

Lund University
LUCS
Cognitive science 61-80p
D-paper
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SUBTITLING OR DUBBING?

An investigation of the effects from reading subtitles on understanding audiovisual material.

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Contents

SUBTITLING OR DUBBING?	1
CONTENTS	2
ABSTRACT	3
INTRODUCTION	4
IMPLICIT LANGUAGE ACQUISITION	6
HOW DOES READING WORK?	7
THEORIES OF ATTENTION	8
EYE MOVEMENT MEASUREMENTS	10
METHOD	11
<i>Material</i>	11
<i>Method for eye-tracking</i>	11
<i>The subjects</i>	11
<i>Procedure</i>	11
<i>Data processing</i>	12
RESULTS	14
DISCUSSION	16
RECOMMENDATION	17
REFERENCES	18
APPENDIX	FEL! BOKMÄRKET ÄR INTE DEFINIERAT.

Abstract

The world of today is characterized by enormous flows of various kinds of information. People are engaged in vast interactions, irrespective of nationality, culture or mother tongue. On the political scene an increased openness and extended international co-operation are obvious signs of the times. In Europe the co-operation within the EU, which soon is about to comprise more nations and thereby more languages, is developing.

The European year of languages 2001 is an initiative of the EU and The Council of Europe. The aim is to increase the linguistic diversity in Europe, promote multi-lingualism and to encourage life long learning of languages. The idea is to show what advantages and possibilities language skills can provide to work life and mobility throughout Europe. One of the most important principles of the 'Year of languages' is that language acquisition brings about understanding between people with different linguistic and cultural backgrounds. The more languages one masters, the better. Therefore it is interesting to examine how subtitling or dubbing of audiovisual material might effect the understanding of the material and perhaps also contributes to language acquisition.

An intuitive argument against subtitling and in favor of dubbing is that subtitling deteriorates the understanding of the material, when one continually moves ones gaze and attention away from the action and towards the subtitles. We wondered if subtitling in stead of dubbing could be assumed to exercise negative influence on the actual understanding/perception of coherence of audio-visual material such as movies and TV programs. In order to find out, we had seventeen subjects to watch the initial 28 minutes of the French movie 'Asterix and Obelix vs Caesar'. Half (9) saw a French spoken version with Swedish subtitles, and half (8) saw a version dubbed with Swedish speech. From eye-gaze measurements the amount of time spent on reading subtitles was calculated, and the data found make the foundation of a discussion on benefits and disadvantages with subtitling versus dubbing.

In the study it was found that less than five per cent of the time was spent on reading subtitles. In the discussion it is argued that the reading of subtitles does not exercise negative influence on the actual understanding of the material and that the use of subtitling contributes to an increased understanding of languages.

Introduction

One can measure how big a portion of the eye-gaze behavior that is spent gathering visual input for the reading of subtitles. That is what is done in this study. The data obtained is then used to show that it is plausible that the extent of the reading of subtitles doesn't lead to a negative influence on the actual understanding, for example through impact on the conscious awareness. We also want to point out positive effects from the usage of subtitling.

The argumentation throughout the paper is built on three themes. First, we want to show that the reading of subtitles can be automated, and thus avoid putting a considerable load on conscious awareness. Secondly we want to show that simultaneity of different cognitive activities doesn't necessarily mean that they impair each other, through interference. Finally, we also want show that language acquisition can take place under the conditions present during the watching of a subtitled film.

First come some definitions of concepts and reviews of important for the understanding of the paper and central to the discussion.

Dubbing means the replacement of a soundtrack for a new one, with a different language than the original.

Subtitling means that a text is shown together with visual material, such as a film. It usually consists of a written version of the lines found in the soundtrack. The language can either be the same as on the soundtrack, or a different one. Subtitling of the kind occurring in the film used in this study is usually done with white text on a black background, in two rows near the bottom of the picture, approximately at the same time the corresponding lines are heard on the soundtrack.

