

A legal analysis of human and electronic agents

STEFFEN WETTIG and EBERHARD ZEHENDNER

Department of Computer Science, Friedrich Schiller University Jena, D-07740 Jena, Germany
E-mail: wettig@informatik.uni-jena.de; nez@uni-jena.de

Abstract. Currently, electronic agents are being designed and implemented that, unprecedentedly, will be capable of performing legally binding actions. These advances necessitate a thorough treatment of their legal consequences. In our paper, we first demonstrate that electronic agents behave structurally similar to human agents. Then we study how declarations of intention stated by an electronic agent are related to ordinary declarations of intention given by natural persons or legal entities, and also how the actions of electronic agents in this respect have to be classified under German law. We discuss four different approaches of classifying agent declarations. As one of these, we propose the concept of an “electronic person” (i.e., agents with limited liability), enrolment of agents into an agent register, and agent liability funds as means to serve the needs of all contracting parties.

Key words: agents, declaration of intention, electronic agent, electronic person, German law, law of agency, legal personality, mobile agent, mobile code, representative, software agent

1. Why do we need agents?

1.1. THE HUMAN WORLD

The term “agent” derived from the Latin word “agere”, which has meanings such as “acting” or “work”.¹ The Longman Dictionary of English Language and Culture (Summers 1992) defines an agent as “a person whose job is to represent another person, a company, etc”. Humans avail themselves of an agent in order to settle specific tasks that they are either not able, not willing, or even not authorised to implement on their own. This may save time and resources, and the agent extends the activity space of a person, also for legally binding actions (e.g. the conclusion of contracts). In the material world, we have different designations for these agents, such as representative, messenger, broker, or assistant.

In the course of time, we have become reliant on these agents, as they make life easier. The following shows an abundance of areas in which these human agents work, and it is to say that we take them all for granted: the

insurance industry, the stock exchange, hotel reservations, publishing, real estate, litigation, advertising, travel agencies, recruiting agencies, and even espionage. Thus it can be said that all tasks assigned to agents (actions plus the provision of information) in the material world are carried out by humans.

1.2. THE ELECTRONIC WORLD

In the virtual world, there is a need to automate time-intensive and repetitive processes by delegating them to representatives. These can be robots (hardware agents) or electronic agents² (software agents), cf. Brenner et al. (1998). We will limit our investigation to electronic agents.

There is no generally accepted definition of an “electronic agent”. This term is to be interpreted with respect to an interdisciplinary area in which different scientific fields of research (e.g., artificial intelligence, information and communication systems, social science, and computer science) with different emphases are represented (Brenner et al. 1998). Software agents are programs that react autonomously to changes in their environment and solve their tasks without any intervention of the user. These features, among others (Wooldridge and Jennings 1995; Kerr 1999a, b; Murch and Johnson 1999; Brenner et al. 1998), distinguish them from conventional software programs.

There are stationary agents as well as mobile ones. Stationary agents are not able to leave their original environment, whereas mobile agents are software programs that move around (migrate) independently in heterogeneous computer networks, see for instance Kotz and Gray (1999). Therefore an infrastructure of agent servers is necessary, which can dispatch, receive, and implement these agents. The “mobile code” – including some internal state or data, if preferred – thus can migrate to the information source for direct evaluation.

Mobile agents have several advantages over stationary agents. Configured locally, they are injected into the network, wandering across it from server to server, eventually returning to the user when their task has been completed. Thus mobile agents reduce the network traffic at the client interface, minimising uplink cost. Their multi-hop ability also yields a shorter response time if the uplink has less bandwidth than the average inter-server connection. Moreover, mobile agents support a “nomadic” computing style, because after delegation of the task, the user can go off-line while the agent works asynchronously.

Simply using an “information search” as an example demonstrates how important intelligent programs could be in the future. However, search techniques in the electronic world differ from those in the material world. In

the past, we obtained information either by personal contact (conversation, telephone call, etc.) or by searching for it (in libraries, encyclopaedias, etc.). Today, we have access to practically any given piece of information worldwide from our own homes via the Internet, and as time goes by, our opportunities are increasing without bound. This abundance of information can lead to “information overflow” or “information overload”. Thus information services that are tailored to fit the user and the situation are becoming more and more important (Zarnekow and Brenner 1999, p. 344).

Searching the Web initially started with “click and browse”, i.e., choosing a suitable web page and clicking on the relevant link to reach the desired destination. This search is refined when clicking on further links on every webpage accessed. As a drawback of this method we need foreknowledge to start the search (e.g. a Website) as well as considerable time, patience, and even luck.

“Search engines”³ avoid these disadvantages though, since the user searches the Web guided by keywords. A search engine presents the results as links, which then can be accessed simply by a click of the mouse. What the regular Web user does not realise though, is that the information hidden behind these links has passed a kind of filtering process, steered by the keywords provided. The more general and undifferentiated the keywords, the larger the number of links with potentially important information, but this also means that there will be a large amount of unnecessary links, too. Search engines are often incapable of distinguishing the context of a user’s request, and thus user control and intervention are required to check the relevance of the results. Also with respect to the refinement of the keywords, the filtering of irrelevant information remains in the hands of the user.

Searching with “electronic agents” will bypass some of the drawbacks of current searching techniques. The provision of information has to be accomplished independently as far as possible. To achieve this goal, however, criteria must be given to the agent characterising the desired information. After reception of the criteria, the agent will search independently for sources and information (Fischbach 1996, pp. 146ff). Its task is to find and present only the most relevant information to the user. The proposed “intelligence” has to check the information for its relevance to the task and must react upon the conditions and changes of the environment without losing sight of the goal. A mobile agent could, for instance, look for a book described by some criteria, while the users can dedicate themselves to other tasks. The agent evaluates the data with an objective function directly at the target site. If the task is solved, the agent returns with additional individual information if required, e.g. book stores near the user, or a price/performance structure. The user then receives the desired information in compact form and with a minimum of expenditure. In the near future, one could go even further by instructing the agent to order the book for the user.⁴

agents. The area, “task”, points out individual talents that the agent needs. Table III gives corresponding concepts pertaining to task.

We can regard the communication skills under two aspects: the interaction of the agent *with the client/user*, or the interaction *with other agents*. Tables IV and V show corresponding concepts pertaining to the communication with the client/user and with other agents.

These complementary pairs of concepts suggest that there might be no principal differences between human and electronic agents. Although the method of execution is case-specific, we notice essentially the same structures.

2. Why study the legal aspects of agents?

We have shown a close relationship between electronic agents and human agents with respect to intentions, actions, and conditions. Legal considerations are a logical consequence of this analogy.

