How to Increase Website Usability with Link Annotations

Paul Chojecki
Fraunhofer-Institute for Telecommunications - Heinrich-Hertz-Institute, Berlin, Germany
paul@chojecki.de

Abstract

A general problem of internet usage is the "informational myopia" (Conklin 1987, p. 40). The hypertext structure confronts the reader with a large number of choices about which link to follow. The question is whether the word which labels the link provides the user with enough information to foresee what he or she will get on the following sites or not.
This contribution describes the evaluation of the **S**urvey **o**n **S**teps-component, a solution approach to the aforementioned problem. It was assumed that information provided by the SoS-Component facilitates the user's decision, whether to use a service option or not. Due to this advantage SoS usage should increase the usability of the entire website.
The results provide significant evidence for this assumption. SoS users performed more efficiently and were more satisfied with their usage in comparison to the control group.

Key words: Link annotations, Website Usability, orientational tools, Survey on Steps

1. Introduction / Background

Internet services and applications are widely spread. They have become more and more important in our every day lives. In the EU25 nearly 50% of the population aged between 16 and 74 years and 90% of the companies were connected to the internet in the first quarter of 2004 (Bautier, 2005). However, in spite of or even because of their dispersion, internet applications and services are also increasing in variety and complexity, generating various usability problems. These problems concern especially information seeking as well as navigation and orientation in such a huge, non-linear organized information space like the WWW. Dix (2004, p. 763) pointed out three reasons why such problems will always exist, no matter how well designed the site structure is. It is "...because the user does not understand the structure; or because the user has individual needs that the designer has not foreseen; or because even a good structure is not perfect.".
A popular solution approach to those problems are tools or components for orientation and navigation e.g. sitemaps, search engines and history logs. Such components become more and more important and there is a growing trend to develop and use them. Yet it is apparent that many problems emerging during the usage of internet applications lack appropriate orientational and navigational components.
One general problem of internet usage is the "informational myopia" (Conklin, 1987). The hypertext structure tends to present a large number of choices about which link to follow to the reader. On the average an internet user makes this decision every 13 seconds (Wirth & Brecht, 1999, p. 157). But does the label appearing as the link provide the user with enough information to foresee what he or she will get on the following sites and thus make a capable

decision? In many cases – almost everybody has experienced some – users get frustrated by websites because they cannot achieve their goals after clicking on a link. Sometimes users even invest many mouse clicks, keyboard inputs and a lot of time to figure this out. A common example is online shopping. 52% of all cancelled online shopping procedures are quit because users cannot pay in the way they have expected. Over 40% of all procedures cancelled are due to too long or too complicated order transactions (FOKUS Medialine Marktstudie, 2001, p. 19).
But how can this dilemma of "informational myopia" be solved? A more anticipatory view over the previous steps or sites can be given by means of link annotations. The idea of link annotations is to augment the links with some form of comments which can tell the user more about the current state of nodes behind the annotated links (Bursilovsky, 1996).

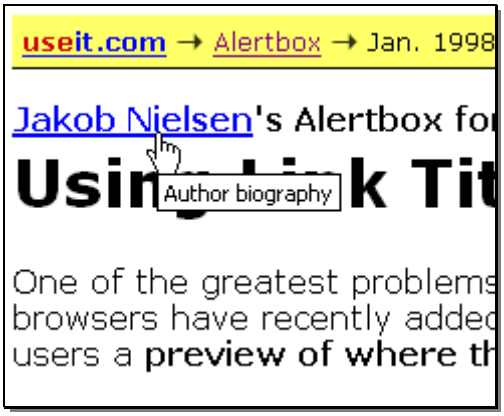

Figure 1: Link annotation realised by the means of the HTML "title" tag.

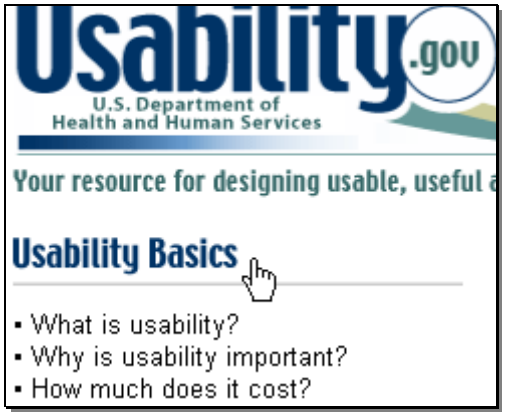

Figure 2: Link annotation realised by the means of textual listing.