The purpose of dubbing and subtitling is usually to make audio-visual material available for a broader group of people. They are based on a translation of the original language into a new one. The extent of usage differs between different countries and to some extent also depending on the target groups. In some countries the use of dubbing is almost total, while in other countries subtitling is the main choice. For an example children and individuals with certain disabilities can't benefit from subtitling, as they do not master reading at an appropriate level. That brings about some dubbing in countries subtitling is the predominant alternative. Some examples of the extent of usage of dubbing and subtitling respectively:

	Cinemas	TV
Germany	<i>Dubbing</i>	<i>Dubbing</i>
Czech Republ.	<i>Subtitling</i>	<i>Dubbing</i>
Sweden	<i>Subtitling</i>	<i>Subtitling</i>

Table over the common use of subtitling and dubbing, respectively.

There is no simple answer to the question how dubbing or subtitling is experienced. The experience is dependent on several things, such as the degree of accustomedness to the method at use and characteristics of the contents of the material at hand. Some possible negative effects with the methods might be:

When dubbing is made to another language it often entails that the language sounds don't fit very well with the facial expressions of the actors. That can lead to an experience, conscious

or not, of slight confusion of the viewer. The effect can be reinforced by such circumstances as that the dubbed voices are recorded with actors who are not moving their bodies as the original actors or who's voices don't fit the original actor's build.

The reading of subtitles require some habitude not to be experienced as annoying, as it means that the focus of one's gaze repeatedly moves between the main actions in the pictures and the subtitles. Furthermore, such an aspect as defective synchronicity between the action, the soundtrack and the subtitles might entail a strenuous demand on one's attention. Difficulties with the reading in it self can also cause strain.

There is no certain limit for when a behavior (in this case the eye-gaze behavior aimed at reading subtitles) demands so much of its modality's perceptual or attentional capacity (or their contribution to conscious awareness), that it exerts a negative influence on the actual understanding of the material attended. One has to consider that reading of subtitles in the ideal case aim to aid comprehension. The relevant point is that there is a balance between the reading of subtitles and the watching of the action, i. e. all reading of subtitles is not negative for the understanding. It's often the other way around!

The consciousness is the domain of the mental apparatus that at a certain moment has access to sensations, perceptions and memories. It can denote the domain that has the possibility to experience. It is in the consciousness the core of understanding and experiencing of coherence take place. Therefore it is important that the consciousness is not loaded with unnecessary processing of information.

Vision is dependent upon the functioning of the eyes. The function of the human eye has been thoroughly investigated. Characteristic of human gaze-behavior is that the eyes move in special ways. During ordinary looking, the eye stands almost still and is for a short moment focusing what is located at the center of the visual field. It then moves quickly to a new so called fixation and so on. Movements of this kind are called saccades, and usually take less than ca 120ms. Their purpose is to move the center of the visual field to what the attention wants to examine the next. During the movements no new visual information is registered, and the input from the last fixation is kept until the saccade is finished and a new fixation begins. The fixations usually last for ca 200-600 ms. (Facts about eye movements from Glenstrup & Engell-Nielsen.)

Implicit language acquisition

There are many theories on how language acquisition works. Krashen (1982) has formulated a theory on second language acquisition called 'the monitor model'. It consists of five hypotheses. One of these hypotheses is built around a distinction between on the one hand *acquisition* and on the other *learning* of a language. Acquisition, the actual gaining of ability within a language, happens when we receive linguistic input that we can understand but do not yet master. The learning of a language, which does not lead to any practical competence, is the theoretical study of a language.

Another of the hypotheses claims that the acquisition of a language takes place only when we perceive comprehensible input, i.e. work with material within or very near our present level of competence.

Put together Krashen's theory means that an individual with basic competence in a foreign language can increase his practical ability for understanding as well as for production within that language through experiencing it in a comprehensible form. That is the case with simultaneous or alternating presence of the same information in one's native and a second language, for an example as with a soundtrack and subtitles.