Due to limitations in space, we will narrow the focus to German law and only treat some selected aspects of it in this section. For further discussions about the law of electronic agents in the USA, Canada, and other states see, for instance, Kerr (1999a, b, 2001), Sartor (2002a), Oskamp and Weitzenböck (2003), Lerouge (1999), Weitzenboeck (2001), or Zankl (2004b).

Table I. Corresponding concepts pertaining to *a priori* knowledge

<i>A priori</i> knowledge	
Human	Electronic
<i>Education and experience</i> These determine the basic knowledge of a human being	<i>Developer-specified</i> The developer of an agent system determines which knowledge an electronic agent has or can acquire
<i>Input from the client</i> From the clients, the agents get orders describing the tasks to be performed, which they must follow	<i>User-specified</i> The users can determine up to which degree the electronic agents receive information from them and which rules they have to obey
<i>Background and environment</i> Background and environment determine the knowledge of the agent. It can make a difference whether the agent works alone or co-operates with others, whether it can use databases and libraries or not	<i>System-specified</i> The system’s knowledge and the system conditions determine the possibilities of the electronic agent

Table II. Corresponding concepts pertaining to learning

learning	
Human	Electronic
<i>Dialog-based</i> Humans learn by exchanging opinions and by conversations	<i>Dialog-based</i> Electronic agents can check possibilities by inquiries and answers
<i>Brain- and knowledge-based</i> Capacity and talents of the brain and the available knowledge determine the ability to learn, i.e., to produce new insights	<i>Memory-based</i> Functionality and contents of the memory affect the possibilities of learning
<i>Human nervous system</i> The human brain is made up of trillions of neurons. They represent a biological neural network and thus serve for data processing and storage	<i>Neural networks</i> Neural networks are an artificial imitation of their biological model, the brains and nervous systems of humans and animals. The ability to learn and the use of parallelism during data processing are important characteristics
<i>Example-based</i> By examples humans can recognise patterns, which might also be helpful for another problem	<i>Case-based</i> Computers and electronic agents look for a solution for a certain case. Once determined, such a solution appears as it had been learned and can be used again
<i>Specialists and experts</i> To solve tasks in special fields, we avail ourselves of specialists and experts. Also, the general possibilities of humans to learn are influenced by teachers and examples of best practice	<i>Neural experts</i> Expert systems are meant to copy the deductive abilities and the specialised knowledge of experts in a certain field

2.1. THE HUMAN WORLD – LEGAL BASICS

2.1.1. *The essence of a legal personality*

The German legal system differentiates between legal subjects and legal objects. Legal subjects, usually humans, can be holders of rights and obligations. For legal objects though (e.g. things, intellectual property rights) this is not possible. These can only be the object of a legal owner's rights (Brox 2001, p. 352, No. 731). Legal objects are thus assigned to legal subjects (Schweighofer 2001, p. 50). Essential characteristics of legal subjects, i.e., owners of a "legal personality" (*Rechtspersönlichkeit* in German), are "legal capacity" (*Rechtsfähigkeit* in German) and "contractual capacity"

Table III. Corresponding concepts pertaining to task

Task	
Human	Electronic
<p><i>Investigation</i> The mission of human agents is to obtain information by searching a variety of sources</p>	<p><i>Information retrieval</i> Electronic agents generally can find information within a short time in a multiplicity of databases</p>
<p><i>Information validation</i> Human agents should examine obtained information for relevance to the given task, thus selecting the most important, only</p>	<p><i>Information filtering</i> The multiplicity of the possible information requires that only a reasonable amount passes the filter of the electronic agent</p>
<p><i>Assistant/adviser</i> Human agents are supposed to act as a kind of assistant or adviser</p>	<p><i>Coaching</i> Electronic agents are supposed to aid humans with their tasks</p>

Table IV. Corresponding concepts pertaining to the communication with the client

Communication with the client/user	
Human	Electronic
<p><i>Communication possibilities and devices</i> Everything can be important here that may be used in interpersonal communication, e.g. letters, telephone, email, etc.</p>	<p><i>Interface</i> Interfaces allow electronic agents to communicate with human clients. Communication regularly will be by well-known computer facilities, e.g. monitor, dialog fields, email, etc.</p>
<p><i>Common language</i> The human agent has to understand the task given to them by their client. Both must communicate in the same language and on the same level. The agent must be able to express themselves comprehensibly and should not be constrained by technical terminology and special expressions</p>	<p><i>Speech</i> Electronic agents and humans have to communicate in some language – whether this is a natural language or a computer language understandable for humans. What matters is that both understand what the other means</p>
<p><i>Social competence</i> For the contact with other humans, in particular for communication, the agent needs social competence, which affects credibility and confidence</p>	<p><i>Social</i> Based on reproduction of human characteristics, the electronic agent may appear more and more as a 'person' to its client</p>

Table V. Corresponding concepts pertaining to the communication with other agents

Communication with other agents	
Human	Electronic
<i>Special communication language</i> In contrast to common language, technical language is made to express oneself on an expert level. Precision and the knowledge of fundamental technical terms are of eminent importance here	<i>Inter agent communication language</i> Electronic agents also use a special language in order to exchange data or to communicate with each other

(*Geschäftsfähigkeit* in German). To further elaborate on these concepts, we refer to the BGB (Bürgerliches Gesetzbuch, i.e., the German Civil Code).⁵

Natural persons

Legal capacity is the ability to have rights and obligations (Brox 2001, p. 318, No. 655). This ability is given to each human being at birth (§ 1 BGB)⁶, and it ends with death. Even babies and mentally disabled persons have legal capacity.

Contractual capacity is the ability to perform legal transactions effectively, i.e., actions that imply legal consequences. But this is only meaningful if the acting persons can understand the consequences of their declarations (Brox 2001, p. 133, No. 222). In the BGB, there is no definition of contractual capacity. In contrast, it specifies all situations in which a person is not deemed to be capable of contracting (§§ 104ff BGB). § 104 BGB declares those not capable of contracting, which are minors under 7 years of age (No. 1), and persons who are permanently mentally disabled (No. 2). Declarations of intention of these persons are ineffective. Minors from 7 up to 18 years of age are considered to be capable of contracting, albeit in a limited way (§ 106 BGB, *beschränkte Geschäftsfähigkeit* in German). That is, their declarations become effective under certain conditions only (§§ 107–113 BGB). Persons over 18 years of age are thus normally considered as capable of contracting (§§ 2, 104ff BGB).

