

## **Children's Models of the Internet**

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This article will show how children (9–12 years old) describe the Internet in terms of different models. It is related to how they understand the reliability of the Internet as well as some other aspects.

The study was carried out in a 4<sup>th</sup>-grade class in 1998/1999. The study has an ethnographic approach. With inspiration from information research on human-computer-interaction, the children's descriptions are categorized as different models: the surrogate model, the metaphor model, and network representation.

The children, who describe the Internet as a network representation, know a lot about how the Internet works and they also talk in terms of reliability. It appears that some knowledge about the system facilitate this reasoning, but it does not appear that their knowledge has to be very great. However, children with very little knowledge seem to have greater difficulties to see through the system.

Among practicing teachers there has been, at least in Sweden, great doubt about whether children younger than teenagers have the ability to develop the necessary skills to search for information on the Internet. In my experience from discussions with teachers and from statistics (Nordicom, 1999), I have found that the use of Internet by young children varies greatly in Swedish schools. In my doctoral dissertation (Enochsson, 2001b) I investigated what young students (9 –11 years) do when they search for information on the World Wide Web (the Web), mainly at school, and how they reflect

on this when they are given the opportunity to work with it for a long period and with guidance. The children in the study had access to everything the Internet can offer without any kind of filters. They also had the possibility of choosing how to search.

A central question, when children search for information on the Internet is to what extent they are able to discriminate between reliable and less reliable web pages on the Net. In this article I have chosen to show how the children in the study describe the Internet system related to reliability on the Net. The gender aspect and some other aspects are also in focus. Some researchers claim that it is not necessary to know about the underlying system to use it in terms of practical use (Turkle, 1984). In this article I pose the question if this also is true for a kind of functional use—reflecting about reliability. Does reflecting about reliability on the Internet interplay with knowledge about the Internet system. If so, what consequences will that lead to?

## Cultural Psychology

The study has an ethnographic approach and is based on Cole's (1996) cultural psychology. Cole's aim is to connect the cultural historic tradition with the anthropological. He claimed that his view of cultural history is more dualistic than others' views, since he splits artifacts into inner and outer ones. My interpretation is rather that he tries to analyze the whole from different aspects.

The artifact is a central concept in cultural psychology. Artifacts are tools used by human beings to interact with the environment. According to Cole (1996), an artifact is any kind of means used for cultural behavior. It is the use of artifacts/tools that separates us from the animals. Artifacts can be psychological as well as technological. Technological artifacts can be pencils, papers, computers, and so forth. Language is psychological and the most important artifact. An important view of artifacts is that they not only facilitate but also interact with the user in a way that makes her/him change, mainly psychologically.

Cole compared his definition of inner artifacts with D'Andrade's concept *cultural models* and the common psychological concept *script*. A *script* must not only be seen as a phenomenon inside the head but must, just like artifacts, work both inside and outside a person.

According to Cole (1996), the analysis of human beings' psychological functions must be done in their daily activities. This is a heritage from Hegel and Marx, who claimed that it was the only way to replace the opposition

between materialism and idealism, since it is in activities that a person experiences the ideas and material remains from earlier generations. In activities, ideas and material are united.

The context in which a person is situated is of great importance for how that person's models are developed. Cole described the context as that which weaves together. He used Birdwhistell's illustration of fibers twisted not into longer fibers but into a rope, which is longer and stronger than each separate fiber. He means that the context cannot be seen as separate parts which affect a person's activities. Everything is wholeness and the context is a relation between at least two entities (threads), which are different elements in one single process.

A person's mind works through the artifacts he or she uses and does not exist only inside the brain or the body. The mind is distributed in the artifacts, which are woven together and which weave together individual human actions in our constantly changing world. Our actions are the arena in which the artifacts are created and used (Cole, 1996).

