The Conclusion of Contracts by Software Agents in the Eyes of the Law

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ABSTRACT

Faced with the ongoing evolution of software agents from mere passive tools to e-tailers acting autonomously for their human owners (principals), new legal challenges appear on the agenda. One of them is the question, whether the traditional law of agency that regulates the legal issues arising from human agents constituting legal relations between their principal and a third party, is applicable for software agents as well.

Based on the characteristics of software agents this paper examines approaches for a legal classification of software agents and thereby analyzes current legislation that deal with the conclusion of contracts by software agents. Finally, this paper addresses remaining legal questions and discusses proposed solutions.

Categories and Subject Descriptors

K.5 [**Legal Aspects of Computing**]: Miscellaneous

General Terms

Legal Aspects

Keywords

Legal Aspects, Law of Agency, Software Agents

1. TRUST AS REQUIREMENT FOR ELECTRONIC TRANSACTIONS

With the change of the agent paradigm from mere communication tools to autonomous 'intelligent' software entities the vision of these agents populating electronic markets, representing their users or owners (their principals) and conducting business on behalf of them, has come into reach. However, thinking one step further, this vision includes the idea of software agents being able to initiate and conclude agreements by themselves without their principals being aware of these actions. Hence, agreements might no longer be generated *through* machines but *by* them, without the intervention or supervision of an individual [30]. Software agents might therefore be employed as initiators and

mediators of electronic transactions assisting human interaction through all stages of the transaction process. However, for this to happen to a large extend, the doubts of the potential users have to be allayed. That is why, as pointed out by Fasli [12], in order for this vision to materialize, one fundamental issue that needs to be addressed is that of trust.

First, users need to be confident that their agents will do what they are intended to do. Second, they need to trust that their privacy is protected and that the security risks involved in entrusting agents to perform transactions on their behalf are minimized. Finally, users need to be assured that any legal issues relating to agents trading electronically are covered to an extend as they are in traditional trading practices [12].

Whereas the first two trust questions have been dealt with by many scientists, so far little results have been achieved when it comes to the legal issues concerning software agents. Some questions to be addressed in detail in the future are for example, as to whether contracts concluded by software agents are contractual binding on the parties, who is liable in case the software agent commits a mistake or causes any damage, or in how far the law of agency[1] is applicable to software agents in this context [30].

This paper analyzes the current legal situation concerning these questions[2]. It starts by looking at the characteristics of software agents in chapter 2, to categorize software agent concept within the legal context in chapter 3. Thereby, the three concepts of software agents as mere passive communications tools (chapter 3.2), of software agents as juristic persons (chapter 3.3) and of software agents under the law of agency (chapter 3.4) are being dealt with in more detail.

As a next step, in chapter 4, a selection of the current legislation on the contract conclusion by software agents will be presented. The paper finishes by focusing on remaining legal

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[1] Agency is the fiduciary relationship that arises when one person (the *principal*) authorizes another person (the *agent*) to create a legal relationship with a third party on the principal's behalf. Generally speaking, this means that when agreements are made by the agent and the agent has adverted that he or she is acting on the principals behalf, the principal is liable for any contract(s) made by the agent, as long as the agent has done what he or she was instructed to do. Thus, the result is, with some exceptions, the same as if the principal had done it by himself.

[2] All legal citations contained herein are based on current legal statutes in effect on February, 8th, 2008, the submission date of this paper. The authors cannot assume any liability for subsequent changes in pertinent laws which might have an impact on the analysis contained in this work.

questions and by discussing proposed solutions (chapter 5).

2. CHARACTERISTICS OF SOFTWARE AGENTS

When aiming at analyzing software agents in the eyes of the law, first of all the term 'software agent' itself has to be looked at and this is where the first problems arise.

As Russel and Norvig [25] pointed out, although the term agent is widely used by many people working in closely related fields of research, so far no universally accepted definition could be agreed on. Solely, a common set of auxiliary agent attributes that characterize software agents exists.