Cognitive information process theory on second language acquisition proposes that human language acquisition is built around a gradual increase in competence and the level of automatism (McLaughlin 1987). The idea is that everything taking place in mental processes leads to habituation and therewith an increased level of automatism. Thus human linguistic communication is highly automated.

How does reading work?

Man has used different kinds of graphical signs for communicative means since very long ago. To read a modern written language consists of a highly structured and formalized task. These characteristics explain why reading can be seen as a routine job. Through extensive training and practice reading gets automated, so that it doesn't demand any conscious strain to be executed. As long as the syntax and the lexicon are both within the normal variation there is no problem. When accustomed patterns are violated there is immediately a substantial increase in the level of strain associated with reading.

The most common form of text in western languages is with black characters on a white background. That provides an excellent contrast, which aids rapid character recognition. For subtitling a black background with white text is often used. The visual contrast is still very good. The black background stripe in turn makes a good contrast to most backgrounds. There are no major differences between reading of texts on papers or, for an example, on a TV screen.

It is well known that perceptual, cognitive and processes under some circumstances can be performed effortlessly. A cognitive process that can be performed without a conscious effort can be called automated. That means that it through extensive practice has come to be a routine. A classical study is often used to show the automation of cognitive processes – Stroop's color-and-colorname-experiment (Stroop 1935). The experiment went like this: The subjects were asked to read aloud the names of colors. It was not the written word, but the color of the ink it was printed with, which was to be spoken. An example: 'Read' written in green ink should be read as 'green'. The result was either that the subject performed lots of errors, or that the responses were slowed down compared to normal reading. This is taken as proof for that automated responses characterize the reading of written words. The Stroop effect means that ordinary reading goes through automation.

Characteristic for automatic cognitive processes is, according to Posner and Snyder (1974, 1975), that they lack intentionality, that they happen outside conscious awareness and that they don't demand access to the limited resources available for controlled, higher mental processes. It is of importance for the argumentation in this paper that the capacity not used by the automated processes can instead be used to follow and keep track of the intrigue in a watched material.

Theories of attention

Attention is the part of perception controlling what stimuli and what interpretations of stimuli that shall be given room in the mental processing. On its way from detection of sensorial input to consciousness vast selection takes place. According to Reber (1995) attention is 'The selective aspects of perception which function so that at any instant an organism focuses on certain features of the environment to the (relative) exclusion of other features'. Further down we will get back to the 'relativity', because it is shown one sometimes seem to be able to percept more than one thing at a time.

It is common to make a distinction between those theories of attention concentrating on some kind of filtering of the signals that later reach consciousness and those that postulate a limited pool of mental capacity, which is to be allocated to adequate stimuli.

De former, so called filter theories, see attention as a filtering of information. Different findings suggest that different kinds of filtering can take place at different levels of the perceptual process. Vi will see that the filtering might mainly be concerned with what reaches conscious awareness. That is not the same as that nothing else is processed.

It seems like if some advanced processing can take place without conscious awareness until something in the information stream is considered relevant for conscious processing. Studies with dichotic listening has shown that if ones name is said in a otherwise unattended conversation, at the same time as one is consciously concentrating on another conversation, one can detect it anyway (Moray, 1959).

The other group of theories on attention, the capacity theories, claim that at every single moment there is a limited amount of resources available for conscious processing of information (Kahneman 1973). Simultaneous processes with few similarities compete only for the limited resources of awareness. Further, automated processes require less from conscious awareness than do processes demanding conscious control.

Wickens (1980) has proposed three dimensions for the division of mental resources. He wants to differentiate between auditive and visual perceptual modalities, perceptual and cognitive resources and, finally, between verbal and spatial process code. For each of these three dimensions it is claimed that two processes compete the more the closer they are to each other. The reading of subtitles is based on vision. The listening to the soundtrack is based on hearing. Thus they differ substantially at least in one of the dimensions. That makes it probable that one can experience both at the same time, without any serious interference, and undergo language acquisition.