### Models of a System

As a contrast to a cultural view, where knowledge is constituted in a dialectical relationship and exists in this relation, is Carroll and Olson's (1988) cognitive view, where mind is completely an inner phenomenon. Models of reality are constructed inside each person. This latter view dominates research on human-computer-interaction and how users learn to handle different systems. Carroll and Olson's theories assumed that users make *mental models* of the system they are going to use. When users get more used to the system, the models get more and more detailed. They say that the concept *mental models* is often used carelessly. In their article they referred to four different types of models, which different researchers have used:

1. *Surrogate model*. The system is a substitute for something else with the same functions. The user only sees what is put in and what comes out. What happens in between could be essentially very different from what is being replaced, and this does not matter to the user. Young (as cited in Carroll & Olson, 1988), who is the researcher writing about this model, says that it could be difficult for users to find adequate surrogates and he questions to what extent this model is used.
2. *Metaphor model*. The system is compared to an already known system that works in a similar way. Carroll and Olson refer to several researchers who have noted that beginner users of word processor programs (during the 1980s) often used the type writer metaphor.

3. *Glass box model.* This model is somewhere in between the surrogate model and the metaphor model. It uses aspects of different metaphors to support a sort of surrogate model. Here, they also refer to different researchers, for example Carroll and Thomas (as cited in Carroll & Olson, 1988). The glass box model has not been found spontaneously with people. Researchers have given the model to test persons to facilitate the understanding of a system.
4. In *network representation* the system is seen as a network with nodes and arcs, the nodes functioning as points where the user makes different choices to make changes in the system (Miller, as cited in Carroll & Olson, 1988). Network representation is a combination of the models previously described (Carroll & Olson, 1988).

Carroll and Olson include a reservation at the end of the article. It says: "Our understanding of mental models (*if they exist*)..." (p. 59, my italics) Whether there is talk about cultural or mental models, the expressions are the same, the prefixes *cultural* and *mental* only shows the theoretical source of the models. In this article I have chosen to emphasize what is similar in the two ways of looking at the phenomenon, although my theoretical base is closer to Cole's. That is the reason I only use the word *model*. This work does not aim to make a synthesis of different perspectives. The study has its basis in cultural psychology, while a cognitive perspective dominates information research. Cole, who has worked for a closer collaboration between different research disciplines and perspectives, should not be alien to using concepts from a research discipline with constructivistic standpoints, such as Carroll and Olson (1988).

### Girls, Boys, and Computers

Traditionally technology is a male sphere: men invent technological things for their own purpose, and by and by when women have discovered their own field of application they assimilate the technology. That is a reason why women are a step behind men all the time where the use of technology is concerned (Kamjou, 1996; Nissen, 1993). In a society run by men for a long time, and where men have constructed and used technology from their point of view, women with another perspective can easily be seen as hostile to technology or technologically illiterate. Turkle (1984) maintained that a computer does not have any intrinsic gender prejudices, that technology in itself is neutral. But Berg (1996) said that you can not speak about

technology without a gender relationship. Technology and gender can never be seen as separate worlds.

Pedersen (1998) has gathered research results on computers in education. Briefly, it can be said about girls and boys, that boys in general are more interested in the technology itself, and girls in what it can be used for. Girls usually have greater demands for meaning, coherence and relevance than boys have. It is seen as a truth that boys have a greater interest in the technology itself. Nissen (1996) based his statements on Haddon, when he wrote that this "truth" is strongly exaggerated. Girls' use is not visible to the same extent as boys': boys' computer use is, for example, more visible in public spaces. But according to Nordicom's (2002) statistics, during an average day boys use computers more frequently (36%) than girls (28%). The average boy spends more time at the computer than the average girl does. Nissen explained this with the fact that men and boys dominate the group of computer devotees.

***Navigating in cyberspace.*** Turkle (1995) described the simulation culture which started with Macintosh's introduction of the desktop in 1984. A way of thinking was introduced, which rewarded manipulating on the surface and working without awareness of underlying mechanisms. The visibility depth was nonexistent. Working with the computer was no longer like giving commands to a machine. The desktop had interactive object, dialogue windows, that "spoke" to the user. People started to interact with technology in the same way as they interacted with other people.

Moving the cursor over the screen with help from a mouse was like navigating in space. This navigating in cyberspace Turkle called bricolage. Bricolage is a French word meaning "do-it-yourself" or fixing things. She borrowed this word from Lévi-Strauss<sup>1</sup>. A bricoleur takes on problem solving by going into a relation with their work, which is more like a conversation than a monologue. Understanding comes from navigating and bricolage rather than from analysis. In the early days of the computer there was no place for the bricoleurs and people who were not interested in analyzing and programming were locked out. In our part of the world these people are mostly women. Papert (1993) compared the bricolage with "trial and error" and in contrast to the bricoleurs he puts the planners.