A fairly comprehensive approach to define software agents in the field of artificial intelligence (AI) was proposed by Wooldridge and Jennings who use common attributes of software agents to develop a 'weak' and the 'strong' notion of agency [34]. In their weak notion they enumerated the following key terms as characterizing software agents: autonomy (i.e. the agent's capacity to act without the intervention of its human principal or any other users and thereby having some level of control over its activities and internal states), social ability (i.e. the agent's ability to communicate with other agents and humans through a shared agent communication language), reactivity (i.e. the agent's ability to perceive an environment and respond in a timely fashion to changes that occur within it) and pro-activity (i.e. the agent's ability to demonstrate goal-directed activity by taking initiative). This list of attributes is expanded in Wooldridge's and Jennings' strong notion of agency in which they furthermore mention knowledge, belief, intention, obligation, mobility, veracity, benevolence and rationality as auxiliary characteristics for software agents and thereby attribute software agents all necessary characteristics to, at least virtually, support all stages of the contractual process.

Although the notions of Wooldridge and Jennings have been quoted very often in AI, from the legal point of view their notion has one important hitch: the autonomy. Thus, even though software agents negotiate, conclude and carry out contracts without any direct intervention of human beings or other agents, they only do so on behalf of their principals. They do not conclude any contracts for themselves, but are supposed to negotiate legally binding contracts for their owners. That is why, from a legal perspective an additional layer for the principal has to be included in Wooldridge's diagram of the abstract view of an agent [33, p. 16].

Figure 1 shows this extension of Wooldridge's diagram. For the legal examination not only one single layer with the software agent that perceives its part of the global environment through sensors and acts upon that environment through effectors needs to be considered, but a second layer with the software agent's principal who has his own perceived environment[3] (e.g. the business context) which he senses and acts upon. The software agent and the principal are in a principal-agent-relationship, meaning that the agent is supposed to act (i.e. negotiate, conclude and carry out contracts) on behalf of its human principal in the principal's name. Thereby, its actions should be based on objectives the principal has derived from his perception of the
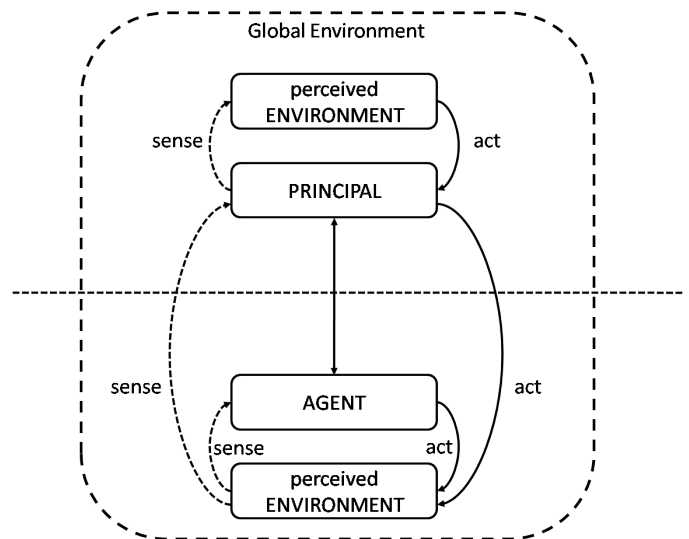
Figure 1: An extended abstract view of a software agent

global environment and given to the software agent.

In case the software agent is replaced by a human person, this constellation would hardly cause any problems as it is generally regulated by the law of agency. However, as this is not the case and the software agent is a computer program, the legal analysis (and consequently the legal interpretation of the direct vertical connection between the principal and the software agent) gets considerably more difficult [1].

Some problems related to the software agents context shall now be analyzed in more detail. Therefore, first of all, in the next chapter a brief introduction on the conclusion of contracts will be given to then attempt to legally classify software agents in this context.

