the same in both languages. Focus is mainly realized through stress — and that is the reason why it is used the same way in so many languages: If the language itself does not rely on stress to distinguish between different words (like for example many Asian languages do), it can be used to emphasize.

English does not use stress to distinguish between words (it does in special cases, but not

enough to rely on it — for example the noun "**ob**ject" vs. the verb "to ob**ject**"), and neither does German, which means stress can be used to focus.

- Was macht du derzeitig?
- Ich schreibe **derzeitig** an meinem ersten Buch.
- Wieviele Bücher hast du geschrieben?
- * Ich schreibe **derzeitig** an meinem ersten Buch.

The same holds true for clefts, but we already talked about that in one of the lessons before this one.

- It was John, who stole the car.
- Es war John, der das Auto gestohlen hat.

A.2.8 Lesson 7 - Focus — Given and New

Focus - Givenness

So why do we use focus? If two sentences using the same words, one with and one without focus, contain the same semantic values, couldn't the hearer figure out the message without it?

The answer is relatively simple: Yes, they probably could. But it wouldn't be as easy.

Making it easy for the hearer to understand a message is an important part of the unspoken agreement between participants of normal conversations. There might be situations where this does not apply, but usually a conversation is meant to exchange information, which makes it important that the other participants are able to correctly interpret your words. If we imagine a conversation in a crowded room with a lot of background noise, which makes the conversation hard to understand, it immediately makes sense why someone would put special emphasis/stress on a specific part.
Lets imagine the following conversation:

- A: "The **car** is on the **bottom of the lake** now."
- B: "Did **Jane** drive the car into the lake?"
- A: "**It was John**, who drove the car into the lake."

Now imagine you were part of the convesation and could only hear the emphasized parts, could you still follow the conversation? And do you think you could without the use of focus highlighting?

- A: "... **car** ... **bottom of the lake** ..."
- B: "... **Jane** ...?"
- A: "**It was John**, ..."

But even in situations where every part of an utterance can be perfectly understood, this strategy helps to make the message easier to parse for the recipient, which usually makes the conversation more enjoyable.

Information status

So what needs to be highlighted in conversation? Everything the other side already knows does not need to be highlighted, because the information is already there. This means we only need to highlight information that is new. By deciding what is highlighted, we assign information status to the highlighted constituent. We practically say, "this is new information, pay attention to this part".

In linguistics this is referred to as "new information" and "given information". This distinction is made on the discourse-level and might even include contextual information that is beyond the current discourse, but known by the speaker to be "given" for the addressee of their message. Take a conversation between two people who both know "Mary", who had been in a car accident. Now compare the following two conversations:

- A: "Did Mary drive the car?"
- B: "The car was driven by **John**."

- A: "Did Mary drive the car?"
- B: * "The car was **driven** by John."

The second one sounds strange. But why is that? Speaker A asks for the driver of the car, which means that this information in the answer will be new to him, while the fact that the car was driven is (obviously) given. Speaker B answers and correctly highlights the new information in the first example. In the second example he highlights given information, which makes no sense according to the agreement we mentioned above - and that's why it does not help us to understand the message and sounds strange.

Given vs. new

It is important to understand on which level the differentiation between given and new works. While "John" might be "given" in the sense that everyone knows who is meant or, in other words, what being is referred to by "John", the information that he was the driver is not given. One could say that the information that John drove the car is "new", but we already know that *someone* drove the car, so only the "John"-part really remains as new and therefore "worthy of highlighting".

The above example shows that it is a smooth transition between what can be considered given and what is new. The isolated example above might sound completely wrong, but it might make sense in a special context. Imagine the following exchange:

- A: "Did Mary drive the car?"
- B: "The car was **driven** by John. **Mary** navigated, though."

In this case "driven" gets the status of "new" information, because speaker B plans to extend the message in a second sentence. They use the second sentence to make the point that although John drove the car the blame cannot be assigned to him alone.
The whole answer is only explainable using contextual information: B could have just answered the question, indicating John as the driver. By adding the extra message about Mary's part, B answers to an assumed implication in A's question. This assumed information in A's question makes it possible for B to highlight a part of the answer that would not make sense

otherwise.

Usually speaker B would not shift the focus to "driven", but use stress on both constituents. We just used the unusual highlighting to make a point, it is more likely to appear in a real-world conversation like this:
"The car was **driven** by **John**."