Turkle characterized the new programming style, the bricolage, as "soft." By that she meant a nonhierarchical, flexible style, which opens the possibilities of having a close relationship to the object of study. As this is a kind of style that is preferred by women in our culture, many of these were more or less locked out from the male dominated computer culture. Now it

is not longer necessary to be familiar with the underlying mechanism to handle the computer. The simulation culture has opened up space for people who have developed a greater variation of cognitive and emotional styles. Especially women have felt that computers are more culturally accepted (Turkle, 1995).

### Critical Reasoning

How the children consider the reliability on the Internet is more profoundly described in another article (Enochsson, 2001a). Briefly, it can be said that many of the children know that there are people who want to mislead others on the Net, but there are also children who believe that everything you put on the Net has to be true. It is a deeply philosophical question as to whether truth exists or not. A fundamental assumption from a cultural perspective is that reality can be described in different ways dependent on the perspective (Säljö, 2000). In this case I chose the concepts *lies* and *truth* from my experience that children in our culture use these concepts. I assumed that the concepts represented a mutual meaning and I decided this was the best way to approach the problem of reliability. In the conception of lies and truth there were also discussions about how to look at web pages from different angles. An awareness that everything is not true or that things can be seen from different perspectives is a basic condition for a critical way of reasoning.

The children's statements varied and were divided into three categories describing how the children reflect on the reliability on the Internet with different levels of abstraction.

**Category 1.** In the first category are children who do not reflect at all upon reliability on the Net and those who think that it is illegal to put lies on the Net. These children describe the world as dualistic in terms of right and wrong.

**Category 2.** The children in category 2 have noticed lies or have lied themselves in chats, but either they do not think that there are lies on the rest of the Internet, or they do not think it is one of their concerns. Here it can also be discussed whether "lies" is a relevant choice of word. Stone (1995) and Turkle (1984) would probably see it as a chat identity, which is a part of the ego. The distinct black-and-white view is loosened up. The dualism dominates certain parts, while other conventions rule other domains.

**Category 3.** The children in category 3 discuss reliability and different perspectives on the Internet with a greater awareness. Sometimes you can be cheated, but it can also mean that different standpoints meet. These children describe a relativistic view of the world.

## Aim

The aim of this article is to describe the studied children's models of the Internet system. Since the research work was directed towards the understanding of how children search for information on the Internet and their descriptions of evaluating the information, a connection has been made between the models the children verbalize and how they describe reliability on the Web. The gender aspect is also taken into consideration as well some aspects of minor value.

The reason I chose those models as a starting point was that I had already seen similar ways of describing the Internet in my material. I had seen the network representation in an early stage of my analysis without using that term. I had also seen different metaphors. With Carroll and Olson's models, I found a way to structure my data.

## Research Question

The research question illuminated in this article is *if* and in that case *how* different models of the system Internet interplay with other aspects of the material, for example the way the children reflect upon reliability on the pages they encounter and if this looks different for boys and girls.

## SAMPLE

The study was conducted in the school year 1998-1999 in a 4<sup>th</sup> grade with 30 students between the ages 9 to 11. The class was chosen as an object for the study for the reason that the teacher worked actively to let the computer become a natural part of the students' knowledge and information searching. The teacher also aimed to use the students' questions as a starting point for her teaching. A lot of time was spent discussing the reasonableness in the different answers the students found.

The computer lab was booked 70 minutes every Friday. Half of the class was there one week and the other the next week. On these occasions,

the teacher showed different ways to find information on the Internet. On each occasion in the computer lab, the students also got the opportunity to surf freely on the Net and to read their personal e-mail. All the students got e-mail addresses through the school administration during the fall semester.

In the classroom there was one Internet connected computer. In adjacent rooms there were eight additional connected computers, two of them in other classes' rooms. In breaks and after school, the students had the possibility to use the computers, both for schoolwork and private use.

