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NAME	Victor Garcia
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Contents

Abstract.

Technological advances make our lives easier; we use any sort of information technologies and gadgets every day for tasks that just a few years ago were impossible to see at the reach of the hand. That technology that is disrupting the way to do things in every field is also present in the dispute resolution arena, computers now offer support to negotiators and mediators during their job and they might probably take a more active role in the future. The object of this paper is to understand how new technologies like Artificial Intelligence influence dispute resolution and how the ADR professional must prepare for the future of their career. The research adopts a pragmatic philosophical approach supported by relativistic ontological and subjectivist epistemological assumptions.

A mixed methodology was applied in the data collection phase of the projects, being the most relevant the autoethnography. The research concluded that important advances in computer systems and Artificial Intelligence still have to take place to see fully automated systems taking over the role of mediators or arbitrators, and our assumptions of trust and fairness influence our perception of computer systems resolving our disputes.

Introduction

In today's world, people use computers every day, realising or not, we interact with any sort of computing technology to make our life easier. We use a PC in our work or university to complete tasks, use smartphones as an entertainment and to communicate with others, we use navigation and GPS software to get to our destinations, some of us use self-driving cars, we interact with virtual customer assistance programs to deal with our queries regarding services we contract, and so on.

The use of computers, machines, or in a broader sense, information technologies, has expanded during the last two decades, mostly thanks to the development of faster internet and data collection and storage technologies.

In this interaction between humans and computers, an important concept must be considered; Artificial Intelligence, which "*makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks*" (SAS 2019). AI allows machines to collect data, learn from it and improve their performance. There are multiple examples of AI applications in use nowadays, including the already mentioned self-driving cars, the famous smart assistants like Siri from Apple or Alexa from Amazon, the IBM Watson system in healthcare, and security and surveillance systems in countries like China. (Mozur 2019)

In the workplace, we have seen the use of machines assisting or replacing humans for decades, mostly in the automobile and manufacturing industries, however, with the improvement of automation, Artificial Intelligence and the developing of new technologies, many occupations will face substantial transformations, changing the jobs and skills of the future (Manyika et al. 2017). In dispute resolution,

some speak about a fourth party, a concept that considers technology as an additional party sitting at the table along with the disputants (two parties) and the third party (the human mediator or arbitrator). (Orr and Rule 2017, p. 2). The fourth party play different roles depending on the dispute and the parties. It might facilitate communication, retrieve data, support information exchange or any other technology related task. Ibid, p. 3) Will the technology make that fourth party take the position of the mediator and become the third party? The object of this research is establishing how Artificial Intelligence and computer systems influence the dispute resolution field in the present and what it means for the future of the ADR. To achieve this objective, the project will try to answer the following questions:

How algorithms and Computer Technologies are currently used in ADR?
How ADR practitioners should approach computer-based ADR?
How AI will impact the position of the dispute resolution professional in the work market?
How computer-based systems manage issues of justice/fairness in dispute resolution?

The research project is divided into 5 chapters. The first is a review of the literature, exploring the work of other researchers, the first projects with intelligent systems in dispute resolution, how Artificial Intelligence works and what are some of the current projects in development. The second chapter reviews the philosophical assumptions, the methodology and strategies this project is based on, and the techniques used to collect the necessary data. The third chapter presents the data in an organised manner, the same data that is analysed in the fourth chapter, the last chapter discussed the findings of the project, followed by the conclusions.

This study pretends to serve as a practical guided for the dispute resolution professional on what to expect and how to act given the fast pace of technological advances.

CHAPTER 1 – LITERATURE REVIEW

1.1. Algorithms and Artificial Intelligence in Dispute Resolution

The first developments of AI in Dispute Resolution were in the field of Law during the 1970's. According to Lodder and Zeleznikow (2005, p292), after a paper published in 1970 by Bruce Buchanan and Thomas Headrick called "*Some Speculation About Artificial Intelligence and Legal Reasoning*" and research from Thorne McCarty in 1977, the interest in AI in Law grew among scholars and practitioners. In 1981, an international conference on Artificial Intelligence and Law was held and ten years later the International Association for AI and Law (IAAIL) was established. Research on computer programs assisting negotiation also began during the 1970's, and "*the first prototype negotiation support systems were built during the 1980's*". (Thiessen et al. 2013, p. 342)

In AI, different tools have been developed to provide computer programmes with the ability to perform tasks, make decisions and learn without human input. Barnet and Treleaven (2018, p. 402) consider AI in two main branches, Knowledge-based systems, and Machine Learning.

1.2-Knowledge-based systems

When presented with a problem, computers equipped with Knowledge-based Systems utilise data bases and algorithms to process, analyse and retrieve information that is appropriate for the case (Lozada 2019, p. 349). The knowledge "*is explicitly represented as ontologies or rules rather than implicitly via code*". (Barnet and Treleaven 2018, p. 402)

Knowledge-based systems have two subsets: Rule-based systems and Case-based systems.

1.2.1.Rule-based systems

These types of Systems use a series of domain knowledge expressed in the form *if* <condition(s)> *then* action/conclusion (Barnet and Treleaven 2018, p. 402). According to Lozada (2019, p. 349), Rule-based are simpler systems that rely on logic premises preloaded by the user and return logic connections and conclusions.

Carneiro et al. (2014, p. 13) affirm that Rule-based systems represent the simplest form of AI application. "*Rule-based Systems (…) are, in general, the straightforward way of implementing a system intelligent behaviour, i.e., they stand for the simplest form of building Artificial Intelligent Systems*".

Zeleznikow (2017, p. 36) use as an example of Rule-based systems, the domain of driving offences in Victoria, Australia, where drivers could lose their license if drunk while driving, having a blood/alcohol level superior to 0.05%. Following the form *if* <condition(s)> *then* action/conclusion, the premise can be modelled as: *IF drive(X) and (blood_alcohol(X) > .05) THEN licence_loss(X)*.