3. SOFTWARE AGENTS IN LEGAL TERMS

3.1 The Conclusion of Contracts

Looking at the current international legislation, both civil and common law define two essential elements for the validity of a contract: capacity and consent [24, 30]. Hence, to be legally valid and enforceable, a contract must have been entered by at least two parties that are capable of contracting in terms of the law and have expressed mutual statements of intention concerning the content of the contract. The capability of contracting means that in practice only natural persons (i.e. human beings) or legal persons[4] have the legal capacity to contract. Thereby, the law assumes the capacity to contract as the rule and defines exception-cases which lead to an incapacity. Hence, e.g. minors or aments are not considered to have the requisite capacity to enter a legally binding contract by the law [30].

Within these legal notions it is important to note that the absence of personality is not the same as incapacity, because incapacity always refers to a natural or legal person and therefore implies personality. In contrast, an entity or

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[3]It has to be noted that besides perceiving his own part of the global environment, the principal normally can perceive and act upon the software agent's environment as well.

[4]Legal persons are sometimes referred to as juridical persons or artificial persons to distinguish them from natural persons.

group from which the legislator has not conferred, or withdrawn personality, is not a person in the eyes of the law and therefore has no juridical life, meaning that no legal basis for attributing (or not) rights and obligations to it exists [32].

Keeping this in mind, it becomes obvious that the use of software agents for the conclusion of contracts leads to considerable doctrinal discussions. How can software agents that have not been attributed judicial personhood initiate contractually binding contracts for their principals and a third party? Three possible solutions to this problem shall now be discussed in more detail: the classification of software agents as simple tools, as juristic persons and last but not least as agents in terms of the law of agency.

3.2 Software Agents as mere Passive Communication Tools

An approach to deal with the above mentioned problems is to consider anything issuing from the software agent as performed by its principal [1]. In this view, the software agent is downscaled to a simple machine or program such as a phone or an email-program, which cannot automatically conclude a contract on behalf of its principal. Hence, in this case it is legally assumed that the principal only used the software agent as a medium of exchange to transmit his will and therefore is legally bound by the software agent's actions. As Lerouge puts it:

> [...] if a party creates a situation in which the electronic agent is to act on his behalf, then the party is bound by the actions of the 'agents' [18].

This approach has got the advantage that it gives a strong incentive to the principals to control that their software agents operate properly. On the downside, it is very harsh. For example, Allen and Widdison, who favored the perception of software agents as simple passive communication tools, asked:

> Is it fair, or even commercially reasonable, to hold the human trader bound by unexpected communications just because it was theoretically possible that the computer would produce them [1]?

This compunction of Allen and Widdison refers to the case that for example the third party is aware that the communication produced by the software agent does not represent the principal's intentions. If software agents are legally treated as mere communication tools, the third party is in the best position to knowingly take advantage of the software agents 'transmission error'. In this case, the principal would have to deal with the consequences, that could result from programming faults, errors of calculation or simple electronic bugs [30].

Nevertheless, the approach of considering software agents as simple communication tools is the most well accepted by legal authors and was considered by the US and the Canadian legislation [2]. Notwithstanding some authors such as Karnow [16] or Kerr [17] have thought about other possible legal categorizations for software agents that shall now be looked at.

3.3 Software Agents as Juristic Persons

An approach that goes directly into the opposite direction of seeing software agents as mere communication tools is to confer legal personhood to them and to then develop a theory of liability on that basis. This approach has got at least two advantages. First of all, by the recognition of an autonomous consent the question of the validity of declarations and contracts enacted or concluded by software agents would be solved without affecting the legal theories about consent and declaration, contractual freedom, and the conclusion of contracts too much [13]. Secondly, it would take away from principals a rather big proportion of the risk, because, by considering the eventual liability of the software agents, it would reduce their responsibility for the software agents' behavior [26].

This approach seems to be rather convenient in all aspects, nevertheless, its adoption poses difficulties as it is very hard to fit software agents into the corset of legal personality. Miglio et al. annotate for example:

> The arguments made for justifying the attribution of legal personality to an entity are based on at least three aspects: moral authority, social capacity and legal convenience [19].