## METHOD

The present study is a part of a dissertation work where several methods have been used to collect data: observations, conversations, questionnaires, interviews, and text documents. Since the aim of the present study is to gain an understanding of children's reflections about reliability on the Net, an ethnographic approach was chosen. In this study, the ethnographic approach means that I, as the researcher, spent time together in school with my informants and got information in several different ways. What a person is able to express does not always correspond with the person's true knowledge. When children are involved it is even more important to take this aspect into consideration, since the power relation between the adult researcher and the child can affect the answers in, for example, an interview. It can of course also affect what the children are doing while they are observed, but during a long period of presence the possibility to build a more relaxed relationship is greater. What a student did in the classroom was compared with what he/she said in conversations and chats, and also with the teacher's assessment of the student's ability. Throughout the study the aim was to give the students' perspective on reflecting on and using the Internet, and the cultural approach according to Cole (1996, p. 119) made it possible to study the connection between their thoughts and their actions. The questions for this study concerned what the students knew about the Internet system, what search strategies the students used, and what web pages they preferred. Questions about reliability and critical scrutiny were emphasized, and this was related to the students' models of the Internet system. Differences between boys and girls were analyzed.

The students were aware of the purpose of my presence, which was mainly during their computer work. However, I was also there while they were doing other things to get to know them better and to gain cultural competence. The main focus of the observations were on what web pages they



chose, how they talked about their choices between themselves, and also how they solved technological problems. The observations were sometimes written down during the lessons and sometimes afterwards. The questionnaires concerned background data like gender, age at present, age when they first used a computer and for what purpose, parents use of computers in their work and the estimated time they spent at the computer every week. During one week the students kept a computer diary where they noticed every time they used the computer and what they were doing both in school and at home. This was compared to a log kept by the school. The combination of different methods has been used to get as rich a description as possible.

Teachers' expectations are significant to children's learning processes (Rosenthal & Jacobsen, 1992). As a consequence of this, interviews have been carried out with the teacher about her intentions with letting the children search on the Web. Her statements have been compared to the other results.

The informants have read their own interview transcriptions. They had the opportunity to comment on and complete the observation notes, which some did. The teacher read and commented upon all the results, and the students discussed some of the results in groups. This *respondent validation* is a vital part of the data collection and a kind of triangulation. There is more likelihood of obtaining the informants' perspectives with this procedure, as also argued by Hammersley and Atkinson, (1995, p. 9). In this way, the students being studied become coresearchers, but I have chosen to call them informants.

As my informants were children, we can expect it difficult for them to realize to its whole extent what it means to take part in the study, since this can be a problem even for adults (Merriam, 1988). All the children in the study were informed that participation was voluntary. One of the children said no to the interview, but agreed to be observed. On some occasions I was asked to wait until the children had read their private mail. As an observer I did not actively take part in the situations observed, but the children knew that they were being observed.

An important part of analysis is reflection on the data. Analyses of collected data have been done continuously and questions have been alternately analyzed separately and together. By Reflecting on collected data at the beginning of the study it may also have affected the ensuing data collection and analyses (Hammersley & Atkinson, 1995), and opened up for an interaction to occur between collected data and my own preconceptions and theories.

The question is not whether I can give a picture that is objective or not. The qualitative research tradition usually assumes that there are many realities (Merriam, 1988). The aim of the present study is to give a picture of what happened right there, right then.

## RESULTS

From the children's oral and written descriptions of the Internet on different occasions, an analysis has been carried out to find out which one of the models presented they would express. Of the 30 students in the class there was data enough from 24 of them to analyze in this way. Five children from the test interviews have been added. Instead of the teacher's statements about these five children, their parents have judged their ability to scrutinize critically. A short analysis of the school context is also added to the results.

### The Context

The teacher worked purposefully to keep a critical discussion alive in the classroom. Different answers to questions were discussed, even what could be considered as realistic scenes in novels and soap operas.