1.2.2. Case-based reasoning (Expert Systems)

Case-based systems, also called expert systems (Barnet and Treleaven 2018, p. 402), is a problem-solving methodology that resolve new problems using similar past cases or experiences.

Given a problem, the system will retrieve from its data base a similar situation and will suggest a similar solution (Lozada 2019, p. 354). The system retrieves and analyses previous cases and "*explain*

why previous experiences are or are not similar to the present problem and adapts past solutions to meet the requirements". (Lodder and Thiessen 2003, p. 75)

In Case-based reasoning, the system assumes that if a new problem is similar to a previous one, the solution or the outcome will be similar. (Carneiro et al. 2014, p. 10)

Lawyers follow this logic reasoning when encounter to new cases in Common Law, "*using the principle of stare decisis, to make a decision in a new case, legal decision-makers search for the most similar case decided at the same or higher level*" in the court's hierarchy. (Zeleznikow 2017, p. 36)

The first projects using AI in Law were developed using expert systems, making computer software capable of solving cases and decide or give advice the same way a human would do it. (Lodder and Zeleznikow 2005, p. 291)

Some authors exclude Rule-based and expert systems from the definition of AI, for them, a system must have the capacity to learn by itself and not depend on strict logical deductions. (Minsky and Papert 1988, p. 47 cited by Lozada 2019, p. 352)

1.3. Machine Learning

Machine Learning is a type of computer program able to learn or acquire new knowledge by itself without a specific input from a human or explicit programming and "*can change when exposed to new data*". (Barnet and Treleaven 2018, p. 402)

Machine Learning software learn from data using algorithms (Morgan and Reed 2019) and adapt based only in the information that receive and process.

Morgan and Reed (2019) consider that the ability of storing large volumes of data and retrieving them quickly, makes Machine Learning software "*more efficient than humans when it comes to analysing massive amounts of data*".

There are three subdivisions or methods to make a machine learn: Supervised learning, Unsupervised learning, and Reinforcement learning.

1) **Supervised learning** includes data sets that have been already labelled or categorised. The algorithm uses the categories to learn the characteristics of the data set and apply the new knowledge acquired to an uncategorised new data set. (Morgan and Reed 2019). 2) **Unsupervised learning** is used when large volumes of data are not labelled or categorised and need to be analysed. Since the data is not categorised, unsupervised learning organise data in sub-groups based in common features. (Morgan and Reed 2019).

3) **Reinforcement learning**, there is no categorised or labelled data, therefore the algorithm takes decisions using a "trial and error" method. "*The algorithm reinforces its successful decisions (as confirmed by human reviewers) and learns from the decisions which lead to negative outcomes*". (Morgan and Reed 2019)

Self-driving cars, personalised product recommendation (Netflix movie recommendation or YouTube video and advertisement suggestions), facial recognition systems (used in mobile phones and security

cameras), and voice-recognition systems (Alexa from Amazon and Siri from Apple) are some examples of Machine learning. (Lozada 2019, p. 355)

For Morgan and Reed (2019), AI is also divided in **weak** and **strong** Artificial Intelligence.

Weak or Applied AI are machines or software programmed to perform specific functions "*in some instances much faster and more accurately than humans*" (Morgan and Reed 2019).

Strict or Strong AI include machines able to make decisions on its own performing cognitive functions in the same way that a human mind. Although, the authors consider Strong AI as a lofty ambition "*still some way off*" but "*considerable investment and development are being made in this area*". (Morgan and Reed 2019)

1.4. Blind-bidding Negotiation Processes

A blind-bidding is a negotiation process for a two-party single issue dispute (commonly used in monetary disputes), where each party submit a bid (offer or demand according to the position of the party in the negotiation), an automated algorithm evaluates them and if the two bids are within an agreed range or they overlap, the case settles for the median. It is blind because the parties have no knowledge about the amount of their counterpart bid or proposal, once the negotiation finish (in settlement or disagreement), the bids are destroyed. (Rule 2000)

According to Farkas (2012, p. 163), new advanced software is capable to settle the dispute "*not just finding simple median values in a monetary dispute"* but also including "*complex "packages" of preferences to satisfy both parties*". Some of these programs Some systems include Cybersettle and

Smartsettle use algorithm optimisation in their blind-bidding process, adjusting the results in concordance with the interest of the parties instead splitting the median.

1.5. Decision Support Systems and Negotiation Support Systems

Computer-based systems able to support human knowledge in the Dispute Resolution field can be seen as **Decision support tools** or systems (DSS), which supplement the decision-making process presenting information, statistics, probabilities, possible outcomes and other pertinent knowledge related to the decision being made, and also as **Decision-making tools** , which "*automate the process, leaving a minimal role for the user*". (Zeleznikow 2002, pp. 37-48 cited by Lodder and Thiessen 2003, pp. 74-75)

1.5.1. Decision-support systems

Decision-support systems provide useful information to the human decision maker using tools that may vary from providing simply raw data to presenting complex suggestions on strategies to obtain the best outcome in a negotiation. (Carneiro et al. 2014, p. 7)

For Lozada (2019, p. 355), Decision-Support Systems help people and organisations making complex decisions "*even in the presence of uncertainty*" using algorithms and engineering techniques which consider probability measures. "*With this capability, they are able to provide useful insights to users even when they lack all of the relevant information to determine an answer with 100 per cent accuracy*". In Law, decision-support systems have the ability to analyse large amount of data and present relevant facts, legal information and past known cases to the parties in order to make legal decisions. (Lozada 2019, p. 349)

Grzegorz et al. (2017, p. 898) consider the object of Decision-support is present the user "*the possibility to consult with an automated system while making decisions*". Sharing the same idea, Carneiro et al. (2014, p. 7), mention that the systems help the user in the decision-making process, and they are not machines that issue outcomes. "*They are systems that, based on important information, issue justified recommendations and compile information that can be useful for the decision-making process*".