These annotations can be provided in many different ways, e.g. in textual form or in form of visual cues (see Figure 1 & Figure 2). Not all implementations of link annotation are an effective support technology in hypermedia (e.g. Fraser, 2001 or Polkehn, 2001).

This contribution describes the evaluation of a new kind of link annotations, the **S**urvey **o**n **S**teps-Component. This component is a comprehensive approach to the solution to the aforementioned "informational myopia" problem. The idea of the SoS-Component will be specified in the second chapter after having outlined the essential problems which motivated the development of this tool.

2. Object of research: The SoS–Component

As mentioned before, users often have to decide which link to follow to achieve their goals. But mostly the link itself does not contain enough information to facilitate a capable judgement. This dilemma affects especially novice users of a website or an offered service option. Because there is no standardisation of link or service option terms, a novice user often does not know what to expect behind a hyperlink. Furthermore there are no standardised procedures, not even for common service options. Thus he or she does not know if under the given circumstances he or she will be able to achieve the goal of this option. Considering a service option like "flight booking", a novice user who even finds the accurate link to this option could still miss his goal because he is not able to pay in any of the accepted ways or he is not a registered member of this service. Another barriers could be time and effort related to

the usage of a service option. Sometimes users fail because the required time to succeed exceeds the time the user has planned to handle this task.
In such cases the user often has to apply the trial and error method to succeed. But this method can be very uncomfortable and has negative impact on usability dependent on the extent of the trail action and the consequences of the error.
During this project many other problems like the aforementioned were identified, which often prevent a success while using a website, e.g. (1) options which can not be used free of charge (e.g. an online version of a scientific article has to be purchased), (2) options which can not be used without a subscription, (3) options that require special software (e.g. Real Player Plug-In) or (4) when numerous and extensive steps have to be performed to reach a goal.

Figure 3: Example of the SoS-Component associated with the "Last-Minute" menu option in the context of a travel website.

The SoS-Component is designed to avoid inconveniences like that. This tool informs the user what can be expected on the next page before clicking on a link. As shown in Figure 3, the SoS-Component looks like a larger tooltip. SoS simply consists of three columns which contain three kinds of link annotation. Firstly, it shows information about the range of services on the next site (e.g. on a travel website the hotel destinations available behind a "hotels" button). Secondly, it displays the requirements a user has to fulfil to use the option behind a link successfully (e.g. only if credit card payment is accepted). Finally, it gives information about the time and effort related to the usage of a service option (e.g. the estimated time to reach the expected goal). An overview about the information which can be given in each column is specified in Table 1. The SoS-Component appears, with a delay time of one second, after the mouse was pointed over a hyperlink. It disappears when the user clicks on the link or move the mouse pointer to another position.

Table 1: Information that can be depicted in the SoS-Component.

Information about the range of services or options:	▪ the exact extent of the service ▪ the quality (refresh period, reliability) of the available service, especially during information retrieval ▪ the variety of offered information formats (e.g. html, pdf, images)

Requirements a user has to fulfil to use the option:	▪ all information and knowledge needed on the users' side ▪ software or technical requirements ▪ total costs ▪ accepted payment methods ▪ necessity of registration or login data ▪ special obligations by means of general terms and conditions ▪ minimal age ▪ dispatch conditions (e.g. shipping and handling, type of dispatch, delivery time) ▪ type and extent of personal data needed by the system ▪ other information and knowledge needed
Information about the time and effort related to successful usage:	▪ number of steps or procedures ▪ estimated time ▪ number of pages to be loaded

3. Experimental Set-Up

3.1 Objectives

The objectives of this project were to verify the effect of SoS usage on website usability, measured as *effectiveness*, *efficiency*, and *satisfaction* with which users achieve their goals on a website. Additionally it was assumed, that SoS causes a stronger effect with regard to complex and unsolvable tasks.