The teacher does not think she has to contribute to the students' knowledge about the system. She has explained metaphorically that every student has a closet in the basement where no one else can enter<sup>2</sup>. The net knowledge, she thinks, will come as they work. She has not noticed any one being blocked by not knowing enough about the system. On the other hand she thinks they all have an idea about how it works. She compares this to mathematics:

You talk about if you should use algorithms in mathematics or if you should train mental arithmetic longer. There's both for and against. Should you give students models or should you let them create models themselves? Some of the idea in problem based learning is that you create your own model. That's the fundamental idea, that the teacher doesn't prescribe a model. I think that works fine. (From Interview 1 with the teacher)

### The Models

All of the children describe a model where the Internet consists of computers all over the world, connected to each other in one way or another. They have different ideas about what these connections look like. Some of them have not thought so much about it and others think it is strange that it

works. From these children the whole scale is covered to those children who describe computers connected through networks, bases, and satellites. Some children know the vocabulary well, but most of them use their own words.

In this specific analysis I tried to sort out different categories without too much baggage of theories. The result of this was that the system can be looked upon as a series of choices or as a practical/technical matter. When reading about Carroll and Olson's (1988) different models, I could see that my choice category had great similarities to their *network representation*, and that my practical/technical category could easily be divided into *surrogate* and *metaphor* categories. I decided to use these categories.

The models were from the beginning (a) the surrogate model, (b) the metaphor model, (c) the glass box model, and (d) the network representation. A clear glass box model could not be found in the material, but the other three could. The two children who possibly could be classified as glass box modelers were placed in the metaphor category on the grounds that metaphors dominated in their descriptions. According to Carroll and Olson, the glass box model has never been found spontaneously.

**The surrogate model.** The children in this category see the Internet as a substitute for something else, but with the difference that it is better in some respects. Instead of writing a letter, it is faster to e-mail; instead of sending for travel brochures, you can find the information you want on the Internet. The Internet can also work by making things more fun. To the direct question whether the Internet works like telephones, for example, some of the children answer that they do not know. They do not talk at all about how it works, neither the technology nor the function. The Internet is like a black box where you put things in and can get things out. Most of the children in this group do not have much knowledge about how the computers are connected. In a talk with Helen it sounds like this:

I: What is the Internet?

HELEN: You can write letters on the computer to each other, but if you can't reach each other or live very far from each other you can write letters on the computer, email and then you can do schoolwork, work on the computer, it's maybe easier....

I ask Helen if she knows how it is connected. She answers:

H: I think it is some satellite thing or something like... I don't really know.

**The metaphor model.** Here, the children focus on comparisons between the Internet and things with similar functions. They do not lay claim to give a complete picture of the Internet. They use their descriptions for certain aspects. Some compare the technology to the telephone, others stress the function and compare it to a phonebook, book or library. The difference compared to the surrogate model is that children who use metaphors try to describe how the Internet works.

I: Can you describe the Internet to me?

JOAN: A big book.

/ — /

I: But, where is this book?

J: In the computer.

I: Is there so much space in the computer?

J: Yes.

/ — /

I: Imagine that you put in a page on your computer. Can I see it?

J: Yes.

I: How does that work?

J: On the Internet. You write it in that book and then some one else can read it.

I: But is it in my computer or in yours or where is it?

J: In the chip.

I: Where is the chip?

J: I don't know really. In the brain.

I: In the computer's brain?

J: Yes.

**Network representation.** Network representation is a combination of the models previously described, and in this one there are examples of both surrogates and metaphors. Not all of the children express this explicitly. The most characteristic element for network representation is that the children talk about the Internet as a series of choices: you choose a search engine, how to search (links, free text), and you choose among the hits available. Steve talks about surrogates, metaphors, and network representation, and his statements will illustrate this category:

STEVE: We say that this one wants to send a mail. Here is one in Sweden, and this is in America, and this one writes a mail, and it's sent to the satellite, and then it's sent to Sweden and that is a bit clever, I think. It doesn't take that long, just a few seconds.

/ — /

I: What is the Internet?

S: It's a net all over the world where people, who have a connection can go in and send mail and contact other people with the same interests and so.

/ — /

S: I have a special address I use to search at: YAHOO! Or AltaVista or so and then there are rows like this...and like this (Steve shows in the air on an imagined computer). Then you can click there. Yesterday I searched that way, but it's not as good. You can click Sport and Leisure, Music and then there are a lot of things there, then I check it out and I leave it and I check sport and look at football, then I can see how the National League goes and things like that.

I: But when you have searched for and found pages. You told me before that you listened to music files. What makes you decide that just one of them is the best?