In any of these cases, results are generally supervised by human experts. Decision support systems are therefore not automated systems that issue outcomes.

In Negotiation, it is not the main goal of these systems to provide specific solutions to the users, but to present information about the issues and the level of disagreement with the other party. The objective is "*demonstrate to users how close (or far) they are from a negotiated settlement*". (Lodder and Thiessen 2003, p. 75)

In Law, an example of a decision-support system is the program SPLIT UP used in divorce procedures in Australia. This system "*makes predictions about the distribution of marital property*" (Carneiro et al. 2014, p. 7), assisting mediators, lawyers and judges of the Familia Court of Australia.

Other areas where Decision-support systems have been used include Finance (banks use the systems to determine if a client might receive a loan), and Government (social security institutions use decision support determining if an unemployed person should receive a benefit. (Carneiro et al. 2014, p. 7)

1.5.2. Negotiation support systems

Negotiation Support Systems (NSS) are programs designed to assist negotiating parties, providing information analysis and communication protocols, and supporting bargaining processes and consensus seeking. (Lim 2000, p. 329)

NSS can also provide modelling techniques based on multi-criteria analysis and game theory to generate possible solutions or present viable strategies. The systems are able of processing data, identify potential settlements and evaluate outcomes, helping negotiators make inform and rational decisions. (Lim 2000, p. 330)

Different from Decision-support systems, NSS not only provide information, figures, and facts, they also promote communication between negotiators and enables cooperation. (Swaab 2004, p. 62)

Rangaswamy and Shell (1997 cited by De Moor and Weigand 2004, p. 41) consider that a NSS have basic functionalities, including: Negotiation preparation (allowing negotiators prepare and evaluate information), Process support (the system adjust the dynamic of the negotiation process), Mediation system (the system substitute or assist a human mediator, encouraging the parties to take action) and Interactive bargaining (promoting direct communication between the parties.

For Kersten (1998, p. 2), the NSS surged as a result of the improvement of Decision-support systems, the enhancement of electronic communications and e-commerce, the time-pressure on managers and professionals in charge of the analysis of considerable amounts of data and the "*employment of the data visualization and multimedia techniques as well as the integration with other systems*". De Moor and Weigand (2004, p. 39) also consider NSS an evolution of Decision-support systems, and affirm that NSS are not only useful because they improve the quality of negotiations through multiple

functionalities, but also, they are necessary due to the increase in amount and frequency of electronically conducted business.

According to Lim (2000, p. 331), negotiators tend to assume a *zero-sum* game approach to the negotiation (where their wins are at the expense of the other loses), consequently "*each negotiator may only achieve a utility value that is much less than the possible optimum*". To resolve this problem, NSS promote the consideration of the issues in negotiation as packages making simpler the potential of trade-off.

1.6. Dispute resolution scenarios and AI

AI can be applied in three different types of disputes scenarios according to Lozada (2019, p. 360), 1) Dispute prevention, 2) Dispute management and 3) Dispute resolution.

1) In Dispute prevention, decision-support systems have been used by armed forces to provide information, create scenarios, and predict possible outcomes in potential conflicts between States. "*these systems show the more relevant human costs as well as the general effects of war on society and the economy*". (Lozada 2019, p. 360)

Other examples of dispute prevention include the system SIARELIS, a decision support programme which use rule-based and case-based reasoning developed to prevent community disputes in Colombia. The system consists in a chat-bot that receive "*questions from users and respond with probable outcomes to their disputes*". (Lozada 2019, p. 360)

2) Dispute management. Lozada (2019, p. 361) considers the programmes PERSUADER and SPLIT-UP as dispute management systems. Both systems use case-based reasoning and help the parties in conflict make inform decisions while conducting a negotiation.

3) Dispute resolution. The communication and interaction over the internet between parties in conflict using ODR mechanisms to settle a dispute is the third scenario where AI can be applied. Another example of AI powered dispute resolution is the chat-bot DO NOT PAY, initially conceive to overturn parking fines in London and New York (Rezvani 2017), now "*support the user in any number of difficult legal situations without the need to enlist the support of a costly human attorney*". (Lozada 2019, p. 362)

1.7. Early computer-assisted dispute resolution projects

1.7.1. MEDIATOR

MEDIATOR was a Negotiation support system constructed using case-based reasoning that assisted negotiators and mediators in multiplayer decision situations. (Jarke et al. 1985, p. 1) The system encouraged consensus seeking, promoting the exchange of information, and using case retrieval and adaptation. The system facilitated the understanding of the dispute and was able to generate a plan for its solution and evaluate feedback from the users (Lodder and Thiessen 2003, p. 87)

The system helped the disputants building a common problem representation of the negotiation. This representation was then presented by MEDIATOR "*graphically or as relational data in matrix form*" (Jarke et al. 1985, p. 2) in three spaces: control space, goal space and preference space. (Ibid.)