3.2 Investigative method

In order to evaluate the impact of the SoS-Component on website usability, a randomised, two group experimental design was used. Fifteen subjects were randomised to each group. All subjects had to deal with six typical tasks on a travel website which was purpose-built for this evaluation. The tasks were presented in randomised order to each subject. The usage of the SoS-Component determined the independent variable. The **e**xperimental **g**roup (EG) was introduced to the usage of SoS before the beginning of the task sequence and was instructed to use the component during all tasks. The other 15 test subjects, the **c**ontrol **g**roup (CG), used a website version without SoS.

The usability was measured by the means of three dependent variables (DV).

DV1: Effectiveness, defined as a solution to solvable tasks or as an early abort of an unsolvable task (only EG).

DV2: The efficiency was measured as mouse clicks and time, a subject needed to perform a task. The mouse clicks and time over minimum were considered in the statistical analysis.

DV3: The users' satisfaction of performing the tasks was quantified by the use of two questionnaires. The responses were coded on a seven point Likert scale (e.g. ranged from 1-strongly dissatisfied to 7-highly satisfied). Firstly the subjects had to valuate their satisfaction after each task (eight items). Secondly the overall satisfaction (21 items) was evaluated after all six tasks had been performed.

3.3 The tasks

After a short introduction and training scenario, the subjects conducted six tasks of different complexity. The test scenario was arranged in a way which allowed a solution to three of

those tasks. Under the given circumstances the other tasks could not be solved by the users. Three tasks related to booking actions were more complex. In these cases the subjects needed more time and more inputs had to be done to perform these tasks. Three tasks related to information retrieval were less complex. The tasks, their complexity and solvability are combined in Table 2.

Table 2: Combinations of tasks, complexity and solvability.

characteristic / task	complexity	solvable	usage problem (why unsolvable in this set-up)
to book a specified flight	high	no	The service does not accept the payment methods that are available to the user.
to book a specified hotel room	high	yes	-
to contract a specified travel insurance	high	yes	-
to find specific information about the parking charge at the specified airport parking garage	low	yes	-
to get a view of a specified beach by the means of a web cam transmission	low	no	A special software plug-in is required but it is not installed on the users' computer. Furthermore it cannot be downloaded and installed in the time available.
to download an electronic travel guide about a specified destination	low	no	This special travel guide is not available on that website.

3.4 The test subjects

12 women and 18 men participated in this experiment. Among them were five pupils, ten students of different disciplines and fifteen employed persons. The subjects were aged between 14 and 60 years (M = 28.6 years; SD = 9.978). The computer and internet experience reported by the subjects on a scale ranged from "1 – very low" to "5 – very high" was above-average, M = 3.93 (SD = 0.81). Between the EG and the CG no significant difference could be detected.

During some of the abovementioned tasks, the subjects had to fill in several website forms with various personal information. Due to protection of privacy, the experimental set-up of solvable and unsolvable tasks as well as the comparability of subjects, it was necessary to control this information. Thus every subject was given the same set of artificial, personal information (e.g. name, address, available credit card) at the beginning of the experiment. Therefore everybody started with the same initial conditions.

4. Results

4.1 Effectiveness

No significant difference could be found between both groups (χ^2 = 0.345; p = .557). The maximum number of solvable tasks per group was 45 (15 subjects, 3 tasks). The EG solved 43 tasks (95.6%), the CG solved 44 tasks (97.8%). With regard to the unsolvable tasks, the

EG used the SoS-Component effectively 34 times and therefore cancelled these tasks before the first click on a link.

4.2 Efficiency

In terms of mouse clicks, one significant difference between the CG and EG could be found (U = 1736.5; p = .00). The CG (M = 18.16; SD = 22.560) executed on average over all tasks nearly three times as much mouse clicks as the EG (M = 6.54; SD = 12.368). The EG needed on the average M = 105.22 seconds (SD = 111.653) to deal with a task, 30 seconds less than the CG (M = 148.78 sec; SD = 164.675). However, this difference did not reach the level of significance (see Figure 4).