S: I check the content, but sometimes I test some for fun. If it isn't any good I check another one where I can see what it is about.

## Interplaying Aspects

**Gender.** If the models are related to the gender aspect, you find that most of the boys give expression to the network representation and the metaphor model. The girls' expressions are more evenly distributed. The boys also verbalize more knowledge about the Internet technology itself.

**Knowledge about the construction of the Internet.** The children are divided into three groups according to their knowledge about the construction of the Internet. When I use the word *knowledge* in this context, it is to facilitate writing. As an interviewer I can not judge what the informants really know, just what is communicated in the talk. Those who know little are those who have not thought so much about the Internet, but assume that there are wires connecting the Internet. Those who know something are those who logically reason that somewhere there must be a central base, which is connected to all computers, but they are not really sure. Those who know a lot can describe a network with servers, satellites, and so forth. Most of the students who know a lot about the construction of the Internet are in the network representation category. The surrogate category consists mostly of children who have not thought so much about how the system is connected or works. Five out of six children in this category are girls. The metaphor category is in the middle and contains both these groups of children.

**Time at the computer.** For one week, the students kept journals of the time they spent at the computer at school and at home respectively. The same week their time at the school computers was logged for comparison. For a few students there was a discrepancy between the journal and the log, and those children's information about time spent at the computer must be considered as unreliable. This reduces the sample and there are very few remaining boys.

According to the girls, some of them spend a lot of time at the computer at home, but the girls in general use the computer less frequently than the boys. If the students' reliable information and the log information is placed together, it is possible to suspect a pattern concerning the distribution over the models. For the boys, the network representation coincides with a lot of time at the computer, but for the girls there is no such pattern.

**Critical reasoning.** Every child who the teacher (or the parent) has judged as using critical reasoning in general—not only when searching on the Internet—has expressed the network representation or the metaphor model. The

same is true for those children who have talked about the importance of knowing who has made the different sites. It is also true for the children who say that anyone can put a site on the Internet. The three aspects mentioned have some characteristics in common, but do not overlap.

**Reliability on the Internet.** To be able to see to what extent the children's models of the Internet influences their use of it, the models have been related to their sayings about the three categories of reliability on the Net. Category 3 is the most reflective category.

It appears that the different models and how the children look at reliability interplay. Children talking in terms of surrogates are those who have the most unreflected view of the Internet. Among those who talk about metaphors, the whole range of reflectivity can be seen and those who talk in terms of network representation belong to reliability category 2 and 3 (Figure 1).

Reliability Model	1	2	3
<b>Surrogate</b>	Helen Angelica Nina	Olivia Stuart	
<b>Metaphor</b>	Evelyn <b>Joan</b> Eric	Louise Jessica Sofie Robert	Annie <b>Robin</b> Larry
<b>Network representation</b>		Jennifer <b>Mathilda</b> Hannah Anthony <b>Luke</b>	<b>Nellie</b> <b>Alma</b> <b>Nadia</b> <b>Steve</b> <b>Dennis</b> Charlie Simon

**Figure 1.** The three models in relation to the three categories of reliability, where category 3 is the most reflective category. Bold type marks the children who are considered by the teacher to use critical reasoning.

## ANALYSIS

It is not surprising that the children in the study have different knowledge about how the Internet system works. It is not surprising either that the boys express more knowledge than the girls, since boys in general show more interest in technology than girls do (Kamjou, 1996; Nissen, 1993; Pedersen, 1998). The less knowledge the children have about the system, the more likely it is that they describe it with surrogates. The opposite is true for network representation. Children using the surrogate model do not even try to describe how the system works. They just say what you can do and that it goes faster, is better, or more fun.

It is unlikely that the teacher has influenced the children's descriptions of the Internet, since she talked about the system as closets in the basement. None of the children use that metaphor.

The girls do not appear to make use of the computers at school, but according to their own statements they spend as much time as the boys do in total. The difference is that for the boys there is an interplay between which model they describe and time spent at the computer. The question can be raised if the boys have a greater need to know how the system works to use it, and if there is no such need for the girls. This is in line with Turkle's (1995) theories that girls in general show a greater interest in the function and technology becomes a side issue.