Baddeley (1986) has proposed a model over working memory. It can be used to explain how attention and consciousness works. The model combines a multi capacity view on attention with a potential explanation of conscious cognitive processes. The model postulates different memory systems for different kinds of 'code' - an articulatory rehearsal loop for verbal process code, and a visuo-spatial scratchpad for spatial process code. These two functional systems are controlled by a third: 'The central executive'. The central unit initiates and supervises processes at the two subordinate systems, and can offer support when their limited capacities are fully used. The combined capacity of 'the central executive' can be seen as the amount of resources that is available for conscious, controlled cognitive processes. One can think of the two slave systems as responsible for the main interpretation of text and speech

respectively, and of the integration of stimuli, providing comprehension, as taking place in 'the central executive'.

Sharp vision is only present at a small area around the center of the visual field. The rest of the visual field is characterized by a lesser sharpness. That does by no means mean that things happening outside the center of the visual field are not registered or cognitively processed. Theeuwes (1993) says that the visual attention consists of two levels, a pre-attentive and a attentive. The pre-attentive is not controlled by conscious awareness, and operates over the entire visual field. Thus it can handle several simultaneous stimuli, and search for those who need to be investigated closer. The other, attentive, is controlled by conscious awareness and is limited to one or a few objects at a time. The normal function is that stimuli chosen by the primary, pre-attentive level are transferred to the secondary, attentive level, and that the gaze is moved so that the center of the visual field is pointed towards them. The point is that things happening outside central vision and also without conscious awareness are supervised and can get to enter consciousness. That is how one notices that there is subtitling in the bottom part of the screen while one is watching the action around the central parts of the screen, or the other way around that something happens in the action while one is reading subtitles.

Through experiments with negative priming it has been shown that stimuli not consciously attended are detected and even subject to semantic analysis. Tipper and Driver (1988) showed that not consciously attended pictures of objects exerted negative priming (slowed the response) on later showings of the corresponding words. That shows that also stimuli that has not been consciously attended undergo semantic analysis.

"The fact that processing and responding to attended visual stimuli are often unaffected by the nature of distracting or unattended stimuli has suggested to many theorists that there is very little processing of unattended stimuli. However, the phenomenon of negative priming indicates that this conclusion is unwarranted. It is probable that there is generally at least some processing of the meaning of unattended visual stimuli, but that this processing often does not disrupt responding to attended stimuli." From Eysenck & Keane, (1995), s103.

Thus it seems like a pointing of the center of the visual field towards subtitles doesn't mean that what happens on the rest of the screen is completely missed and not registered at all. It doesn't matter that some happenings take place in the peripheral parts of the visual field or without conscious recognition. They can still contribute to the understanding of the material.

Eye movement measurements

As mentioned above human visual behavior is characterized by different kinds of movements, which combine with fixations. Because of connections between attention, perception and vision it can sometimes be of interest to figure out what a person is looking at. Techniques for studying people's visual behavior are called eye movement measurements. They usually work through determining how the eye moves relative a point of reference. In that way it is possible to study what someone is looking at.

The main idea is that what the eyes are pointing towards gives information on what is perceived, and thereby also what might enter conscious awareness. Usually, there is an assumed relationship between the direction of the eye-gaze and attention.

Hyönä (1993) has showed that quick reading has obvious limitations – if one reads too fast, and doesn't fixate often enough, one loses content. Norlund (2000) has shown that one during speed-reading has to fixate on the relevant content in text (i.e. what is new information), in order to understand. That was two examples of eye-gaze measurement based studies.

It is clear that eye movement measurements can be used to what someone looks at, and thereby also what parts of his attention is directed at.

Method

Material

In this study we have used a French film, Asterix versus Caesar, in two versions. One with the original soundtrack and Swedish subtitles, and one dubbed to Swedish and with no subtitles. Due to an attempt to adjust the lines read to the pictures, it is common with a discrepancy between the read lines and the ones used for subtitling. The subtitles are usually closer to the original script.