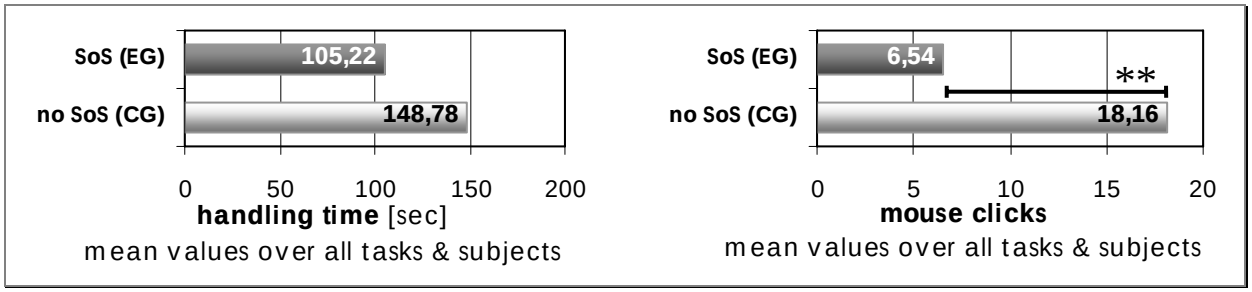

Figure 4: Differences between EG and CG with regard to efficiency metrics. Indications of statistically significant differences: **p < .01, *p < .05.

4.3 Satisfaction

Both groups were very satisfied during the usage of this website. Nevertheless there is a significant difference between the groups with regard to the overall satisfaction (p = .01, t = -2.762). As depicted in *Figure 5* the EG (M = 5.89, SD = 1.04) is more satisfied than the CG (M = 4.91; SD = 0,89). This difference could be validated by analysing the averaged results of satisfaction after each task. This difference is statistical significant at the 1 percent level (Mann-Whitney U-Test, U = 2013; p = .00).

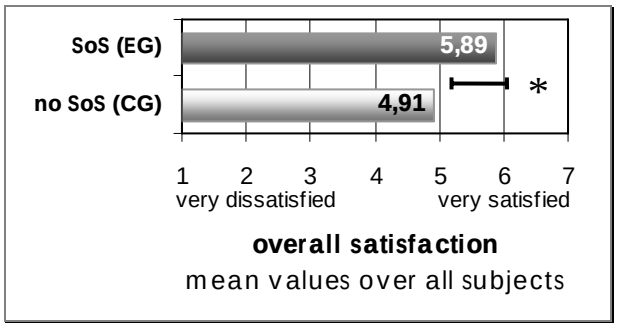

Figure 5: Differences between EG and CG with regard to satisfaction. ***** *indicates statistical significance at the 5 percent level.*

4.4 Additional findings

Solvable vs. unsolvable tasks

With regard to solvable tasks and *handling time*, a statistically significant difference could not be found between the groups (U = 900; p = .364). But the CG needed more time, approximately 100 seconds longer than the EG to handle each unsolvable task. Furthermore the CG used significantly more *mouse clicks* during solvable tasks (U = 746; p = .03) as well as during unsolvable tasks (U = 288.5; p = .00). On the average the CG clicked one more time during solvable tasks and 21 more times during unsolvable tasks (EG: M = 8.56; SD = 16.81; CG: M = 29.67; SD = 27.08). No significant difference regarding the *satisfaction* of both groups during solvable tasks (EG: M = 6.08, SD = 1.05; KG: M = 5.84; SD = 0.98) could be calculated. But during unsolvable tasks the EG (M = 6.06 SD = 1.07) experienced significantly more satisfaction (U = 195; p= .00) than the CG (M = 3.90, SD =1.23). The results comparing solvable and unsolvable tasks are depicted on the right side of *Figure 6*.