Starting with the aspects of the construction of the Internet and how the children talk about reliability, there appears to be a hierarchy among the models from the surrogate model over the metaphor model to the network representation. This is also true for critical reasoning from the teacher's viewpoint and for time spent at the computer (the latter is valid only for boys). It could mean that it shows a sort of development, but it does not have to be so. That could only be seen in a longitudinal study.

The teacher's understanding of the children's critical reasoning is grounded in the children's total behavior and is not only connected to the Internet. According to the teacher's judgement, the children's reasoning about reliability on the net does not seem to correspond with their critical spirit in general (Figure 1). A possible explanation is that children spending a lot of time on the Internet develop a critical reasoning more easily in relation to the information they meet there. However, this is not the case among these children. There are children who are judged as critical by the teacher and who spend a lot of time at the computer, who still think that everything on the Net has to be true; and there are also examples of the opposite.

Reliability can be understood differently in different media and the explanation can perhaps be found here. It can be that the Internet is discussed



more in relation to reliability than for example, TV and/or newspapers/magazines. This can affect children's awareness of lies on the Internet.

There is also a possibility that certain metaphors "lock" the thinking. If the Internet is seen as a book or a library, as some children say, they might associate it with the scrutinizing, which is connected to books in libraries.

Knowledge is contextual and it is first of all the environment where the children meet the computer which affects their thinking about it. The teacher's aim to make the computer a natural working tool affect this, as does the teacher's way of always bringing things up for discussion. But even if knowledge is contextual, the cultural psychology does not mean you have to learn from the beginning in every new situation. We construct schemata which to a certain extent are transferable between different situations (Cole, 1996). This means that other factors in the children's lives also affect this situation.

If we want children to have the possibility of learning things, it is important to let them practice. As far as information searches on the Internet are concerned, it is important to train, and it is important that it is allowed to take time, and that experimentation and failure are allowed (Hert, Rosenbaum, Skutnik, & Backs, 1995).

## CONCLUSIONS

What conclusions can be drawn from this study? What is interesting, is that in this material, it can be suspected that there is interplay between different aspects, which can be studied further. Children describing the Internet system in terms of network representation are also the ones who know a lot about how the system works and also talk in more reflected terms about reliability. It appears as if some knowledge facilitates this reasoning, but it does not appear as if their knowledge has to be very great, as children with less knowledge also talk about reliability on the Net. This could be seen as being in line with Turkle's (1995) theories that it is not necessary to have a complete mastery of the system to use it. However, children with very little knowledge seem to have greater difficulties seeing through the system.

What this study aims to point out is that there appear to be certain interplaying aspects that should be investigated further. From a cultural perspective, it is not relevant to pose the question about what came first, the chicken or the egg. Different aspects work in a dialectical relationship and the aspects mentioned are probably developed in interplay, in parallel. Carroll and Olson (1988) also pointed to this matter. According to Carroll and Olson, a model from the outside can help in understanding the system. In this study,

only spontaneous models were asked for. Perhaps discussion about different models can be a way to develop understanding of the Internet as a system, both technically and functionally, naturally in a context where other aspects are discussed and where the Internet is used practically. A study focusing specifically on children's models in relation to their view of the Internet's reliability and critical reasoning could cover a wider sample. In the classroom studied, the teacher was very active in helping the children develop their own understanding of the system with discussions. A possible design would be to study classes where these discussions took part combined with work on the Internet compared to classes where the students worked only on the Internet. This could make it possible to evaluate the help in developing models, and also if children develop models by themselves by working on the Internet. Control groups not working on the Internet added to these classes would make it possible to see how an intervention could effect the children's reflections on the Internet's reliability. It is also possible from the categories in the results of this study, to design questionnaires. The problem with questionnaires where the categories are presented is that the respondents can choose a category they do not fully understand.

The contribution to the field from this study shows that it is important to understand how children develop their knowledge of the Internet as a source of information, which is not always reliable; how they develop their understanding of how different standpoints meet, and that anyone can put anything on the Net. Knowledge that is essential in a growing information society.

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## Notes

1. Lévi-Strauss used this word to contrast the western society's analytical methodology with the concrete association-rich science in many non-western societies.
2. The server of the school is situated in the basement.