Legal entities

Beside natural persons, legal entities have also been introduced. A “legal entity” (*juristische Person* in German) can be either an association of humans (e.g., a registered association) or an asset (e.g., a company with limited liability: Ltd., or *GmbH* in German), to which legal capacity and contractual

capacity is accorded by a legally binding act or by a special law. For associations, §§ 21ff BGB are applicable; for the GmbH, the regulation is § 13 GmbHG.⁷

2.1.2. *The formation of contracts*

Every day we encounter legal scenarios, and the definition of a standard conclusion of a contract portrays this. A contract is a legal transaction comprising declarations of intention of at least 2 persons, one stated such that it is contingent upon the other (Brox 2001, p. 51, No. 76); we use the term “meeting of minds” (“consensus ad idem”) as a metaphor. A substantial element of any contract conclusion is thus the declaration of intention. A declaration of intention [henceforth DOI] is a private expression of one’s will, addressed to another person and directed towards the achievement of a certain legal consequence (Brox 2001, p. 52, No. 80). As a precondition, the legal effectiveness of any digital statement depends on the acknowledgement of it as a DOI: even a digital statement has to be understood as a DOI in the sense of the BGB. According to the BGB, a DOI becomes effective only when received by the addressee (§ 130 I BGB); this is called a DOI with requirement of receipt. A contract generally is formed by the fact that a person delivers a DOI (called offer) to another person, and the addressee of this offer in due time (§ 146 BGB) likewise delivers another DOI (called acceptance) that they are willing to accept the offer (§§ 145ff BGB), see Figure 2.

For legally binding actions, e.g. the delivery of a DOI, and all consequences arising from these, we are, in principle, personally responsible. But, usually, we cannot perform all necessary actions personally. Thus, we often delegate the fulfilment of such tasks to other persons who act as agents for us. And so the problem emerges as to whether, and to what extent, we are liable for the actions – v and in particular for the DOIs – initiated by our agents, and how we can fulfil our obligations. Legal regulations were therefore created to settle the cases and problems that may arise. An agent

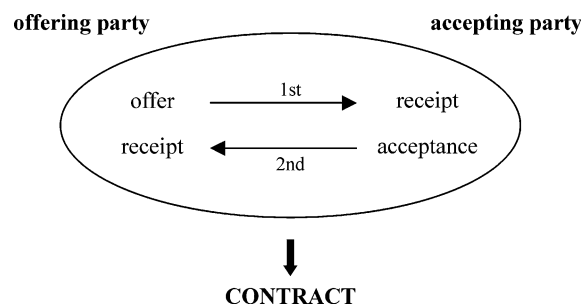


Figure 2. Principal mechanism of a contract conclusion, according to German law.

thus can appear e.g., as a “representative” (§§ 164ff BGB) or as a “messenger” (§ 120 BGB). Representatives (*Stellvertreter* in German) state their own DOIs on behalf and with the mandate of other persons (§ 164 BGB).⁸ Messengers (*Boten* in German) do not make their own declarations, but solely convey the DOIs of other persons (§ 120 BGB).⁹ (To learn more about these two concepts cf. Section 3.2.1.)

2.2. THE ELECTRONIC WORLD – AUTOMATION OF LEGAL PROCEDURES

The virtual world is closely associated with the automation of human actions by computers. The advent of automation has also introduced the problem of automated legal procedures. As early as the end of the sixties, the first scientific arguments on this new topic appeared. At that time, probably nobody could foresee the paramount importance of the Internet as we know it today. The relevant work focuses on the declaration of intention, cf. Mehrings (1999, p. 30, No. 80ff) or Kuhn (1991, p. 47ff), in each case with further references. The DOI, apart from the legal capacity and the contractual capacity of the concerned party (cf. Section 2.1.1.), represents the essential legal basis for attributing (or not) rights and obligations to a certain person.

The possibilities arising from the new technical developments had to be integrated into existing legal systematics. Although there are different designations and justifications, we can differentiate between three fundamental case groups (Mehrings 1999, p. 35, No. 90ff):

2.2.1. Electronically transmitted declaration of intention

By an “electronically transmitted declaration of intention” (*elektronisch übermittelte Willenserklärung* in German) we mean a declaration that is produced as usual but conveyed electronically to the other party. An example would be inserting a name, address, and commodity into an order form on the computer, and then forwarding the completed order electronically. Here the computer provides the electronic order form only; the declaration of intention is still being made by humans.

2.2.2. Automated declaration of intention

In contrast with an electronically transmitted declaration of intention, an “automated declaration of intention” (*automatisierte Willenserklärung* in German) is mechanically produced as a whole with the help of a computer program. Consider for example an insurance policy composed and printed after collecting the necessary data, such as the customer’s name, term,

insured risks, etc. The insurance policy produced in such a way is then mailed to the insured person by ordinary mail.

2.2.3. *Computer declaration*

When making a “computer declaration” (*Computererklärung* in German), the actual declaration (such as an order) is electronically produced with the help of an autonomous computer program and also conveyed electronically; no human action is involved (Kuhn 1991, p. 65; Mehrings 1998, p. 31; Mehrings 1999, p. 36, No. 92ff). The operator of the computer system does not even know of any declaration and never exerts any direct influence on whether a declaration is made, and if so, to whom it is addressed. Still more autonomously, the transaction could be performed on both sides via computer, e.g., between two data processing systems. The prevailing opinion concludes that a computer declaration has to be seen as a DOI of the facility user (Kuhn 1991, p. 62; Mehrings 1998, p. 31). The reasoning for this is twofold (Kuhn 1991, pp. 62ff; Mehrings 1999, p. 41, No. 105ff):

Declaration “ad incertis personas” (declaration vending machine)

One possible explanation gives the legal institution of a *declaration “ad incertis personas”* (i.e., an “offer to anyone”), cf. Köhler (1982, p. 132). Metaphorically, a computer here acts like a vending machine, delivering declarations instead of goods. By installing the vending machine, its owner implicitly delivers an offer to anyone, provided the machine is working normally and there is an availability of goods (Kuhn 1991, p. 61). Once set to work, no further intervention of the owner is necessary. By putting money into the slot, anyone can accept the offer, thereby concluding a contract. We may now think of a machine keeping complete declarations of intention on stock (Köhler 1982, p. 132; Kuhn 1991, pp. 61f).

Blank declaration – ‘stretched procedure’ (the computer as a working tool)

On the other hand, a computer declaration can be seen as a “blank declaration” (*Blanketterklärung* in German), like a signature in blank. In consequence, a computer declaration would be a DOI of the computer user, cf. Kuhn (1991, pp. 66ff), Mehrings (1999, p. 42, No. 110), also Gitter and Roßnagel (2003, p. 66). At the issue time of a blank declaration, the issuer does not yet know the concrete future contents of the to-be-completed form. The declaration is provided in a “stretched procedure-like way” (*gestrecktes Verfahren* in German, cf. Cornelius (2002, p. 355)) on demand, by having completed the blank form through a *personified tool* (Köhler 1982, pp. 133f; Kuhn 1991, pp. 66ff). The declaration itself is due to the issuer of the blank

form. This solution thus starts from the general legal rules (Cornelius 2002, p. 355). At the time of the data input, there is still no concrete DOI of the computer user (Kuhn 1991, p. 57; Mehrings 1998, p. 31). It cannot make a difference if the user, instead of a human, employs a computer, thus a *technical tool*, to mechanically complete the declaration (Köhler 1982, p. 134; Mehrings 1998, p. 31). This is just a division of labour between man and machine (Cornelius 2002, p. 355). Evidently, the computer user wants this declaration attributed to themselves, so it is their own DOI.