A "strange" focus placement usually points towards additional information. There are basically three explanations for this kind of "strange" focus:

1. The speaker does not have sufficient language skills.
2. The speaker made a mistake.
3. The speaker wants to allude to additional information.

All three cases can be resolved by asking questions. The above conversation might have gone like this:

- A: "Did Mary drive the car?"
- B: "The car was **driven** by John.
- A: (irritated) "What do you mean?"
- B: "Well, he **did drive** the car, but **she** was navigating.

Comparison with German

German and English are so much alike. Why did we need so long to learn it? :-)

Again, in German, as in English, information can be "given" or "new" in the discourse. Given information does not need to be highlighted, while new information should be.

- Hat Mary das Auto gefahren?
- Das Auto wurde von **John** gefahren.
- Hat Mary das Auto gefahren?

- * Das Auto wurde von John **gefahren.**

Even the part about implication works the same in German. Whenever a part that seems to be given is highlighted and the speaker did it intentionally, it means that it is in fact not given:

- Hat Mary das Auto gefahren?
- Das Auto wurde von John **gefahren**. **Mary** hat allerdings navigiert

A.2.9 Lesson 8 - Focus particles

Focus particles

The English language has several mechanism of assigning focus. Some words automatically assign focus in a sentence.

When reading a sentence that uses a focus particle, we automatically adjust the stress to match the focus. Read the following sentences out aloud and watch your pronounciation. What part do you emphasize?

- "He did not look at the picture."
- "He did not even look at the picture."

The word "even" in the second sentence acts as a focusing word — like a sentence-lens — and shifts the focus from the standard "look at the picture" to a more specific "look". The message changes from a relatively neutral statement to one with a strong implication: The "did not even"-part means that he also did not do anything else and is generally used to imply a resentment about it.

These words, also called "focus particles" or "focalizers", modify the meaning of other constituents in the sentence — usually the one directly after them — and draw focus to them.

- Even **Martha** took pictures of the show.
- Martha even **took** pictures of the show.

- Martha took even **pictures** of the show.
- Martha took pictures even of **the show**.

They can be used in combination with stress; they do not create a binding rule about where to put stress, but interact with it. Consider the following sentence and how you would put the stress:

- Bill ate only two apples.

The focus particle "only" shifts the focus to "two apples", most likely you would have pronounced it accordingly. Now compare the following three versions of the sentence:

1. Bill ate only **two apples**.
2. Bill ate only **two** apples.
3. Bill ate only two **apples**.

Our focalizer "only" keeps its function in all three examples of this sentence. In the second and third one, additional information is implied by stressing specific constituents of the sentence: Sentence 2 implies that the number of apples eaten by Bill is important, while in sentence 3, the kind of fruit is assigned importance by the speaker.

Focus adverbs

Most of these words are adverbs and can be categorized by the semantic modification they apply to a sentence. The following table shows a list of focus adverbs and their category:

Addition:	also, as well, too, even
Limitation:	alone, not only, but, only, exactly, precisely, just exclusively, purely, simply, merely, solely
Partial Limitation:	chiefly, primarily, at least, mainly, especially, mostly, in particular, notably, particularly, for the most part
Negation:	neither / nor
Choice:	either
Surprise:	even

Emphatic do

Another often used word that modifies focus in a sentence is the so called "emphatic do". The difference between a normal "do" and an "emphatic do" is, that the emphatic do is inserted into a sentence when it is not needed grammatically. Compare the following sentences:

- I brought out the trash this morning.
- I *did* bring out the trash this morning.
- Kate checked the data before it was presented to the client.
- Kate *did* check the data before it was presented to the client.

The first sentence of each pair contains the normal (or unmarked) version of the sentence, the second one contains the "unneccessary" do, which sets focus on the following verb.
Emphatic do emphasizes the following verb by inserting the auxiliary verb "do" in front of it. While this extra verb is needed when negating an action — as in "He *did not* go" — it serves the special purpose of amplifying the following verb — as in "He *did* go".
Emphatic do can only be used to amplify action, it can not be freely placed like the focus particles in the examples at the beginning of this lesson.

Comparison with German

Last lesson. We finally have a difference between the languages again. While the focus particles are relatively similar in both languages, German has no emphatic do.

Most **focus particles** can be directly translated from English to German.