Looking at the criteria, it becomes obvious that it is debatable whether software agents can be classified as juristic persons. Thus, even though Wooldridge's and Jenning's notion of software agents assumes intelligence and autonomy (see chapter 2) it is not at all certain that software agents can achieve self-consciousness i.e. that they make conscious, moral decisions on their own.

The argument of social reality needed for conferring legal personality is based on the fact that many artificial legal persons are regarded as social organisms with a distinct social will. It can be debated in how far the social will can be attributed to software agents, however in literature quite often the view is advanced that the gap to software agents having the capacity for social action is still a substantial one [1].

The third argument for justifying the attribution of legal personality to software agents mentioned by Miglio et al. - the legal convenience - has been originally applied to confer personality to limited liability companies. This conferment has some advantages: having legal personality a company can sue or be sued in its own name and independently of its members, it can own its own property (independently of its members), and can have perpetual succession until dissolution, thereby surviving the death or change of its directors and shareholders [30].

Even assuming that it is possible to fit software agents into the above mentioned corset, some problems remain. Thus, an initial and direct consequence of conferring software agents with legal personality would be that they would legally be subject to the classical theory of law patrimony [8]. Patrimony is composed of both active legal situations (such as rights, powers, options) and passive legal situations (such as obligations, burdens and duties). Hence, in case of ascribing legal personality to software agents this would imply to give them patrimonial rights and to also make them subject to liabilities for negligent acts or omissions, just as humans.

Another argument that is put forward when justifying that it is still difficult to attribute legal personality to software agents, is the problem of the software agent identification: does it coincide with the hardware or with the software? And what happens in the case that software and

hardware are dispersed over more that one site owned by different individuals [1]? As in the case of companies, a possible solution may be to set up a kind of registry where anyone who wishes to use software agents in e-commerce should register not only the name for identifying the software agent and a kind of digital signature of the agent, but also himself for the purpose of being identified as the software agent's principal [1, 16, 19]. However, in contrast to the case of limited liability companies mentioned above, in economic terms the expenses for introducing such a system might be hard to justify as traders could easily include an interchange agreement in their contracts which would serve the same purposes as a registry.

Looking at all the arguments, this paper draws the conclusion that at the moment it would be inappropriate to give software agents the status of juristic persons. In the next chapter one last solution to classify software agents in legal terms shall be discussed - applying the law of agency for them.

3.4 Software Agents as Agents under the Law of Agency

At a first glance, applying the law of agency to software agents seems very tempting and has been discussed at length by a great deal of literature in the United States as well as in Europe. After all, one might want to argue that a software agent autonomously concluding contracts for its principal without any human intervention, is very similar to a human agent serving the same purpose. This view has been put forward by Fischer, who argues that the comparison seems obvious:

> [...] when computers are given the capacity to communicate with each other based upon pre-programmed instructions, and when they possess the physical capacity to execute agreements [...] without any human awareness [...] beyond the original programming of the computer's instructions, these computers serve the same function as similarly instructed human agents of a party and thus should be treated under the law identically to those human agents [[14] quoted by [18]].

Fischer argues his approach to be reasonable, as under the American law of agency, an agent does not require contractual capacity in order to be able to act as an agent. However under the common law, an agent needs to accept his mandate as according to §26 of the Restatement 2d of U.S. Agency Law, in order to establish an agency relationship, the parties have to express a written or verbal agreement that determines the authority, duties and liabilities of the agent [19]. Fischer himself admits that the application of this concept to computers is not feasible, and as a consequence proposes the adoption of the legal fiction consent to try to satisfy this criterion of agency law.

Looking at law of agency, it furthermore has to be noted that it can be based on two different kinds of representation, either on representation demanded by the law (i.e. legal representation), or on a voluntary agreement between two parties (i.e. voluntary representation) [4]. In voluntary representation, at least in civil law countries, it is not absolutely necessary that the representative has full legal capacity, but it surely is required that he portrays the 'natural capacity of understanding and wanting' [3] (i.e. that he needs to have

a minimum of capacity to understand the configuration and possible consequences of the act to be performed), because the representative acts in the name of the principal and concludes legally binding contracts for him. As Bellia puts it:

> A person with limited capacity, such as a minor, may be an agent, but a person with no capacity whatever may not [5].