Given more intelligent electronic agents in the future, it does not seem impossible that these agents will not only collect information, i.e., observe and compare the providers of certain goods but also buy products on behalf of the user. Depending on its program, an agent solely informs its owner, or concludes the business completely on its own (Brenner et al. 1998). This possible development demands a legal discussion of such agent declarations.

3. Classification of the agent declaration with respect to German law

Not only in e-Commerce there is strong motivation to automate certain tasks. Often this also concerns legally binding actions, where automated DOIs as well as automated contract conclusion by means of an electronic agent enter the game. If a person acts through an electronic agent, the question arises of how the agent or the agent's declaration should be classified with respect to German law.

Four different approaches to classify the agent declaration deserve further elaboration as possible solutions to this question:

1. The "traditional approach" – agent declarations as computer declarations.
2. The "modern approach" – ascribing a legal personality to an agent.
3. The "historical approach" – contractual capacity without legal capacity.
4. The "progressive approach" – the "electronic person".

The progressive approach suggested by us, which is based on Karnow's idea of an "electronic persona" (Karnow 1994, 1997, pp. 117ff), will be introduced and discussed in detail in Section 4 below.

3.1. THE TRADITIONAL APPROACH: AGENT DECLARATIONS AS COMPUTER DECLARATIONS

For reasons stated above, the agent declaration can be compared with a *computer declaration*. The disciples (Cornelius 2002, pp. 353ff; Gitter and

Roßnagel 2003, pp. 64ff) of this “traditional approach” equate the former to a computer declaration, therefore considering it as a DOI of the agent’s owner (i.e., the computer user). One can justify this because of some similarities in the essential structure of the declaration generation process. Fixing the specific contents of the DOI is left to the computer and the electronic agent via input data (Mehring 1998, p. 31). It appears noteworthy, however, that the agent features an increased degree of intelligence and the ability to make autonomous decisions that are not fixed by rigid rules: an exact prediction of program execution is not possible. If the user could indeed predict the behaviour, there would be no need for any agent (Sartor 2002b, p. 6). Thus it is hardly possible to speak of completed declarations kept in stock (Cornelius 2002, p. 354). Nevertheless, a comparison with the blank declaration and the stretched procedure supports the traditional approach. The situation of interest appears similar from the point of view of the declaration’s addressee, despite the special capabilities and the intelligence of the agent. Thus, to some extent, it is acceptable to classify the agent declaration as a computer declaration, which in turn would be a declaration of the agent’s owner. Yet, mobile electronic agents deserve special treatment. The notion of the computer declaration was developed at a time when today’s technical possibilities were not yet foreseeable. Concerning the computer declaration, it is assumed that the computer system (and therefore the agent) is accessible to the user; the user is the operator of the system (or acts relatively close to it). But this premise is not always true with mobile agents. Mobile code is executed in environments that may be completely unknown to the owner of the agent or where they possibly can have little influence. Due to a larger independence and greater spatial distance from the user, the parallel to a human representative seems more obvious with mobile agents.

3.2. THE MODERN APPROACH: ASCRIBING A LEGAL PERSONALITY TO AN AGENT

The “modern approach” consists in the consideration of whether a legal personality can be ascribed to an electronic agent. If this would be the case, the agent possibly states its own DOI, and so rights and obligations of an effective contract could apply to it. Unusual as this construction may appear at first sight, further discussion is worthwhile because this has been a starting point of numerous discussions in other countries as well (Kerr 1999a, b, 2001; Schwarz 2001; Schweighofer 2001; Weitzenboeck 2001; Sartor 2002a; van Haentjens 2002; Oskamp and Weitzenboeck 2003).

If we examine the legal requirements for a legal personality (cf. Section 2.1.1.), we have to state the following: an electronic agent is an artefact and

thus cannot be regarded as a natural person. Moreover, there are no special legal regulations in Germany that would explicitly attribute legal capacity or contractual capacity to a computer or an electronic agent. Thus, at this time, electronic agents have no assured legal personality.

3.2.1. Reasoning by analogy

However, as already shown above, there are certain operative similarities between human agents and electronic agents. Thus it is well justified to study, by analogy, already existing legal institutions when trying to find a legal classification of agent declarations.

The historic legislators of the BGB could not have foreseen the technical developments which eventually resulted in independently acting electronic agents. Few counted on the fact that there would be “intelligent machines” that autonomously represent users and act as representatives. But any willing person should be allowed to be represented by a software agent (Schwarz 2001, p. 69). Thus we are faced with a loophole in the law. Such a gap can be filled by analogy, by applying an already existing legal regulation to the problem. Besides the existence of an “unwanted regulation gap” (*planwidrige Regelungslücke* in German), a further precondition for arguing by analogy is “comparability of interest”, which may be deduced from the following existing regulations:

The agent as a representative (a double analogy)

We can regard the *electronic agent as a representative*¹⁰ (*Stellvertreter* in German) of the agent’s owner, following § 164ff BGB.¹¹ Representatives state their own DOIs on behalf and with the mandate of other persons. One problem here seems to be the notion of an “own” DOI, because this is only possible for a legal subject. Besides, a representative must be at least capable of contracting in a limited way (§ 165 BGB);¹² our analogy could cover this problem. But here we need a double analogy, because both legal capacity as well as (at least limited) contractual capacity are necessary.

A substantial principle of the German law is the “freedom of contract” (*Vertragsfreiheit* in German). Freedom of contract means that any person can conclude a contract with any other person, as far as the contents of this contract is not prohibited by law. This also implies that any person can make use of another person (e.g. a representative) for the conclusion of such a contract. However there is a danger that an unauthorised person claims to be a representative of another person, or that a representative exceeds their given authority. For this case, it would be inequitable for the falsely represented person to be responsible. But since the third party – by the appearance of a supposedly authorised representative – could rely on

concluding a valid contract, it would be also unjustified if the contract were ineffective.

In order to reconcile both legitimate interests, the German legislation introduced the liability of the representative without representative authority, which can be interpreted as a kind of “transaction protection” (*Verkehrsschutz* in German). If a representative acts without actual representative authority, § 179 BGB¹³ states that the contracting party can adhere to the representative, because the latter acted toward the third party. The contract in this case is taken as concluded with the representative.