- Even **Martha** took pictures of the show.
- Sogar **Martha** hat Bilder von der Show gemacht.
- Martha took even **pictures** of the show.
- Martha hat sogar **Bilder** von der Show gemacht.

The main differences is that German has more focus particles than English, which leads to the problem that not all of them can be translated directly. Sometimes when in German a focus particle is used, the English translation has to contain a more complex construction.

Emphatic do is something that German does not know. English uses "to do" in combination with "not" to negate sentences, while German can simply use "nicht" with the original verb.

- Ben did not go to the cinema.
- Ben ging nicht ins Kino.
- We did not drive to Aachen yesterday.
- Wir fuhren gestern nicht nach Aachen.

As a result, the positive use of "to do" in English can have its own meaning. This would have been possible in German as well (and is used in some colloquial forms in local dialect), but did not become part of "Hochdeutsch".

- Ben did go to the cinema.
- Ben ging (wirklich) ins Kino.
- We did drive to Aachen yesterday.
- Wir fuhren (wirklich) gestern nach Aachen.

A.3 Quiz Template (JSON)

```
{
    title : "QUIZ_TITLE",
    text  : "QUIZ_TEXT",
    exercises : [{
      type    : "mc", // Can be "mc", "mc!" or "mr"
      title   : "EXERCISE TITLE",
      text    : "EXERCISE TEXT",
      answers : [{
          text    : "ANSWER_1",
          correct : true
      }, {
          text    : "ANSWER_2",
          correct : false
      }, {
          text    : "ANSWER_3",
          correct : false
      }, {
          text    : "ANSWER_4",
          correct : true
      }],
      response : {
          correct : "CORRECT_RESPONSE",
          wrong   : "WRONG_RESPONSE"
      }
    },{
      type    : "mc", // Can be "mc", "mc!" or "mr"
      title   : "EXERCISE TITLE",
      text    : "EXERCISE TEXT",
      answers : [{
          text    : "ANSWER_1",
          correct : true
      }, {
          text    : "ANSWER_2",
          correct : false
      }],
      response : {
          correct : "CORRECT_RESPONSE",
          wrong   : "WRONG_RESPONSE"
      }
    }]
}
```

A.4 Evaluation Questionnaire

Fragebogen

Willkommen zur Evaluierung des e-Learning Moduls.

Creating an information structure e-learning module for advanced German learners of English

Vielen Dank, dass Sie an dieser Evaluierung teilnehmen. Im folgenden Fragebogen haben Sie die Möglichkeit Ihre Meinung zum Modul abzugeben. Ihre Rückmeldung wird ausgewertet und in das finale Modul einfließen.

Worum geht es?

Im Modul haben Sie etwas über das Phänomen "Information structure" im sprachwissenschaftlichen Zusammenhang gelernt. Wir würden nun gerne von Ihnen wissen wie Sie das Modul fanden. Sie sollen uns im folgenden mitteilen ob Sie den Aufbau des Moduls und den Inhalt mögen, ob Sie die Bedienung und das Design mochten, ob Sie etwas gelernt haben oder der Inhalt zu schwer war, oder ob Sie gar Fehler endtdeckt haben.

Zielgruppe

Das Modul richtet sich in erster Linie an Deutsche Muttersprachler, die Englische Sprachwissenschaft studieren und bereits Vorkenntnisse mitbringen. Leider ist diese Eingrenzung aber nicht sonderlich spezifisch und Vorkenntnisse schließt viele Unterschiedliche Wissensstände ein.

Um diese verschiedenen Wissensstände abzudecken, richtet sich dieser Fragebogen an:

- Studienanfänger mit Englischvorkenntnissen
- Studierende der Englischen Sprachwissenschaft
- Akademiker mit abgeschlossenem Sprachwissenschaftsstudium
- Englische Muttersprecher

Universität

Das Modul wird im Rahmen einer Abschlussarbeit am Institut fuer Anglistik, Amerikanistik und Romanistik am Institut Anglistische Sprachwissenschaft unter der Leitung von Univ.-Prof. Dr.phil. Stella Neumann entwickelt.

Ansprechpartner

Sollten Sie Fragen oder Probleme haben, können Sie mich jederzeit kontaktieren:

E-mail: jens@himmelrath.net

Telefon: 06221 - 187 11 15

0163 - 597 80 13

Der Fragebogen sollte nicht mehr als 10 Minuten in Anspruch nehmen.