Of course one might wonder whether an intelligent software agent might have that minimum of capacity to perform representative acts. No doubt that this kind of devices will probably have a much greater capacity to foresee all the consequences of its acting than any minor. Nevertheless, there is still a difficulty that the application of the law of agency for software agents cannot solve. One of the biggest problems that is closely linked to chapter 3.3 is that the law of agency is only applicable for legal persons and only legal persons can make contracts. This flaw was recognized by Kerr who suggested:

> [...] in order to invoke the principles of agency, it is therefore necessary to include electronic devices within the set of rules that form the external aspect of agency [17, p. 55].

Kerr justifies this exclusion of the internal agency relationship (meaning the one between the principal and the software agent) by quoting Bowsteadt and Reynolds [17], who claimed that disputes in e-commerce will only take place between the principal and the third party. This assumption however leads to the problem of the principal being without any recourse against the software agent in situations where the agent exceeds its sphere of influence or when it employs another incompetent agent. Consequently, the principal is in the situation of having rights and duties with respect to the third party, but not with respect to internal relations [15, 18].

Besides all the above mentioned problems with the application of the law of agency to software agents, the agency theory has been criticized for its relatively complex and sometimes even incomprehensible structure. De Miglio for example claims that it fails to explain several issues and makes to many exceptions to the law of agency [19].

Summing up, this paper concludes that the application of the law of agency to software agents, though attractive, leaves a number of unanswered questions such as the internal principal-agent relationship. That's why, although favored by many scientists, in the eyes of the authors it cannot be used for software agents under the current legislation.

4. LEGISLATION ON THE CONTRACT CONCLUSION BY SOFTWARE AGENTS

After having had a look on how software agents could be understood in legal terms, in this chapter, the focus will be on a number of enacted legislation and the way these have dealt with the negotiation and conclusion of contracts by automated means such as software agents. Thereby, the pros and cons of the individual laws and their articles will not be discussed, but the laws as well as their implications for software agents will only be presented as facts.

Some of these laws, such as the UNICITRAL Model Law on Electronic Commerce [28] or the U.S. Uniform Electronic

Transaction Act [22] have taken the approach to legally attribute the operations of the software agents to the principal. The United States Uniform Computer Information Transaction Act (UCITA) [23] attributes the actions of the software agents to the principal, however, an overtone of the law of agency can be found in some sections. In contrast, the European Union's Electronic Commerce Directive [11] takes a slightly different approach. It is the only legislation that does not directly refer to software agents, however it directly encourages EU member states to enact legislation that allows for the conclusion of contracts by electronic means. Last but not least the current case law on software agents will be discussed to finish the examination of the legislation on contract conclusion of software agents.

4.1 The United Nation's UNCITRAL Model Law on Software Commerce

The first legislation that will be briefly looked at is the UNICITRAL Model Law that was passed by the United Nations General Assembly Resolution 51/162 on December 16th 1996 in order to further the progressive harmonization and the unification of electronic commerce. The UNICITRAL Model Law is in so far interesting, as its Article 2 already implied the use of software agents. Thus, article 2(c) [28] states that:

> 'Originator' of a data message means a person by whom, or on whose behalf, the data message purports to have been sent [...]

In the Article-by-Article Remarks for article 2 [28, article-by-article remarks] further information on the role of the computer program:

> Data messages that are generated automatically by computers without direct human intervention should be regarded as 'originating' from the legal entity on behalf of which the computer is operated. [...]

Hence, in the view of the UNCITRAL, software agents are mere communication tools. The software agent is limited to electronically transmit the declarations of intentions of its principal. As a result, the principal is obligated for all unforeseen events. The underlying idea is that the person using a software agent is liable for the effects deriving from its use, as long as the software agent is not capable of autonomously expressing an own will.