Every party uses private and shared database views and Decision-support systems to interact with the mediator. The exchange of views among the parties constituted exchange of information which ultimately lead to consensus. A human mediator could use the system to support compromise between the parties using concession-making procedures built-in the MEDIATOR system. (Jarke et al. 1985, p. 1)

MEDIATOR was one of the first cased-based decision support and problem solver systems and it was used to recommend solutions to international disputes. (Kolodner and Simpson 1989, pp. 507, 509)

1.7.2. INSPIRE

INSPIRE was a negotiation-support system which allowed users perform negotiations online, mainly through email and web browsers. Disputants exchanged offers and the system, through utility functions, evaluated and presented in graphs the proposals determined to be Pareto-optimal. (Lodder and Zeleznikow 2013, p. 76)

The system allowed each disputant to construct utility functions to evaluate their own offers and those of their counterpart, then, the programme represented offers and counteroffers in graphs allowing the parties to see how close or far a possible solution to the dispute could be. When the parties reach an agreement, the system verify the Pareto-optimality. (Lodder and Zeleznikow 2013, p. 84)

1.7.3. Adjusted winner

The Adjusted Winner system, created by Steven Brams and Alan Taylor (Aziz et al. 2015, p. 454), is a dispute resolution mechanism that allows the distribution of multiple divisible resources between

two parties. The creators claim that the system "*produces dispute solutions that are envy-fee, efficient and equitable*". (Gylthe 2006, p. V)

The Adjusted Winner mechanism is a point allocation procedure where the parties introduce a list of items in dispute, then they must distribute 100 points across the items indicating how much they value each of them. Once the information is introduced, the Adjusted Winner distribute the items to each party. (Lodder and Thiessen 2003, p. 78) The system might determine that some items or issues need to be divided to guarantee each disputant receive the same amount of points, the division may imply "*selling a piece of property and distributing the money received from it or sharing custody of the children*". (Lodder and Zeleznikow 2005, p. 331)

The point distribution encourages the participants to declare their preferences over the items (Aziz et al. 2015, p. 454), and the system will make the division in a way that each participant obtain the same number of points (Zeleznikow and Bellucci 2003, p. 24) and receive the items they value most. Gylthe 2006, p. V)

Brams and Taylor (1999, p. 2 cited by Gylthe 2006, p. V), consider solutions proposed by the Adjusted Winner as Envy-free because "*every person thinks he or she received the largest or most valuable portion of something – based on their own valuation – and hence does not envy anyone else*", it is also efficient because "*there is no other allocation that is better for some party without being worse for another party*" (Ibid.) and equitable as "*both parties think they receive the same fraction of the total, as each of them value values the different items*". (Brams and Taylor 1999, p. 14-15 cited by Gylthe 2006, p. V)

1.7.8. Family Winner

The family Winner system, created by Emilia Bellucci and John Zeleznikow (Zeleznikow 2017, p. 40), is an adaptation of the Adjusted Winner algorithm (Lodder and Thiessen 2003, p. 7), using the same approach taking a group of items or issues in dispute and allocating them among parties according to the value each disputant give to every item. In Family Winner, the dispute is divided in issues and sub-issues. (Zeleznikow and Bellucci 2003, p. 25)

The system presents a list of items in dispute agreed by the parties, then each disputant must establish their priorities allocating ratings (from 0 to 100) to every item according to their valuation "*which signify the item's importance to the party*" (Zeleznikow 2017, p. 40). After thar, the system uses algorithms and influence diagrams to determine the distribution of the items between the parties. The ratings does not represent monetary value of the items, they represent how much a disputant values the item. (Bellucci 2008, p. 13)

The items have two ratings, (one for each disputants) and the system allocate every item to whom value them the most. After this phase, the system asks the parties whether they agree with the distribution. If there is disagreement, the system starts a negotiation item-by-item, dividing or decomposing every item into pieces or sub-items and ask the parties to rank every piece "*so that it may be better distributed*" (Carneiro et al. 2014, p. 15). The decomposition or division process ends when there are no more items in dispute. (Ibid.)

Family Winner was created and has been used to support Australian family law cases. Lodder and Zeleznikow 2013, p. 78)

1.7.9. Asset Divider

The Asset Divider system was developed by Emilia Bellucci (Lodder and Zeleznikow 2013, p. 79) incorporating the same principles of the Family Winner system with improved user interface and reporting services (Bellucci 2008, p. 17). The similarities with Family Winner include the trade-off mechanism and the use of ratings for every item in dispute representing the importance given to the item by each party.

Asset Divider use rating allocation and dollar (monetary) value for each item. During the preparation of the negotiation and before placing the list of items and the ratings into the Asset Divider, the parties (by direct negotiation or with the assistance of a mediator), preestablish dollar values for each item and agree in a "*proposed percentage split*" which reflects the percentage of the total amount of items every party might obtain in the final settlement. (Lodder and Zeleznikow 2013, p. 79)

Once the monetary values and the ratings are loaded into the system, Asset Divider allocate each item to the disputant whose rating is the highest, then the system checks the dollar value for that item and compares it with the amount permitted by the proposed percentage split, "*if by allocating the item in question the party exceeds its permitted amount, the item is removed from its allocation list and placed back into negotiation*". (Lodder and Zeleznikow 2013, p. 79), if the dollar value does not exceed the amount permitted, then the allocation proceeds.

When an item is allocated, the system change the ratings of the rest of the items still in negotiation using equations that take into account different variables, including the value of the item allocated in relation with the rest of the items in the list, the value of the items which rating will change as a result of the allocation and

Whether the item is a win or lost depending of the party. The equations "*modify ratings by comparing each one against that of the item recently lost or won (each party's set of ratings are modified as a result of an allocation*)" (Lodder and Zeleznikow 2013, p. 79). After this mechanism, the system proceeds with the allocation of the next item in the list.

1.7.10. Square Trade

Different authors affirm that the rapid expansion of ODR mechanisms since the late 1990's was possible due to the experience of the Square Trade system, developed to manage and resolve e-commerce disputes originated in the eBay online site. Fernandez and Masson (2014, p. 397) believe "*the undisputed precursor of computer-based mediations was SquareTrade*" designed to handle the "*overwhelming volume of online based transactional disputes*". In opinion of Breaux (2015, p. 1), "*one cannot begin a discussion on ODR without starting with eBay and SquareTrade*". In the same idea, for Schmitz and Rule (2017, p. 35) "*a startup company, SquareTrade.com, (…) grew to become the web's most successful online mediation service*". Finally, for Lodder and Zeleznikow (2005, p. 298-9) "*one very popular, and probably the most successful, ODR site to date is SquareTrade*".