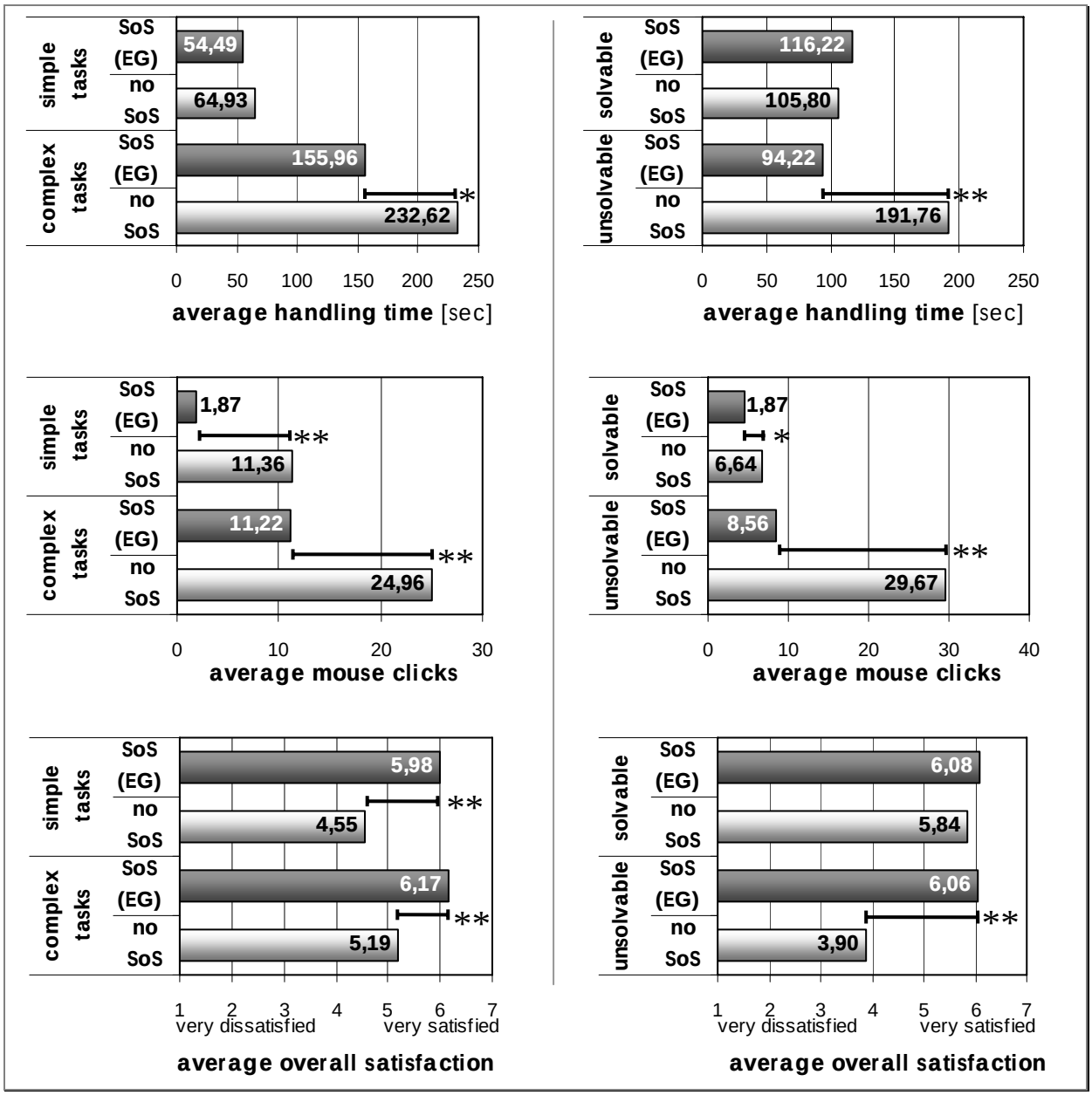

*Figure 6: Comparative results between the groups with regard to complexity (left side) and solvability (right side). Indications of statistically significant differences: **p < .01, *p < .05.*

Complex vs. simple tasks

With regard to *effective performance* of complex or simple tasks no significant differences could be found between the groups. Furthermore both groups needed about 60 seconds to perform simple tasks. The *handling time* of complex tasks was significantly different in both groups (U = 768.5; p =.049). The CG (M = 232.62; SD = 187,6) needed more time than the EG (M = 155.96; SD = 130.57). With reference to *mouse clicks* there were significant differences for complex (U = 555.5; p =.00) and simple tasks (U = 270.5, p =.00). The CG (simple tasks: M = 11.36; SD =16.32; complex tasks: M = 24.96; SD = 25.86) always needed more mouse clicks than the EG (simple tasks: M = 1.87; SD =3.2; complex tasks: M = 11.22; SD =15.94)