4.2 The European Electronic Commerce Directive

The Electronic Commerce directive is based on the UNICITRAL Model Law on Software Commerce. It is fairly procedural and does not establish any substantive rules of European law. Hence, a European Community (EC) directive is binding, as to the result to be achieved, upon each Member State to which it is addressed, but it is left to the national authorities to choose the form and methods [10, §249 III]. Nevertheless, Article 9 (1) states that:

> the Member States shall ensure that their legal system allows contracts to be concluded by electronic means [and] that the legal requirements applicable to the contractual process neither create obstacles for the use of electronic contracts

nor result in such contracts being deprived of legal effectiveness and validity on account of their having been made by electronic means [28].

As in the UNCITRAL Model Law on Software Commerce reference on software agents can be found in the European Electronic Conference. Thus, within the explanatory notes of the Electronic Commerce Directive software agents are mentioned, as it is stated that:

> the Member States will have to: [...] not prevent the use of certain electronic systems as intelligent electronic agents [28].

In spite of that, according to Jurewicz the 'electronic agent' regulation was not included in either the recitals or in the articles of the directive [15].

Scientists have been debating whether the earlier-cited Article 9(1) as well as Article 11 of the European Electronic Commerce Directive which govern electronic contract formation, can be applied for the conclusion of contracts by software agents. A strict interpretation of Article 11 may suggest that the article refers to a human rather than an electronic agent, as it does not allow an automatic electronic response since the language used in the provisions refers to 'a recipient' and 'his consent'.

On the other hand, it could also be argued that no exceptions which preclude 'a recipient' from being an electronic agent are made in the Directive. This approach has been accepted by the majority, because it promotes the development of electronic commerce and complies with international standards [20].

4.3 The United States' Uniform Electronic Transaction Act

The United States' Uniform Electronic Transaction Act (UETA) was approved and recommended on July 23rd-30th, 1999, by the National Conference of Commissioners on Uniform State Laws (NCCUSL) to be enacted in all states of the U.S. The law was promulgated to remove electronic commerce barriers by validating and effectuating electronic records, signatures and contracts. Hence, in the 'Prefatory Note' to the Act, the drafters stated:

> the Act makes clear that the actions of machines (electronic agents) programmed and used by people will bind the user of the machine, regardless of whether human review of a particular transaction has occurred [22, prefatory note].

The term 'electronic agent' (i.e. software agent in this paper) is then defined in Section 2(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 [22].

Accordingly, the UETA directly recognizes the autonomy of software agents. This view is intensified by the drafter's comment number 5 to section 2 of the UETA:

> 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 program, and even devise new instructions' (Allen and Widdison [1, p. 25]). If such developments occur, courts may construe the definition of electronic agent accordingly, in order to recognize such new capabilities [22, comments].

Hence, the drafter of the UETA recognized that software agents may act autonomously, however they considered them as mere tools of their principals and their actions as extension of the human action. This picture is intensified when looking at section 10 of the UETA that provides rules dealing with the effects of errors. The section contemplates several effects of human errors in automated transactions, however no software agent related errors such as a malfunction of the agent, etc. are mentioned.

4.4 The United States' Uniform Computer Information Transaction Act

Like the UETA, the United States' Uniform Computer Information Transaction Act (UCITA) was approved and enacted by the NCCUSL in 1999. It was intended to be a response to the enormous growth of electronic commerce at that time and created a framework for electronic contracts. Originally the drafters wanted to incorporate the act into the Uniform Commercial Code (UCC), a former version of the UETA, as Article 2B, but in the progress of the further elaboration decided to enact it as a separate act.

As all other U.S. legislation, the UCC treated software agents as mere communication tools of their principals. However in the subsequent draft of the UCITA, some modifications were made. The final version of the UCITA defines the term 'electronic agent' as follows:

> a computer program, or electronic or other automated means, used by a person 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 [23].