Before the Square Trade project, eBay offered two dispute resolution mechanisms, the first was an online forum where parties attempt to find a solution on their own, and the second, human mediators which worked with the parties to settle the dispute communicating and working online. Due to the volume of daily transactions and the number of disputes related to low value items, it was unsustainable for eBay keeping these methods. (Barnet and Treleaven 2018, p. 404)

According to Schmitz and Rule (2017, p. 35), in 1999 the University of Massachusetts along with eBay, created a pilot program to resolve disputes between buyers and sellers users of the online

auction site. When the program was launched, the systems was flooded with cases. "*That pilot program evolved into a startup company, SquareTrade.com*" (Ibid.)

Square Trade developed an assisted negotiation process to handle disputes over transactions between parties located geographically distant. The disputes generally involve one-time transactions with low monetary value related to billing, item delivery and warranties. (Breaux 2015, p. 1)

The users started the resolution process by filling a complaint in the eBay web site. The system showed to the user a menu with several options, each describing the type of the complaint, once the user selected an option, the system deployed a list of possible solutions to the complaint, from which the user could select one or introduce they own suggestion. Afterwards, the system sent the complaint and the suggested solution to the other party along with a list of other possible solutions to choose from. The receiving party can also suggest their own solution. "*This back and forth continues until the matter is resolved or an impasse is reached*". (Breaux 2015, p. 1)

If the parties were unable to reach an agreement using the system, the dispute was transferred to an evaluation phase where eBay would take a final decision a settle the conflict. (Schmitz and Rule 2017, p. 37)

Square Trade licensed its dispute resolution software to other companies and in 2006 abandoned ODR projects to focus in consumer warranties. (Katsh 2012, p. 27)

1.7.11. Other experiences

The first decision-support system that used Artificial Intelligence was Lift Dispatching System or **LDS**. (Lodder and Zeleznikow 2005, p. 311) Developed in early 1980's by the Rand Corporation, it

was used to support lawyers in the settlement of product liability cases. The LDS knowledge included case law, legislation and "*informal principles and strategies used by lawyers and claims adjustors in settling cases*". (Lodder and Thiessen 2003, p. 81)

PERSUADER was a computer program which implemented game theory and case-based reasoning to support negotiators and mediators in labour disputes. The system was able to handle multi-party, multi-issue disputes. (Carneiro et al. 2014, p. 16)

SPLIT-UP is a rule-based system that suggest solution over property distribution in divorce cases in Australia. It is not a Negotiation support system, but parties can use the program to establish the BATNA for their divorce negotiation, "*hence provides an important starting point for negotiations. Split-Up first shows both litigants what they would be expected*". (Zeleznikow and Bellucci 2003, p. 23)

Users are able to introduce hypothetical situations into the system and obtain "*clear ideas about the strengths and weaknesses of their claims".* (Ibid.)

DEUS was intended as a Negotiation Support System designed to help mediators have a better understanding of the issues in dispute in family property negotiation. The system did not have any intelligent function but presented useful information related to the level of disagreement between the parties. (Zeleznikow and Bellucci 2003, p. 23)

ClickNSettle was an online negotiation and mediation system operated by a private company specialised in Law. (Clark et al. 2003, p. 12) The system used an online binding negotiation process, where each party propose or bid the amount of money that considers acceptable to settle the dispute.

When the two parties' proposals overlap or reach a close distance, they may decide to end the dispute. (Business Insurance 2001)

Settlement Online Systems was an Australian online dispute resolution service where parties exchange offers and demands directly or using a case manager if they request. A zone of settlement is designated, and an agreement is reach if one of the offers is equal to two thirds or more of the opponent demand. (Clark et al. 2003, p. 11)

Thiessen et al. (2013, p. 342) provide a list of other systems, some of them developed for research purposes. The list includes: AniMed, AutoMed, Fair Outcomes, Genie, Genius, Graph Model, Invite Joint Gains and Negoisst.

1.8. CURRENT PROJECTS

1.8.1. EU Consumer ODR Platform

It is a web-based platform developed by the European Commission, that provide assistant to customers and trader in their disputes related to online purchase of goods and services. (Barnet and Treleaven 2018, p. 403-4)

1.8.2. MODRIA

The developers of the Square Trade dispute resolution mechanism for eBay created the MODRIA system, which is a cloud-based platform commercially available where businesses and governmental institutions can build their own dispute resolution services. The system supports online negotiation,

mediation and arbitration with online tools including document generation and management, scheduling, videoconferencing, reporting and status messaging. (Barnet and Treleaven 2018, p. 404)

1.8.3. Cybersettle

It is a negotiation support system where parties settle a single-issue dispute through a "double blind bidding" mechanism. According to the system creators, Cybersettle handle over 200.000 claims reducing costs and settlement time in 85%. (Barnet and Treleaven 2018, p. 404)

In the double-blind bidding mechanism, the parties offers and demands are confidential, they do not know what the other disputant is offering, they are only aware that there is a negotiation in progress, "*the computer operates according to a formula and when the offers are within a specific range it announces a deal*". (Thiessen et al. 2013, p. 343)

1.8.4. Smartsettle

Smartsettle is a Decision and Negotiation support system created by Ernest Thiessen (Carneiro et al. 2014, p. 16), that find settlements to disputes using satisfaction functions based on the preferences declared by the parties. The system attempts to "*find the middle ground among parties to settle disputes*". (Ibid.)

According to Lodder and Thiessen (2003, p. 78), Smartsettle is an interactive program "*developed to assist those involved in negotiating agreements among parties having conflicting objectives*" and can be used by parties in dispute or by a trained mediator.