Method for eye-tracking

The method used for this study is based on IR light. The eye is illuminated with IR light. A CCD camera located beside the light source is used to detect the reflection of IR light from the eye. The point of reflection is compared with the relatively dark area consisting of the pupil. After a calibration, the relative coordinates can be used to tell what the subject is looking at. The result is a computer file with coordinates for the center of the visual field over time. When this data file is compared to the object watched, conclusions can be drawn on what has been seen when. Information can also be found on when and for how long the eye has stood still for so long that a fixation has taken place.

The subjects

The persons (N=17) included in the study were volunteering university students, men and women, between ages 20 and 25. The subjects were divided into two groups, where one was used as a reference for the other. No matching was done – random assignment was used between the two groups.

Procedure

The study was conducted on one subject at a time. The subjects had been told in advance that they should get to watch video and that we were going to film one of their eyes during the experiment.

The experiment was started with a questionnaire about personal data. There was also a chance for the subject to ask questions

Then the subject sat down in a chair placed about one meter from the TV, which was of the size 28". The subject received oral instructions on the necessity of him or her sitting fairly still during the experiment, which was planned to take approximately 30 minutes. There was also a brief explanation of the measurement technique.

After calibration of the equipment the recording of data began. Half of the subjects saw a French-speaking version of the film, and half saw a version dubbed to Swedish. The two versions were identical concerning editing.

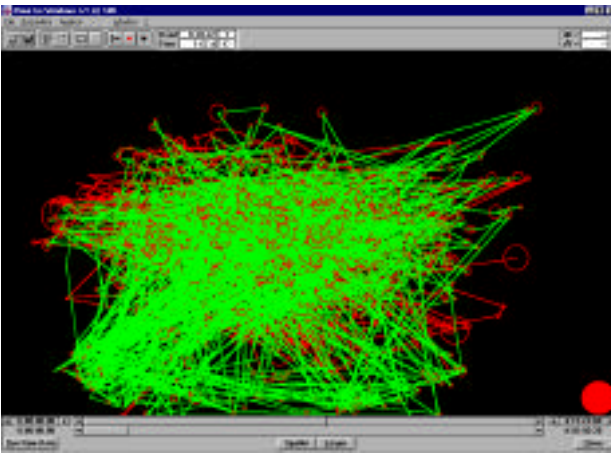
After 28 and a half minute, at a previously chosen point, the data recording as well as the video was stopped. We then told the subject that the experiment was over.

Another questionnaire ended the process. It contained questions about whether the subject had seen the film before, if he had understood the story, about the self-evaluated level of competence in French and the extent of studies of French.

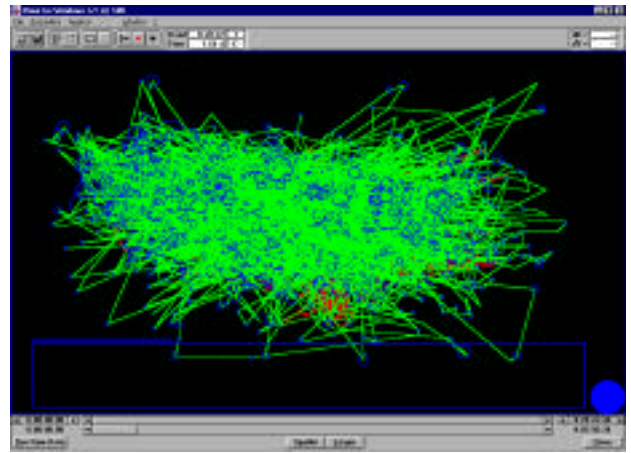
Data processing

The results from the measurements given as graphs over the direction of gaze over time, as graphs over fixations over time, and as data tables. The data tables contain such data as the duration of the entire measurement, the amount of time the gaze has been directed towards certain areas of the screen and how many and how long fixations that have been done towards the same areas. As a fixation any episode longer than 80 ms with the gaze immobile. (The time was chosen because it is a multiple of the equipment's time quanta, and because it is short enough to not exclude any actual fixations.)