Although the phrase 'on the person's behalf' is used, what might indicate some kind of agency relationship, the Official Comments to the UCITA state that:

> The legal relationship between the person and the automated agent is not equivalent to common law agency, but takes into account that the 'agent' is not a human. However, parties that use electronic agents are ordinarily bound by the results of their operations [21].

In Section 202(a) of the UCITA, software agents are then attributed the ability to conclude legal contracts:

> A contract may be formed in any manner sufficient to show agreement, including offer and acceptance or conduct of both parties or operations

of electronic agents which recognize the existence of a contract [21].

As the UETA, in section 213(a) the UCITA attributes the legal actions of the software agents to their principal, which are legally made responsible for the agent.

> An electronic authentication, display, message, record, or performance is attributed to a person if it was the act of the person or its electronic agent, or if the person is bound by it under agency or other law [21].

Despite this strong notion of treating software agents as simple communication tools enacting the will of their principals, in section 112(b) it can be noted, that parts of the agency concepts are nevertheless included, as direct reference is made to the need that according to §26 of the Restatement 2d of U.S. Agency Law, in order to establish an agency relationship, the parties have to express a written or verbal agreement that determines the authority, duties and liabilities of the agent:

> [...] an electronic agent manifests assent to a record or term if, after having an opportunity to review it, the electronic agent authenticates the record or term or engages in operations that in the circumstances indicate acceptance of the record or term [21].

This overtone of the law of agency in some sections make it hard to follow the central idea of the UCITA and in the eyes of the paper made it open to a number of discussions.

4.5 Case Law on Software Agents

After having had a look on the texts of several laws, this last subchapter shall deal with the case law on software agents. So far, the case law on software agents is relatively scarce as firstly the application of software agents for e-commerce transactions is still in the early stages of development, secondly courts have only heard a few cases focusing on the conclusion of contracts by software agents, and thirdly many cases that would have solved some of the issues mentioned in this paper are settled [15]. In order to show how case law decisions can treat similar situations differently on an international level, this paper will focus on two cases, an American and a German one. Both cases 'only' dealt with automated systems of communication and hence might not be completely appropriate for the analysis of software agents, however as shown in chapter 3, the classification of software agents as mere passive communication tools is the most well accepted one by legal authors and as such has a high significance for the future legal decision on software agents.

The first American case that involved automated systems of communication was Corinthian Pharmaceutical Systems, Inc. vs. Lederle Laboratories[5]. In this case the court decided that a response of the seller's computer and the issuance of a tracking number for a purchase did not present a acceptance of the buyer's offer. As an explanation the court reasoned that the telephone computer ordering system that was used for the answer, performed automated acts that could not constitute a legal acceptance [15]. Observers of

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[5]724 F Supp 605, United States District Court, S.D. Indiana, Indianapolis Division, 1989.

the case later argued that the courts decision might have been different in case a more sophisticated system (i.e. one that verified the validity of the incoming orders, checked the inventory level, allocated the necessary part of the inventory for the order and then issued a tracking number) would have been employed.

In contrast, a German court, interpreting the German law, decided differently on a very similar case. The case involved a seller using an automated communication system for offering and selling goods via the Internet. The automated system offered goods below the price intended by the seller and generated automatic replies for the buyers emails saying that the 'offer' would be 'carried out' immediately [29]. The court argued that the person on whose behalf the program had been developed and in whose name the messages were sent (i.e. the principal) was legally responsible. Hence, the court recognized the electronic messages as legally binding expressions of one's intentions that therefore result in valid contracts [29].

Just looking at these two court decisions it has to be noted, that at the moment, no standard legislation exists, neither nationally[6], nor internationally. This problem is aggravated as soon as deals are close on an international level, as then the question comes up, which national law to use, especially in the case this has not been agreed on in the general terms and conditions of the contract. As a consequence it is important to solve the issues concerning the conclusion of contracts by software agents, not only on a national level, but to work on an international solution.