During the negotiation process using Smartsettle, the parties may communicate online, change their initial preferences, or make counteroffers with the assistance of the system. Smartsettle can generate suggestions based in the current conditions of the negotiation and the parties may accept or reject them. When the parties disagree, they may request Smartsettle to make an equal distribution of the item in dispute. The entire negotiation is perform online using the Smartsettle web platform, at the end of the process a document is containing the aspects of the negotiation is generated automatically. (Carneiro et al. 2014, p. 16)

The Smartsettle system is based in six steps: 1) Parties agreed to the guidelines, 2) Parties identify interests in dispute, 3) the demand and value are rated by both parties, 4) software proposes settlement, 5) software optimises settlement based on negotiation and 6) the parties sign the framework agreement. (Barnet and Treleaven 2018, p. 405)

1.8.5. ODR M-S Program

The International Centre for Dispute Resolution (ICDR), a division of the American Arbitration Association (AAA), developed the ODR M-S Program, a system consistent of two steps, first online negotiation and then, if the dispute is not settled, online arbitration. The system aimed to reduce the time and cost of resolution in small claims between manufacturers and suppliers. (Altenkirch 2012, p. 49)

The online negotiation uses a "*Double-Blind Bidding"* process developed by Cybersettle. In this process the applicant must upload in the system three settlement demands in descending order of value according to what he is willing to accept. Then, the counterpart submits three offers in ascending order of value. The system considers each demand and offer as "bids", and pair the three proposals of the applicant with those of the counterpart in the order (the highest demand with the lower offer).

Each pair is considered a round of bidding. If in any round the applicant bid is the same or less than the counterpart bid the dispute is automatically settled. (Altenkirch 2012, p. 51)

It is a blind bidding because the proposal of each party, the bids, remain confidential during the whole process, even after a settlement is agreed. (Ibid.)

In case of no agreement after the three rounds, the dispute proceed to the second step, Online Arbitration. This phase is not automated, the parties will choose a human arbitrator from a special panel provided by the AAA. During this step, the parties will not exchange documents and there are no hearings, the arbitrator will decide with the information already submitted in the previous step by the parties. The award is binding and is issue via a case management and communication system. (Ibid.)

EXPERTIUS is a decision-support system that advices government officials and judges in Mexico over the concession of pensions. The system present information about a citizen requesting the benefit and advice the user of the program whether the person is eligible or not. The system also assists in the determination or calculus of the pension. (Carneiro et al. 2014, p. 14)

1.9. Intelligent systems in Law

In Law, intelligent systems are widely in use as information support. Computer programs analyse large amounts of data and organise and prioritise documents with similar subjects, support lawyers in case assessment processes and "*early evaluation of the risk of defending or prosecuting a case*". (Beioley 2019)

TIARAC project. Telematics and Artificial Intelligence in Alternative Conflict Resolution (TIARAC) is a research project from the University of Minho in Portugal. The project aim is the application of AI technologies in Law developing intelligent negotiation support systems and legal decision support systems. (Carneiro et al. 2014, p. 17)

We Claim is an online platform that assist clients on small claims related to travel (cancelled flights, lost luggage, delayed departures). It uses a semi-automatic dispute resolution process and it has settled more than 1000 claims. (Barnet and Treleaven 2018, p. 403-4)

1.10. ODR, ADR and Intelligent systems

The concept of Online Dispute Resolution (ODR), since its beginning in the mid-1990s, was associated with disputes originated on the internet, mostly in e-commerce transactions. Zeleznikow (2017, p. 35) notes that "*the prevailing belief was that those whose disputes that originated on the internet would find little difficulty in attempting to resolve these disputes via the World Wide Web*". Some authors believe that ODR refers to the traditional dispute resolution mechanisms (negotiation, mediation, arbitration) performed in an "*online environment*". (Fernandez and Masson 2014, p. 396)

However, with the evolution of information and communication technologies, ODR is also used to settle disputes not originated online. For instance, online blind-bidding negotiation support systems can be used to solve insurance claims and other financial disputes "*not necessarily related to e-commerce*". (Lodder and Zeleznikow 2005, p. 300)

According to Halket (2012, p. 87) there is not consensus in the literature over the way the online process influences the dispute resolution process. Some authors believe the whole process must be

held online to the considered ODR, while other authors consider a process as ODR if it were facilitated or assisted using any online application.

For Thiessen et al. (2013, p. 341), ODR embraces every dispute resolution mechanism assisted electronically. Orr and Rule (2017, p. 2) consider ODR as "*the use of information and communication technology to help people prevent and resolve disputes*", and for *Hörnle (2003, p. 28), it is possible to use ODR to solve disputes arising online and offline.*

Rule (2016, p. 8) shared an even broader vision of ODR where the use of mobile phones, email, spreadsheets and word processors is enough to consider as ODR any dispute resolution process: "*ODR and ADR are fundamentally the same thing (…) ODR does open new opportunities for dispute resolution, but essentially it is the same activity as ADR, just using different tools*". Wahab (2013 cited by Breaux 2015, p. 3) completely disagree with this vision, referencing e-arbitration, the author claims that the simple exchange of communications via electronic mechanisms or the use of video-conference software during an arbitration hearing "*would not suffice to characterize the process as e-arbitration*."

Referring the use of intelligent systems in dispute resolution, Fernandez and Masson (2014, p. 396), consider "*highly specialized settlement software*" and even the eventual use of "*avatars or holography*", as tools of ODR, along with emails, instant messaging applications, video-conferencing software, and other advanced technologies.