The EG satisfaction (M = 5.98; SD = 1.09) during the simple tasks is significantly higher (U = 381.5; p =.00) the CG satisfaction (M = 4.55; SD = 132). Both groups are more satisfied with handling complex tasks than simple tasks. The satisfaction of the EG (M = 6.17; SD = 1.03) is

significantly higher (U = 586.5; p =.001) than the satisfaction of the CG (M = 5.19; SD = 1.57). These results are depicted on the left side of *Figure 6*.

5. Discussion

The results show significant evidence for the increase of website usability as an effect of the SoS usage. However, not all usability metrics were significantly influenced by the means of the SoS-Component. Effectiveness could not be enhanced, but it was also not retarded by the use of SoS. It has to be mentioned that there is only a little feasibility to enhance an effectiveness of 97.8% (CG). The evaluated website was already simple and usable, thus the effectiveness should be implemented and investigated on further, less usable websites to analyse the effects of SoS on effectiveness.

Significant effects of SoS could be found for efficiency. In particular SoS users needed less mouse clicks to perform their tasks. With regard to unsolvable and complex tasks, positive and significant effects could be found for mouse clicks and needed time to handle a task. One interesting finding is that the SoS-Component significantly reduced the number of mouse clicks while performing solvable and simple tasks. Additionally SoS users did not needed more time than the CG to handle those tasks. One might expect, that the SoS usage is time intensive because of the additional reading time and therefore delays the users performance. But the abovementioned results confirm the opposite. Even during short and simple tasks SoS does not cause a delay. Furthermore a positive effect of SoS on satisfaction was found. Despite the fact that all subjects were overall highly satisfied with this travel website (see *Figure 5*), SoS could still increase the satisfaction. The satisfaction of the EG was independent of the task, constantly high. The largest difference in satisfaction between the groups was found during unsolvable tasks.

Overall the EG performed more efficiently and was more satisfied with the usage than the CG. Particularly with regard to complex and unsolvable tasks, SoS causes a strong impact on website usability. It can be concluded that the SoS-Component is a valuable tool which is worthwhile to be further developed, investigated and implemented.

References

Bursilovsky, P. (1996). Methods and techniques of adaptive hypermedia. *User Modeling and User Adapted Interaction, 1996, v6, n2-3. pp 87-129.*

Bautier, P. (2005). Internetnutzung in der EU25. PM Eurostat 62/2005.

Catledge, L. & Pitkow, J. (1995). Characterizing browsing strategies in the world wide web. In *Computer Networks and ISDN Systems: Proc. 3rd WWW Conference*, Vol. 27, (p.1065-1073).

Conklin, J. (1987). Hypertext: An introduction and survey. *In IEEE Computer*. (p. 17-41). Online available at: http://cpe.njit.edu/dlnotes/CIS/CIS732_447 /Cis732_7R.pdf [09.05.2004].

Dix, A., Finlay, J., Abowd, G., Beale, R. (2004). *Human Computer Interaction.* Essex: Pearson Education Limited

FOKUS Medialine. (2001). *Der Markt der Onlinekommunikation*. Marktstudie [PDF-Document]. Online available at: http://medialine.focus.de/PM1D/ PM1DN/PM1DNA/pm1dna.htm [29.06.2005].

Fraser, L., Locatis, C. (2001). Effects of Link Annotations on Search Performance in Layered and Unlayered Hierarchically Organized Information Spaces. In *Journal of the American Society for Information Science and Technology*, 52(14) S. 1255–1261.

Wirth, W. & Brecht, M. (1999): Selektion und Rezeption im WWW: Eine Typologie, in: Schweiger, W. & Wirth, W. (Hrsg.): *Selektion im Internet. Empirische Analysen zu einem Schlüsselkonzept* (p. 149-180). Opladen: Westdeutscher Verlag.