However, construed in the context of the suggested analogy, this regulation appears somewhat problematic. The electronic agent as a contracting party is useless to the third party as long as it cannot incur a liability in a material way. In this case, § 179 BGB would be without any effect (Kuhn 1991, p. 66; Cornelius 2002, p. 355; Gitter and Roßnagel 2003, p. 66, footnote 16).

The agent as a messenger (a simple analogy)

A further approach would be to regard the *electronic agent as a messenger* (*Bote* in German) of the agent’s owner (van Haentjens 2002, p. 85). Messengers do not make their own declarations, but solely convey the DOIs of other persons (§ 120 BGB).¹⁴ Here a simple analogy would suffice, because legal capacity is sufficient to act as a messenger. However, an electronic agent participates in fixing the contents of a declaration (Cornelius 2002, p. 355; Gitter and Roßnagel 2003, p. 66), thus doing more than a messenger does. According to Schwarz (2001, p. 68), this analogy is also not applicable if the receiver of the DOI recognises that the declaration is provided by an electronic agent and not by its user.

The agent as a minor, capable of contracting in a limited way (a double analogy)

We have not yet considered in detail the approach to regard the *electronic agent as a minor* capable of contracting only in a limited way (*beschränkt Geschäftsfähiger* in German). This possibility was also mentioned by Zankl (2004a, p. 2), but without further treatment. If one continues to pursue this idea, the situation would be as follows: a double analogy would be needed, because both legal capacity and limited contractual capacity would be necessary. As already mentioned, DOIs stated by persons with limited contractual capacity are regulated in §§ 106ff BGB, cf. Section 2.1.1. These articles are intended to protect the rights of minors. Note, however, that these regulations concern constellations in which the minor themselves wants to conclude a contract. So far, we have assumed that an electronic agent only

tries to serve the interests of its owner, i.e., that it is not interested in contracting for its own sake. This again would lead to the view of a representative. Any person with limited contractual capacity may be representative (§§ 107, 165 BGB) and messenger at the same time. Thus these cases appear to be already covered by the solutions discussed above but with only limited contractual capacity.

3.2.2. Comparability of interest

Comparability of interest (*vergleichbare Interessenlage* in German) in all three regulations essentially relates to the question of how close an electronic agent can get to the legal status of a human (Schweighofer 2001, pp. 50f). In Section 1, we started a comparison of the abilities of electronic agents to those of humans. If we extend these thoughts to the legal aspects, we notice a clash of the technical and the philosophical/ethical interpretations of the terms autonomy, intelligence, etc. The technical interpretation poses no major problem, but the philosophical/ethical interpretation is closer to the legal view. Nevertheless certain authors accept the analogy (Schwarz 2001, p. 69).¹⁵ It has been argued that a person is a life-form that is responsive to reasons. The person is self-determined and moral (Schweighofer 2001, p. 48ff). In addition, identification of the intelligent agent is problematic: “Is it the hardware? Is it the software? What if hardware and software are dispersed over several sites and maintained by different individuals?” (Allen and Widdison 1996, p. 42).

The basis of the will, consciousness of one’s own existence, is not yet accepted for current information processing systems, and thus an analogy is rejected (Kuhn 1991, p. 65; Weitzenboeck 2001; Cornelius 2002, pp. 354ff; Gitter and Roßnagel 2003, p. 66). However, it does not seem in principle impossible to acknowledge a legal personality for an electronic agent, provided an even greater independence and further progress in the research on artificial intelligence is achieved (Cornelius, 2002, p. 354).¹⁶

If we concern ourselves with this philosophical question in the light of artificial intelligence, we probably should not completely disregard Asimov’s 3 laws of robotics (Asimov 1986) in this context, which are supposed to hold for software agents also:

1. A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings, except where such orders would conflict with the First Law.
3. A robot must protect its own existence, except where such protection would conflict with the First or Second Law.

Beside this philosophical starting point, it is also necessary to regard further aspects of a legal personality for robots and intelligent agents. What in essence constitutes a legal personality? Schweighofer (2001, pp. 51f) suggests the following criteria:

- Material criteria of the legal personality: mobility, senses (vision, hearing, touch), autonomous intelligence, consciousness (quality of perception, intention, identity, space of reasons).
- Beginning and end of the legal personality, capacity to act, liability fund: birth and death, registration, repair, technical outdatedness, age weakness, full or limited capacity to act.
- Robot owner (robot ruling power): acquisition and transfer, limitation of the rule (individual or collective).

If one regards this abundance of aspects, the possibilities of intelligent agents appear rather moderate at the moment. Schweighofer (2001, p. 52) therefore claims that a qualification even for the lowest level of the human capacity to act is far beyond discussion at the moment. But, as the automation of daily life continuously progresses, it seems promising to pursue further such questions.

3.3. THE HISTORICAL APPROACH: CONTRACTUAL CAPACITY WITHOUT LEGAL CAPACITY

A further idea is mentioned by Schweighofer (2001, p. 52)¹⁷ who suggests trying the *model of a contractual capacity without legal capacity*. In Roman law, slaves had no legal capacity but were allowed to act at their will; their actions were legally attributed to their master (Schweighofer, 2001, p. 52, footnote 10).¹⁸ But this contradicts the dogmatic construction of current law. Contractual capacity inherently presumes legal capacity in this thinking.¹⁹ If a person is not legally responsible, they cannot possess the right to conclude contracts. Schweighofer's suggestion therefore has to be rejected. There cannot be an "electronic slave" after the Roman model.

4. The progressive approach: The 'electronic person' – Proposal for a new legislation

4.1. THE IDEA

An alternative to using an analogy to existing legal institutions would be the creation of new legal regulations inducing the desired result, i.e.,

explicitly granting (under certain conditions) a legal personality to electronic agents. Why shouldn't there be an 'electronic person' (or *e-Person*) beside the natural person and the legal entity?²⁰ No objections from a legal-theoretical point of view! The existing legal system already contains a construct that obtains legal capacity and contractual capacity by legal regulation: the legal entity (Zankl 2004a, p. 2). This procedure is conceivable also for electronic agents. Comparable to the register of companies (*Handelsregister* for the GmbH in Germany), there could be an agent register.²¹ Due to the technical closeness such a register could even be kept online. The owner of an agent could grant a certain amount of money to the agent by enrolling it into this register. The result would be a kind of agent with limited liability (Ltd. Agent). Since liability safeguarding is very important, this fund could back up claims of the contracting parties in case of problems (Sartor 2002b, p. 9).²²

The crucial question is as always: *Who is liable?* If business is done correctly, legal concerns are usually irrelevant. But if problems emerge, matters change dramatically. The approaches discussed so far would yield the following results: following the traditional approach, the owner of the agent is liable, because the DOI is attributed to him. Following the modern approach, the electronic agent possibly would be liable in principle; but as claims practically cannot be realised against the agent, liability falls back again on the owner of the agent. The concept of an *electronic person* (*e-Person*) offers a crucial advantage over the other approaches: it allows a limitation of the liability for the owner of the agent. The contracting party also draws some advantage from this: if they realise that they are negotiating with an electronic agent, they could check the solvency of the agent in the register before concluding the contract; see Allen and Widdison (1996, p. 42f) for a similar argument. Thus we would get a win-win-situation, satisfying all parties. Eventually, this could greatly benefit confidence in agent technology.