The same authors (Ibid., p. 397) also state the difference between computer assisted mediation and computer-based mediation. In the former, communication technologies are used to facilitate the traditional mediation (computers are used in the preliminary phase of mediation to exchange

information or video-conferencing software is used among the parties and the mediator), in the latter, the mediation is performed using any form of DSS or NSS allowing the parties analyse data or receive settlement strategies and suggestions (parties might use blind-bidding software alternatives)

1.11. Advantages and Disadvantages Intelligent Systems

Cost and time savings are referred as the main advantages of intelligent systems is dispute resolution. The automated resolution process of some NSS may settle a dispute in a more timely and efficient manner, decreasing the costs for the parties (in some cases there is no need of legal representation or assistance). (Fernandez and Masson 2014, p. 399) Governments and private entities have used intelligent systems (like blind-bidding) to significantly reduce the volume of their backlog of complaints. (Farkas, 2012 cited by Fernandez and Masson 2014, p. 399)

Another advantage is convenience, the parties may be in different geographic and time zone locations and may have different work schedules making difficult to arrange a traditional ADR setting. Additionally, communication through a computer-based dispute resolution system may "*result in the balancing of power if one of the parties is more articulate or persuasive in face-to-face discussions*". (Breaux 2015, p. 1) Furthermore, some systems use an internet or cloud hosting interactive platforms where parties in dispute can find instructions and information, post materials, view and respond post of the other party and use tools like DSS and NSS. *(Hörnle 2003, p. 29)*

However, particularly in mediation, elements of verbal and non-verbal communication that can be perceived and used by the mediator to regulate the intensity of the process during a traditional face-to-face session are lost if the parties only communicate and settle the dispute using computer-based systems. Moreover, language and cultural differences represent risks of miscommunication, making human mediators more suitable for certain situations depending on the complexity of the issues.

(Fernandez and Masson 2014, p. 400). In the opinion of Beioley (2019), the mediation process "*is inherently a human one*".

An individual might trust more the information presented by an algorithm than the same information brought by a human. Intelligent systems overcome possible biases of human negotiators, mediators, and arbitrators. Algorithms and computer systems only evaluate information charged into the system with no judgment "*on the basis of your race, sex, age, income, or other characteristics*". (Orr and Rule 2017, p. 5) Although, the perception of impartiality of the systems might be compromised due to the absence of regulation and ethical guidelines in which ODR operators provide their services. Most of the ODR services providers are private companies, the lack of information regarding their relationships with corporations of other sectors might impact their image of neutrality and impartiality. Traditional mediators and arbitrators are usually governed by codes of conduct and by the law. (Fernandez and Masson 2014, p. 400)

The access to technology is another disadvantage identified when using computer-based resolution systems. For disputes arise offline, any of the parties might not have a computer, mobile phone, or internet connection. Computer or technology literacy is another factor that might keep one party out of the system. (Fernandez and Masson 2014, p. 400)

The exchange and storage of information through the internet might compromised the confidentiality of the parties. If a digital record is kept online, the data could be leaked or stolen. Furthermore, if identity authentication measures are not in place, there is an "*open possibility of negotiating with an impostor*". (Fernandez & Masson 2014, p. 401)

1.12. Fairness and Ethical Considerations

One of the main challenges for intelligent negotiation systems is the development of advice and solutions based on "*justice rather than merely meet the interests of the disputants*". (Lodder & Thiessen 2003, p. 94)

According to the studies in Australian family law disputes performed by Lodder & Zeleznikow (2005, p. 335) in some dispute resolutions, compromises "*might conflict with law and justice*". For instance, using a fully automated system (where the resolution is based in the consensus of the parties) in a divorce dispute, if the woman's only goal is keeping the children, to be granted custody, she might give all the property and possessions to the husband. The final settlement meets the objectives of the parents; however, the interests of the children might be affected since they could be deprived of financial resources. In cases like this "*the use of negotiation support systems that attempt to equally satisfy both parties is limited*". (Lodder and Zeleznikow 2005, p. 336)

In a different idea, for Orr and Rule (2017, p. 5), as more disputes are settled outside the formal justice system (courts and tribunals) and the development of the technology and algorithms used in intelligent dispute resolution systems have been driven mainly by private sector initiatives, the role of the public sector in the provision of justice may be weakened.

There is also a risk of bias in the advice or solutions generated by intelligent systems. Case-based reasoning systems rely on data related to similar past cases, if in the previous cases the resolutions reflect the biases of the human decision-makers, then the intelligent system is likely to replicate the same pattern. (Lozada 2019, p. 354)

Orr and Rule (2017, p. 14) sustain that developers of intelligent systems for dispute resolution will face complex ethical and moral design choices. The authors present a possible scenario where a computer with advanced capabilities in reading facial expressions might be able to determine if a party in a dispute is lying. Also, hypothetically a computer might be equipped with an MRI scanner, making it able to provide certifiable evidence that a disputant is not telling the true.

The dilemma for the developers is whether an AI system should be provided with that kind of capabilities "*giving computers so much visibility into things that we as humans cannot perceive ourselves (…) or should the AI be forbidden from considering it?".* (Ibid.)

1.13. Intelligent Systems in the Future of ADR

Most of the literature agrees that the use of intelligent systems in dispute resolution will expand thanks to advances in information and communication technologies, the positive results of some systems already in use, supporting the resolution of disputes faster and cost-effective, and moreover for the widespread uses of modern devices mostly by younger generations.

The use and customisation of computer-based systems will "*eventually become a skill that practitioners should master*". (Fernandez and Masson 2014, p. 403) New technologies and ODR platforms are in constant development and dispute resolution professionals face the challenge of not becoming obsolete, they will need computer and technology managing skills as much as their negotiation and mediation expertise. Dispute practitioners with knowledge and experience in intelligent systems will have a competitive advantage offering better solutions for their clients. (Morgan & Reed 2019) Not only dispute resolution professionals should learn and experiment with

intelligent platforms, also "*training programmes should make ODR a core component of ADR education*". (Rule 2016, p. 11)

For Breaux (2015, p. 4) we are in an increasingly "*paperless society*" where technology is gaining more relevance in people's lives and where the resolution of disputes using modern devices will continue to rise. There are discussions of hypothetical future e-arbitration platforms with AI equipped computers taking decisions without human intervention. Thiessen et al. (2013, p. 343) share a similar vision where fully automated dispute resolution software can be expected due to the rapid development of powerful computers and sophisticated algorithms.