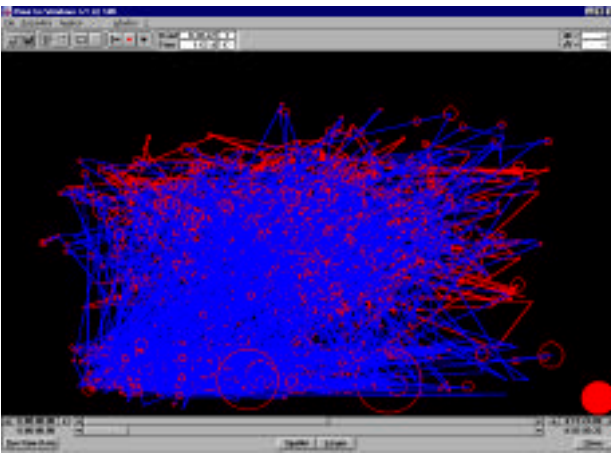
From the graphs over the gaze behavior areas corresponding to where on the screen the subtitles appeared were defined. Those areas were then used in automated calculations on the gaze behavior mentioned above. The data obtained are central in the discussion below. Some examples of graphs:



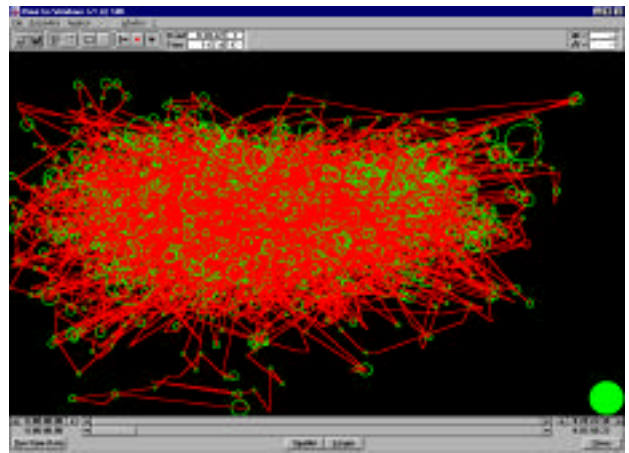
Pic 1, Sub1, Fixations graph, Half time



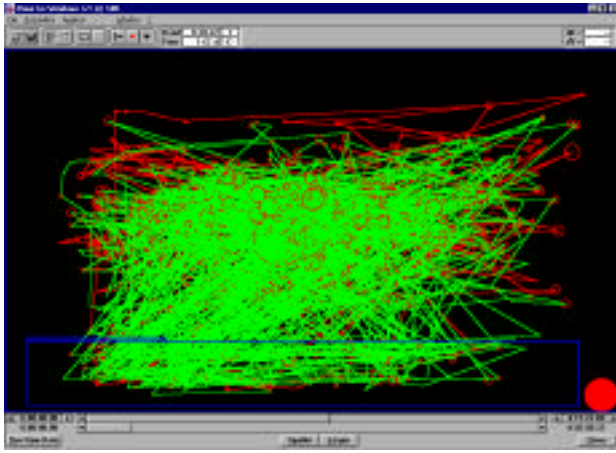
Pic 2, Sub8, Fixations graph, Full time



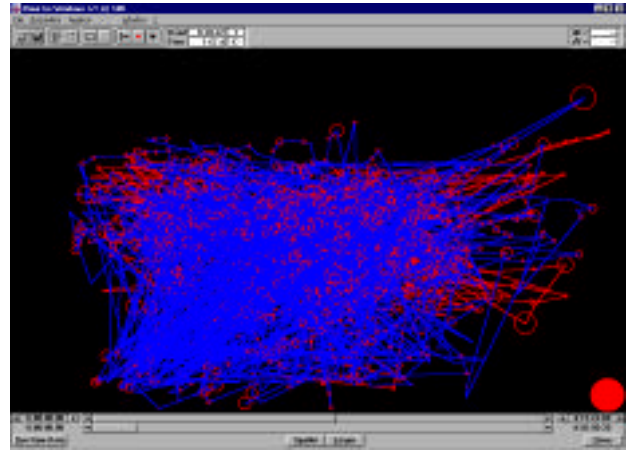
Pic 3, Sub9, Fixations graph, Half time



Pic 4, Sub12, Fixations graph, Full time



Pic 5, Sub14, Fixations graph, Half time



Pic6, Sub16, Fixations graph, Half time

The pictures above are examples of the graphs representing data. On some of them one can see the rectangles, a rather big one with a much smaller on top, defining the subtitling area. The circles are points of fixations, and the size of the circles is proportional to the duration of the fixations. Subjects 8 end 12 are from group 1, subjects 9 and 14 from group 2 and subjects 1 and 16 from group 3 in the analysis. (For definitions of the analysis groups, see 'Results' below.)

'Half time' means that the graph is over the first half of a session. 'Full time' means that the graph is over a full session.

Results

Here the data used in the discussion are presented. A more extensive data report can be found in an appendix.

From which version of the film the subject had seen and from the self-reported level of competence in French the subjects were divided into three groups. One group consisted of the subjects who had seen the version dubbed to Swedish. In order to investigate if there were any differences in the reading-behavior that could be linked to the abilities in French, the subjects who had seen the French-speaking version of the film were divided into two groups. This resulted as follows:

Group 1 – The subjects who saw the Swedish-speaking version. (8).

Group 2 – The subjects with moderate or no competence in French, who saw the French-speaking version. (5).

Group 3 – The subjects with good competence in French, who saw the French-speaking version. (4).

Which group each subject was placed in can be seen in the appendix.

In the analysis data for fixations should be used, because reading consists of a mix of fixations and saccades. With ordinary text a normal reader fixates approximately once per word, except for the shortest words. In between the point of gaze is moved through saccades. During reading there is no smooth pursuit of the gaze. Thus it is relevant to measure the time of fixations when studying subtitle reading behavior. During reading the saccades take less time than the fixations. That means that a doubling of the time of fixations will provide a slightly exaggerated estimate for the time spent on reading.