4.2. QUESTIONS AND THE SEARCH FOR SOLUTIONS

If we continue to pursue the concept of the electronic person (and also registered agents), we encounter two important questions that deserve further consideration:

1. *Assume there is an agent register governed by legal regulations. Should we also allow for unregistered agents, and what would their status be?*

This first question is relatively simple to answer. In our opinion, the registration of an agent should be an advantageous option, only. Unregistered electronic agents would be treated as under the current legal situation, thus according to the traditional approach or the modern approach we

discussed above. At this status the user is responsible for the electronic agent. One could now ask: why create an *electronic person*? But, as was pointed out in this work, substantial uncertainties exist on how the hardly tangible electronic agents should be legally treated. Further, this could imply unlimited liability of the user. Although the suggested *e-Person* does not remove the basic liability of the user, because in consequence they always must provide the liability fund, the use of Ltd. agents has the great advantage that one can limit the liability to a certain amount. Our concept may then strengthen the overall legal security as well as the confidence in the usability of the agent technology.

2. *If legal regulations for electronic persons were to be created, how can we define such an electronic person?*

When studied more closely, this second question turns out to be fundamental. Rights and obligations can only be specified if their applications are clearly foreseeable. There have already been various definition attempts from a technical perspective. From a legal point of view, an unequivocal definition would be desirable. This, however, demands for an interdisciplinary co-operation of technicians and legal experts, which still necessitates a comprehensive scientific treatment. We would be pleased to promote such research by supplying our own approach simply as an attempt. In our view, the American and Canadian regulations could be used as a starting point for such a discussion. They read as follows:

The U.S. Uniform Electronic Transaction Act (UETA) defines an electronic agent in paragraph 2 (6), cf. UETA (1999):

SECTION 2. DEFINITIONS. In this [Act]:

(6) “Electronic agent” means a computer program or an electronic or other automated means used independently to initiate an action or respond to electronic records or performances in whole or in part, without review or action by an individual.

A drawback of this definition is that electronic agents are seen only as machines or tools (Weitzenboeck 2001; van Haentjens 2002), although reference is made to future developments of electronic agents that act autonomously and without human intervention in the scope of the programmed parameters.²³

The U.S. Uniform Computer Information Transaction Act (UCITA) defines electronic agents in the following way, cf. UCITA (1999):

SECTION 102. DEFINITIONS

(27) “Electronic agent” means a computer program, or electronic or other automated means, used independently to initiate an action, or to respond to electronic messages or performances, on the person’s behalf

without review or action by an individual at the time of the action or response to the message or performance.

Electronic agents are thus defined as computer programs that are able to act independently without review by a human (Kerr 1999a, p. 228). Although it is stated that the electronic agent acts on a person's behalf, the electronic agent is not considered a representative of its user in the sense of the common law (Weitzenboeck 2001). The electronic agent nevertheless does bind its user legally (van Haentjens 2002).

In 1999, the Uniform Electronic Commerce Act (UECA) was adopted in Canada (Weitzenboeck 2001). Electronic agents are defined in paragraph 19 of the second part of the UECA (1999) as follows:

Table VI. Comparison of the three quoted definitions word by word

UETA	UCITA	UECA	Differences
electronic agent means a computer program or an electronic	electronic agent means a computer program or electronic	electronic agent means a computer program or any electronic means	
or other automated means used independently to initiate an action or respond to electronic records	or other automated means used independently to initiate an action or to respond to electronic messages	(-) used to initiate an action or to respond to electronic documents	or other automated means independently records, messages, documents
or performances (-)	or performances on the person's behalf	or actions (-)	performances, actions on the person's behalf
in whole or in part without review or action by an individual	(-) without review or action by an individual	in whole or in part without review (-) by a natural person	in whole or in part or action individual, natural person
natural person (-)	at the time of the action or response	at the time of the response or action	at the time of the action or response
(-)	to the message or performance	(-)	to the message or performance

19. In this Part, “electronic agent” means a computer program or any electronic means used to initiate an action or to respond to electronic documents or actions in whole or in part without review by a natural person at the time of the response or action.

An electronic agent is regarded as a computer program (or any electronic means). The authors of this paragraph considered that transactions via computer usually are automated. It has been perfectly clarified, however, that an electronic agent is only regarded as a tool, which has nothing in common with an agent in the sense of the law of agency (UECA 1999).

A comparison of the three quoted definitions is shown in Table VI. A schematic view like this can hardly produce a generally applicable statement, because the context in the respective law as well as other existing regulations matter. If we nevertheless would dare to generalise, we could formulate the following theses:

- Thesis 1:* The points that are present in all three definitions seem to be substantial components of agents from the legal view.
- Thesis 2:* For the points that show differences in the choice of words or that are missing in some definition it remains to examine whether a legal reason for these differences can be found, or whether the cause is purely editorial.

For the latter however, a more detailed study of these regulations and their legal systematics would be necessary. Our investigation has presented a cross section of the current German legal situation in application to the subject material, and is not intended to serve as a finished thesis. Our excursus was meant to point out possible approaches to find a definition. We hope that this contribution aroused interest in this problem and will give rise to further discussion.

5. Conclusions

Following the explanations above, it should be clear now that we live in an “agents’ world.” All the time, wherever we are, we are surrounded by agents. Nobody is able to deal with all necessary tasks personally. In the digital age, we will see more and more functions delegated to electronic (software) agents. The agent, as an assistant or even a representative, can support the user in their daily work. It is obvious that tasks transferred to electronic agents, just as actions performed by humans, may lead to certain legal consequences. A study of electronic agents particularly under legal aspects seems unavoidable to that extent.