Bitte füllen Sie die im Fragebogen angegebenen Felder aus und klicken Sie auf "weiter". Wenn Sie die letzte Seite des Fragebogens erreicht haben, können Sie den Fragebogen über den Button "Senden" abschicken. Über den Button "zurück" können Sie zur vorherigen Seite zurückkehren um Ihre Antworten zu ändern.

Ihre Antworten werden anonym gespeichert und ausgewertet, es gibt nach dem Abschicken des Fragebogens keine Möglichkeit ihre Daten zu identifizieren und nachträglich zu ändern.

Persönlicher Hintergrund

Ich bin...

( ) kein Experte

( ) Student Sprachwissenschaft (Grundstudium)

( ) Student Sprachwissenschaft (Hauptstudium)

( ) Sprach-Experte (Dozent, Lehrer, Übersetzer, etc)

Ich habe Erfahrung mit e-learning:

( ) Keine

( ) Wenig

( ) Viel

Fall ja, womit?:

Bitte zutreffendes wählen:

Ich benutze Computer...

( ) ...jeden Tag.

( ) ...manchmal.

( ) ...selten.

( ) ...nie/fast nie.

Ich benutze das Internet...

( ) ...jeden Tag.

( ) ... manchmal.

( ) ...selten.

( ) ...nie/fast nie.

e-Learning

Es ist eine gute Idee, dass Universitäten e-Learning Module anbieten:

( ) Ja

( ) Nein

Wenn nein, warum?

Wie würden Sie ihre e-Learning Erfahrung mit diesem Modul beschreiben?

( ) Sehr gut

( ) Gut

( ) Neutral

( ) Bin verwirrter als vorher

Wie würden Sie ihre Lernerfolg mit diesem Modul beschreiben?

( ) Sehr gut

( ) Gut

( ) Keiner

( ) Bin verwirrter als vorher

Didaktik

Haben sie alles verstanden?

( ) Ja

( ) Nein

Fall nein, was nicht?

Waren die Quizfragen zu schwer oder zu einfach?

( ) Zu schwer

( ) Zu einfach

( ) OK

Wie bewerten sie die Erklärungen im Modul?

( ) Sehr gut

( ) Gut

( ) Ausreichend

( ) Schlecht

Falls die Erklärungen nicht gut waren, was kann verbessert werden?

War der Inhalt gut strukturiert?

( ) Ja

( ) Nein

Falls nicht, wie könnte man es verbessern?

War der Inhalt verständlich?

( ) Ja

( ) Nein

Falls nicht, wie könnte man es verbessern?

Hätten sie weitere Hilfe benötigt, als die im Modul verfügbare?

( ) Ja

( ) Nein

Falls ja, wobei?

Ist ihnen sonst noch etwas negativ aufgefallen?

Ist ihnen sonst noch etwas positiv aufgefallen?

Technik:

Sind technische Probleme bei der Benutzung des Moduls aufgetreten?

( ) Ja

( ) Nein

Falls ja, welche?

Hat das navigieren durch die Lektionen problemlos funktioniert?

( ) Ja

( ) Nein

Falls nein, was funktionierte nicht?

Wie bewerten sie die Geschwindigkeit des Moduls?

( ) Sehr gut

( ) Gut

( ) Ausreichend

( ) Schlecht

Wenn nicht gut, was störte?

Design:

Wie bewerten Sie Navigation?

( ) Sehr gut

( ) Gut

( ) Ausreichend

( ) Schlecht

Falls nicht gut, was könnte man verbessern?

Waren die Links zu Erklärungen leicht genug erkennbar?

( ) Ja

( ) Nein

Falls nein, wie wäre es besser?

Gefällt ihnen das Design insgesammt?

( ) Ja

( ) Nein

Falls nein, was gefiel Ihnen nicht?

Generell:

Gibt es noch etwas was sie abschließend anmerken möchten?

A.5 Thanks and Acknowledgments

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Oliver Twardowski
`http://www.addictedtocoffee.de`
`http://www.smashingmagazine.com/`
	Flags for language selection

Sebastiaan de With `http://www.icondesigner.net`	Feedback Icon
Oxygen Team `http://www.oxygen-icons.org/`	Previous/Next Buttons
`http://preloaders.net/`	Preloading animations used in this module