5. REMAINING LEGAL QUESTIONS

Last but not least, some remaining legal problems shall be discussed, starting with the most important one: the risk bearing in case contracts concluded by software agents fail. Although, as shown in the last chapter, according to the different legislation, contracts may be concluded with the help of software agents, by applying the objective theory of contracting that signifies that contracting parties are bound to a contract if they expressed their intention to do so, this is of little use in case possible transaction partners do not feel comfortable with it and refrain from using software agents.

Within the existing legislation, situations are imaginable, where one of the contracting parties wants to get out of a contract concluded by a software agent. To do so, it then has the chance to either argue that the software agent failed, was defective or acted improperly and consequently a mistake or an unfair unconscionability (in common law countries), or an error or bad faith (in civil law countries) occurred [31].

One way to deal with this problem is proposed by Weitzenböck. She suggests to try to

> [...] identify how risk is to be apportioned where one of the parties is alleging that the electronic agent malfunctioned [31].

However, as she herself points out, it can prove to be rather difficult to decide whether the risk should be borne by the programmer, the principal and/or the person who trained the agent. In case the software agent malfunctions, the user

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[6]In similar cases to the one just mentioned, German courts have already decided differently. That discrepancy is said to stem from conflicting views regarding the distribution of risks in e-commerce transactions [29].

might have remedies against its programmer, but of course the programmer might have limited his warranty or even excluded it in the general terms and conditions of the contract.

Another problem that needs to be addressed is the one of the residual error. According to the British [7] and the U.S. [9, §105] legislation an offeree cannot legally bind the offeror, in case he knows or has reason to know that the offer has been changed accidentally due to residual errors and does not represent the original intentions of the offeror any more. Thus, in case a 'reasonable man' could suspect an occurred residual error, the offeree is not permitted to 'snap-in' [18]. The situation gets more difficult in case the offeree could not have suspected an error and has reasons to believe that the offer made by the offeror corresponds to his true intentions. For this case judicial doctrines are divided. Corbin for example argues that the delivered offer would be binding for both transaction partners and hence the sender of the offer is deemed to take the risk of a residual error and to pay the 'cost of confidence' [9, 6], however his opinion is heavily discussed.

Summing this chapter up, the conclusion can be drawn that issues of security as well as the proper functioning and the reliability of software agents are very important for their users. A number of suggestions have been put forward to address this problem.

One of them was suggested by Stuurman and Wijnands. They proposed a labeling system very similar to that by Lerouge, only that their system wasn't a voluntary one. In detail, Stuurman and Wijnands proposed the development of a security classification in combination with the certification of agents by reference to a particular class of security standards. This would allow requirements to be imposed in respect to the security level which the software agent must fulfill if its principal wants it to be authorized or accepted for certain activities [27]. As a consequence of such a system, controlling mechanisms (e.g. for a monitoring in order to determine whether the agent complies with the specified level of security) are very likely to be required. However, as mentioned above when discussing Lerouge's proposal, the economic reasonability has to be proven.

6. CONCLUSION

Although still not widely used today, it is not unreasonable to predict that in the future, software agents as initiators and mediators of electronic transactions assisting human interaction through all stages of the transaction process, are very likely to foster economic commerce. However, for this to happen to a large extend, the doubts of the potential users have to be allayed. A starting point to strengthen consumers confidence is the general resolution of todays legal questions, as potential users will almost for certain refrain from using electronic agents in case of legal uncertainties.

Against this background, it is important that computer law scientists deal with the issues raised, by researching the compatibility of technological options and the regulatory framework already existing in the technological development process. On the one hand, this means that they have to provide guidelines for the technological development and on the other hand, they have to commence feasible and/or necessary amendments to the contract law.

This paper has outlined a number of ways to deal with todays legal uncertainties such as establishing a labeling system for agents or developing a certification system for them.

All these proposals have their advantages and their disadvantages. Hence, in order to find a suitable solution to pros and cons of all alternatives have to be deliberated about and to be internationally and conjointly worked on by scientists, not only from jurists, but from scientists from all other disciplines (especially computer science) as well.

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