At first sight, the electronic agents can be interpreted as computer declarations without problems. However, this probably applies only to the “normal” (stationary) software agents. Modern day technology – and in particular the existence of mobile agents – was not yet foreseeable at the time when the legal classification of the computer declaration took place. A renewed examination of the resulting benefits and risks of electronic agents is thus required. With mobile agents, a new problem appears. While the current legal systematics attributes an action of a computer to the operator, the code and data of a mobile agent do not reside on the computer system of the agent’s owner, but on another computer. This represents a new quality, because the agent’s owner usually does not have influence on the foreign computer system. A manipulation thus would be outside their control. Due to larger independence compared with the computer and the spatial distance of the user, the parallel to the material representative and to this extent the acknowledgement of its own legal personality seem more obvious with mobile agents. But we found that there is a very broad line between a technical, legal, and philosophical/ethical interpretation of the terms used. The creation of an agent register is a possibility which could eliminate existing ambiguity over the legal status of electronic agents. It is hoped, this present contribution will encourage further discussion.

Acknowledgments

We thank our referees and our friends for many valuable suggestions and comments that helped to improve the paper.

Notes

¹ According to Rothermel and Schwehm (1998), ‘agent’ also stems from the Greek word “agein”, which means ‘to drive’ or “to lead”.

² Other designations are: intelligent agent, digital agent, shopping agent, autonomous agent, softbot, crawler, userbot, knowbot, etc. A comprehensive introduction to the agent technology is given by the “UMBC Agent Web” – University of Maryland Baltimore County, online: <http://agents.umbc.edu>, and “Agentlink”, the European Network of Excellence for Agent Based Computing, online: <http://www.agentlink.org>.

³ Search engines are for instance: www.google.com, www.wisenut.com, and www.teoma.com.

⁴ Whether this will be possible, and how such proceeding has to be classified legally, is studied in the sequel of the present work.

⁵ German version of the BGB online: http://bundesrecht.juris.de/bundesrecht/GESAMT_index.html. English excerpts online: <http://www.hull.ac.uk/php/lastcb/bgbengl.htm> (older version), also <http://www.iuscomp.org/gla/statutes/BGBrest.htm> and <http://www.iuscomp.org/gla/statutes/BGB.htm>. Cited as available on January 6, 2004.

⁶ § 1 [*Beginning of legal capacity*] *The legal capacity of a human being begins with the completion of birth.* (Source cf. note 5.)

⁷ “Gesetz betreffend die Gesellschaften mit beschränkter Haftung. German version online: http://bundesrecht.juris.de/bundesrecht/GESAMT_index.html. Cited as available on January 6, 2004.

⁸ § 164 [Effect of declaration by a representative] (1) A declaration of intention which a person makes in the name of a principal within the scope of his agency operates directly both in favor of and against the principal. It makes no difference whether the declaration is made expressly in the name of the principal, or if the circumstances indicate that it was to be made in his name.

(2) If the intention to act in the name of another is not apparent, the agent's absence of intention to act in his own name is not taken into consideration.

(3) The provisions of (1) apply *mutatis mutandis* if a declaration of intention required to be made to another is made to his agent. (Source cf. note 5.)

⁹ § 120 [Rescission because of incorrect transmission] A declaration of intention which has been incorrectly transmitted by the person or institution employed for its transmission may be rescinded under the same condition as a declaration of intention made in error as provided for by § 119. (Source cf. note 5.)

¹⁰ In result Schwarz (2001, p. 69).

¹¹ § 164 [Effect of declaration by a representative] (1) A declaration of intention which a person makes in the name of a principal within the scope of his agency operates directly both in favor of and against the principal. It makes no difference whether the declaration is made expressly in the name of the principal, or if the circumstances indicate that it was to be made in his name.

(2) If the intention to act in the name of another is not apparent, the agent's absence of intention to act in his own name is not taken into consideration.

(3) The provisions of (1) apply *mutatis mutandis* if a declaration of intention required to be made to another is made to his agent. (Source cf. note 5.)

¹² § 165 [Representative limited in competency] The validity of a declaration of intention made by or to an agent is not impaired by the fact that he is limited in competency to enter into legal transactions.

¹³ § 179 (Liability of an unauthorised agent) (1) Whoever has entered into a contract as agent is, if he has not given proof of his authority, bound to the other party at his choice either to carry out the contract or to compensate him, if the principal refuses to ratify the contract.

(2) If the agent did not know that he had no authority, he is bound to compensate only for the damage which the other party has sustained by relying upon the authority; not, however, beyond the value of the interest which the other party has in the validity of the contract.

(3) The agent is not liable, if the other party knew or should have known of the lack of authority. The agent is also not liable if he was limited in his competency to enter into transactions, unless he had acted with the consent of his legal representative. (Source cf. note 5.)

¹⁴ § 120 [Rescission because of incorrect transmission] A declaration of intention which has been incorrectly transmitted by the person or institution employed for its transmission may be rescinded under the same condition as a declaration of intention made in error as provided for by § 119. (Source cf. note 5.)

¹⁵ See van Haentjens (2002, p. 85) for the messenger solution.

¹⁶ Probably as a result also see Zankl (2004a) or Schweighofer (2001, p. 52).

¹⁷ With reference to Schwarz (2001).

¹⁸ For some more information see also Kerr (1999a, pp. 237ff).

¹⁹ Also Zankl (2004b, p. 99) considers such a solution as problematic.

²⁰ Schweighofer (2001, p. 51) calls this an “artificial human”. Karnow (1994; 1997, pp. 117ff) calls this “electronic persona”, “eperson” or “eper”. He says also, that better terms may come and prefers the term “tupels” by analogy to peoples and “tupern” by analogy to person.

²¹ Kind of a register also suggested by Allen and Widdison (1996, p. 42) and Karnow (1996, pp. 193f).

²² Schweighofer (2001, p. 52) has also the idea of funds.

²³ Clarified in the Draft Comments to the definition of electronic agents in paragraph 2 of the UETA as follows: “While this Act proceeds on the paradigm that an electronic agent is capable of

performing only within the technical strictures of its preset programming, it is conceivable that, within the useful life of this Act, electronic agents may be created with the ability to act autonomously, and not just automatically. That is, through developments in artificial intelligence, a computer may be able to “learn through experience, modify the instructions in their own programs, and even devise new instructions”. (Allen and Widdison, 1996, p. 25). If such developments occur, courts may construe the definition of electronic agent accordingly, in order to recognize such new capabilities”. UETA (1999), Draft Comment Section 2.