	Fixated time in the subtitling area
Group 1 (8)	24.6 s
Group 2 (5)	78.0 s
Group 3 (4)	47.5 s

Table over fixation times

Group 1, on average, spent 24.6 seconds on fixations in the subtitling area. This will be used as a reference for how much time the other two groups can be assumed to have spent on fixations in the subtitling area when there has been no subtitles. (The value is actually slightly too high to be a good reference. The ones who saw the subtitled version could not see all that the other group saw in the subtitling area, when subtitles sometimes interfered with other happenings in the same area.) Group 2 on average spent 78.0 seconds on fixations in the subtitling area, and group 3 on average spent 47.5 seconds.

If one from group 2:s value subtract the time for group one, the result is 53.4 seconds. The corresponding value for group 3 is 22.9 seconds. These times can be seen as approximations of the time spent on fixations of texts. With the obtained values, it is shown that the group with the most competent French-users (group 3) on average spent 57% less time on fixations of text than the less competent group (group 2). That can be taken as evidence for the fact that a greater linguistic competence decreases the need for reading subtitles.

We have shown that the ones who at least partly read the subtitles (groups 2 & 3) on average spent 40 seconds on reading subtitles. If we add as much time for saccades, which in reading take less time than the fixations, we find that 80 seconds were spent on reading. That is less than 5 per cent of the more than 1700 seconds the measurements lasted.

Summed up: The result 5 % is based on measurements of fixations and a rough (exaggerated) approximation of saccades. It ought to provide a realistic (but high) value for how much time was spent on reading subtitles.

Discussion

Mental processes can be automated. This apparently is true for reading. We can assume that reading ability is a highly automated function with the subjects, and that it requires very little of the capacity available to consciousness.

Two simultaneous mental processes compete for the capacities they both make use of. If the processes are relatively separated concerning what domains they use, in reality they compete only about the capacity of consciousness or attention. Further it can be said that during reading (of subtitles) other visual stimuli can still be detected and processed.