References

- Allen, T. and Widdison, R. (1996). Can Computers Make Contracts? *Harvard Journal of Law and Technology (HJLT)* 9(1): 25–52.
- Asimov, I. (1986). *Robot Dreams*. Berkley Publishing Group: New York.
- Brenner, W., Zarnkow, R., and Wittig, H. (1998). *Intelligent Software Agents: Foundations and Applications*. Springer: Berlin, New York.
- Brox, H. (2001). *Allgemeiner Teil des BGB*. 25th edn. Heymann: Köln, Berlin, Bonn, München.
- Caglayan, A. K. and Harrison, C. G. (1997). *The Agent Sourcebook*. John Wiley & Sons: New York.
- Cornelius, K. (2002). Vertragsabschluss durch autonome elektronische Agenten. *Multimedia und Recht (MMR)* 5(6): 353–358.
- Fischbach, R. (1996). Verständige Schlapphüte – Für und Wider: Intelligente Softwareagenten. *iX* 1996(4): 146–155.
- Gitter, R. and Roßnagel, A. (2003). Rechtsfragen mobiler Agentensysteme im E-Commerce. *Kommunikation und Recht (K&R)* 2003(2): 64–72.
- Karnow, C. E. A. (1994). The Encrypted Self: Fleshing out the Rights of Electronic Personalities. *The John Marshall Journal of Computer and Information Law* 13(1): 1–16.
- Karnow, C. E. A. (1996). Liability for Distributed Artificial Intelligences. *Berkeley Technology Law Journal (BTLJ)* 11(1): 147–204.
- Karnow, C. E. A. (1997). *Future Codes—Essays in Advanced Computer Technology and the Law*. Artech House: Boston, London.
- Kerr, I. R. (1999a). Spirits in a material World: Intelligent Agents as Intermediaries in Electronic Commerce. *Dalhousie Law Journal* 22(2): 188–249.
- Kerr, I. R. (1999b). Providing for Autonomous Electronic Devices in the Uniform Electronic Commerce Act. Online: <http://www.law.ualberta.ca/alri/ulc/current/ekerr.pdf>, as available on January 6, 2004.
- Kerr, I. R. (2001). Ensuring the Success of Contract Formation in Agent-Mediated Electronic Commerce. *Electronic Commerce Research* 1(1/2): 183–202.
- Köhler, H. (1982). Die Problematik automatisierter Rechtsvorgänge, insbesondere von Willenserklärungen. *Archiv für die civilistische Praxis (AcP)* 182: 126–171.
- Kotz, D. and Gray, R. S. (1999). Mobile Agents and the Future of the Internet. *ACM Operating Systems Review* 33(3): 7–13.
- Kuhn, M. (1991). *Rechtshandlungen mittels EDV und Telekommunikation*. Beck: München.
- Lerouge, J.-F. (1999). The Use of Electronic Agents Questioned under Contractual Law: Suggested Solutions on a European and American Level. *The John Marshall Journal of Computer and Information Law* 18(2): 403–433.
- Mehrings, J. (1998). Vertragsabschluß im Internet. *Multimedia und Recht (MMR)* 1(1): 30–33.
- Mehrings, J. (1999). Vertragsabschluss im Internet. In Hoeren, T. and Sieber, U. (eds). *Handbuch Multimedia-Recht: Rechtsfragen des elektronischen Geschäftsverkehrs*. Loose-leaf edn, part 13.1, update level August 2003. Beck: München.

- Murch, R. and Johnson, T. (1999). *Intelligent Software Agents*. Prentice Hall: New Jersey.
- Oskamp, A. and Weitzenboeck, E. M. (eds) (2003). *The Law of Electronic Agents*. Proceedings of the 2nd Workshop on the Law of Electronic Agents (LEA 2003), Edinburgh. Complex 5/03, Unipub Forlag: Oslo. Also online: http://www.iids.org/research/legal_aspects/events/ProgramLEA2003.htm, as available on January 6, 2004.
- Rothermel, K. and Schwehm, M. (1998). *Mobile Agents*. In Kent, A. and Williams, J. G. (eds) *Encyclopaedia for Computer Science and Technology*. volume 40, supplement 25, 155–176. Marcel Dekker: New York.
- Sartor, G. (ed.), (2002a). *The Law of Electronic Agents: Selected Revised Papers*. Proceedings of the Workshop on the Law of Electronic Agents (LEA 2002). Bologna: CIRSFID, Università di Bologna. Also online: <http://www.cirfid.unibo.it/~lea-02>, as available on January 6, 2004.
- Sartor, G. (2002b). *Agents in Cyberlaw*. In Sartor (2002a), 3–12.
- Schwarz, G. (2001). *Die rechtsgeschäftliche ‚Vertretung‘ durch Softwareagenten: Zurechnung und Haftung*. In Schweighofer, E., Menzel, T. and Kreuzbauer, G. (eds) *Auf dem Weg zur ePerson*. Schriftenreihe Rechtsinformatik, volume 3, 65–72. Verlag österreich: Wien.
- Schweighofer, E. (2001). *Vorüberlegungen zu künstlichen Personen: autonome Roboter und intelligente Softwareagenten*. In Schweighofer, E., Menzel, T., and Kreuzbauer, G. (eds) *Auf dem Weg zur ePerson*. Schriftenreihe Rechtsinformatik, volume 3, 45–54. Verlag österreich: Wien.
- Summers, D. (ed.) (1992). *Longman Dictionary of English Language and Culture*. Longman: Harlow, Essex.
- UCITA. (1999). *Uniform Computer Information Transaction Act*. Online: <http://www.law.upenn.edu/bll/ulc/ucita/ucita01.htm>, with last revisions and amendments 2001, as available on January 6, 2004.
- UECA. (1999). *Uniform Electronic Commerce Act*. Online: <http://www.law.ualberta.ca/alri/ulc/current/euecafin.htm>, as available on January 6, 2004.
- UETA. (1999). *Uniform Electronic Transaction Act*. Online: <http://www.law.upenn.edu/bll/ulc/fnact99/1990s/ueta99.htm>, including comments, as available on January 6, 2004.
- van Haentjens, O. (2002). *Shopping Agents and Their Legal Implications Regarding Austrian Law*. In Sartor (2002a), 81–94.
- Weitzenboeck, E. M. (2001). *Electronic Agents and the Formation of Contracts*. *International Journal of Law and Information Technology* 9(3): 204–234.
- Wooldridge, M. J. and Jennings, N. R. (1995) *Intelligent Agents: Theory and Practice*. *The Knowledge Engineering Review* 10(2): 115–152. Online: <http://www.csc.liv.ac.uk/~mjw/pubs/ker95/ker95-html.html>.
- Zankl, W. (2004a). *Juristische Aspekte Künstlicher Intelligenz*. Online: <http://www.e-zentrum.at/rechtsdoku/weitere/dokus/ki.doc>, as available on January 6, 2004.
- Zankl, W. (2004b). *E-Commerce- und Internetrecht*. Online: <http://www.e-xam.at/pdf/ecomminternet.pdf>, as available on January 6, 2004.
- Zarnekow, R. and Brenner, W. (1999). *Diensteebenen und Kommunikationsstrukturen agentenbasierter elektronischer Märkte*. *Informatik-Spektrum* 22(5): 344–350.