Thus we can conclude that the reading of subtitles probably has not exercised negative influence on the actual understanding/perception of coherence of the film used. Especially as only (less than) 5 per cent of the time was used for reading. To the extent that the subjects and the film used are representative for other populations and other audio-visual material, the results can be generalized to: 'The use of subtitles does not exercise negative influence on the actual understanding/perception of coherence of audio-visual material such as movies and TV programs'.

Language acquisition takes place when two languages, of which one is mastered and the other is at least familiar, are used alternately and with the same content. That means that an increased use of subtitling in stead of dubbing in Europe could lead to an increased understanding of languages throughout Europe, and thus to a better understanding between European peoples.

Another important aspect is that subtitling is not as economically expensive as dubbing. In order to make a dubbing, there is a need for a written script with the lines to be read. Such a script is all that is needed for subtitling, while dubbing also requires the reading aloud of the lines, preferably by actors. That is more costly than subtitling.

Arguments against a too wide use of subtitling are the limitations in reading ability present with children and disabled individuals. That means that certain persons can not use material that is only subtitled and not dubbed. In order not to exclude those individuals from participation, it is important to use some dubbing.

It can be assumed that the use of subtitling does not exercise negative influence on the actual understanding/perception of coherence of audio-visual material such as movies and TV programs. The discussion above shows that.

Thus there ought to be no serious limitations for the conscious awareness to integrate the perception of the actors with the read text.

Recommendation

The aspect of language acquisition and its potential contribution to integration, along with the economical advantages, means that subtitling can be recommended as method to a bigger extent than today.

It would be interesting to closer examine the phenomena around the use of subtitling and dubbing of audiovisual material. It is of extra importance with qualitative studies of both comprehension and language acquisition. There are obvious practical fields of applications for such studies. As an example the work with integration can be mentioned.

Investigations of alternative methods for helping individuals with disabilities that make them unable to benefit from subtitling are also an important field to study. It might perhaps encompass alternative soundtracks, alternative subtitles or totally different channels of information transmission.

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Appendix I

Result table

	Txt or Dub	Grou p	Time tot	Tme %reg	Tme%Txt	N Fix	N Fix Txt	TmeFixTxt
Fp 1	T	3	1722.86	87	15	3164	217	28.22
Fp 2	D	1	1724.74	82	3	4099	94	17.06
Fp 3	T	2	1726.10	95	20	3399	444	56.88
Fp 4	D	1	1732.92	85	6	4533	248	37.96
Fp 5	T	2	1721.20	96	28	3888	895	109.64
Fp 6	D	1	1731.04	88	13	4552	548	78.36
Fp 7	T	3	1723.38	82	19	2864	288	33.94
Fp 8	D	1	1722.48	98	1	5876	26	3.84
Fp 9	T	2	1722.72	90	35	2581	678	109.2
Fp 10	D	1	1722.16	96	3	5487	198	28.3
Fp 11	T	3	1722.20	89	17	4174	619	68.42
Fp 12	D	1	1722.34	96	2	5199	81	10.4
Fp 13	T	2	1721.32	93	20	4558	632	59.86
Fp 14	T	2	1722.32	80	22	3699	588	54.3
Fp 15	D	1	1722.40	93	3	4797	65	11.62
Fp 16	T	3	1722.04	97	18	4832	559	59.4
Fp 17	D	1	1721.14	98	1	5989	79	9.38

Fp XX: Subject number XX

Txt or Dub: The subject saw a subtitled (txt) or dubbed (dub) version of the film

Group: What group the subject was in during data analysis

Time tot: How long time the measurement lasted (seconds)

Tme %reg: How big a portion (%) of the measurement that resulted in data

Tme %Txt: How big a portion (%) of the time registered that the gaze was directed towards the text area

N Fix: Total number of fixations

N Fix Txt: Number of fixations with the gaze directed towards the text area

Tme Fix Txt: The total time of fixations with the gaze directed towards the text area (seconds)