However, in opinion of Carneiro et al. (2014, p. 23) the objective of development fully automated systems is "*rather utopic*". Despite the existence of current automated programs, the development of completely autonomous intelligent systems is "*far from what was initially envisioned".* However, the research conducted trying to achieve that goal has provided intelligent tools allowing faster and efficient dispute settlements.

1.14. AI in the workplace

In the past, changes in the workplace produced by robotics and computers occurred mostly in manufacturing jobs (activities that require physical and highly repetitive tasks), however, developments in internet technologies, software, and powerful computers, have increased the range of activities susceptible to be changed, including clerical and professional roles "*such as insurance and law that have seemed wholly reliant on humans' judgment and understanding*". (Wright 2019)

Some theories project that technological advances in AI will provoke the substitution of humans and subsequent destruction of certain jobs, and other theories claim that AI will increase demand for new kind of labour. (Agrawal et al. 2019, p. 197).

Agrawal et al. (2019, p. 203) see the change in the workplace with the implementation of AI technologies in the same way the introduction of automated teller machines (ATMs) influenced the job of bank tellers. With the ATMs distributing bank notes and taking lodgements, the bank tellers could focus in other more important activities like assisting and offering solutions to clients. The ATM did not replace jobs, it changed them.

In opinion of Benedikt and Osborne (2013, p. 19) occupations where subtle judgement is required, the probability of automation has increased while in other activities that require more critical thinking, algorithms and computer systems might only give recommendations to human operators. Some estimations suggest that sophisticated algorithms will be able to replace around 140 million full-time knowledge workers worldwide.

For Sako (2020, p. 27) in the analysis of AI and the future of work, it is important to make a distinction between tasks and jobs. The tasks are automated, not the jobs. For the author, computers substitute some tasks and complement others. "*AI substitutes some tasks, complements others, and creates new tasks*".

A study performed by Manyka and Sneader (2018) from McKinsey Global Institute, concluded that not all occupations can be fully automated but most of them will be affected by computer systems. Specifically, the report found that 60% of occupations have tasks that can be automated. *This means that most workers (...) will work alongside rapidly evolving machines"*. (Ibid. p. 3)

Arntz et al. (2016, p. 21) believe the results of some studies and estimations about jobs lost, created, and changed and the overall economic impact of the implementation of AI during the next years, overstate technological capabilities. Experts "*overestimate the potential of new technologies*" attributing more comparative advantages to robots or machines in comparison to humans in activities involving judgment and common sense.

Despite the increasing ability of advanced algorithms and computers to automate non-routine tasks, some activities like negotiation, persuasion and fine arts require creativity, complex perception, and human social intelligence. These types of activities are "*unlikely to be substituted by computer capital over the next decade or two*". (Benedikt and Osborne 2013, p. 27) Sako (2020, p. 26)

Chapter 2 – Research Philosophy Methodology and Methods

2.1. Research Philosophy

According to Sanders et al. (2015, p. 124), research philosophy "*refers to a system of beliefs and assumptions about the development of knowledge*". Researchers make a series of assumptions about the reality (ontology), the perception of knowledge (epistemology) and the influence of their own values (axiology) in every phase of the research especially during the formulation of the research questions, the choice of methods and the interpretation of the findings.

Ontology refers to the researcher "*beliefs about the nature of reality*". (Killam 2013a, p. 15), reflex about what exists and what is true and how we can know about it. From an ontological point of view there are two opposite perceptions of reality: realism, and relativism.

Realism assumes the existence of an objective reality that can be measured and generalised (Ibid. p. 17). For realists there is only one reality or "truth", and it is separate from human behaviour. The truth does not change, and it is the same experienced by all social actors. (Sanders et al. 2015, p. 128).

In Relativism, there are multiple subjective perspectives of reality that can change influenced by culture and experience. For relativists there is not one "truth" because reality is connected to context and individual experiences. "*Truth is contextual, which means that can be multiple truths*" (Killam 2013a, p. 15)

According to the vision and understanding of the reality by the author of this research paper, the study of dispute resolution is a subjective matter where individuals and reality are interconnected and there is not a single truth. Parties in dispute may see the causes and consequences of the conflict with different perspectives according to the context and they experience the resolution process differently.

Epistemology is concerned with the nature of knowledge (what is valid and legitimate knowledge and how can be transmitted to others (Saunders et al. 2015, p. 127). For Killam (2013, p. 18), epistemology examines how knowledge is acquired and the relationship between the researcher and the knowledge. (Killam 2013a, p. 18)

It is necessary to identify the own ontological assumptions about objective or subjective (realism or relativism) reality before considering how epistemology influence the attempt to discover knowledge.

For Blackman and Moon (2017) observing the relation between object and subject determine how epistemology influences the research. In Objectivist epistemology the reality exists separate and independent from the individual, the researcher is outside "*looking for an objective measure of the object*". In Subjectivist epistemology the individual is in constant engagement with multiple perspectives of reality, the researcher is inside the reality, there is proximity between researcher and researched. (Killam 2013b)

This research project assumes the subjectivist epistemology idea of the relation between the researcher and the object of study. In line with the initial assumption about the interconnected reality with individuals (relativistic position), the author of this paper considers that is not possible to see and study the reality from an outsider perspective. The context and the interrelationships of the

researcher with others are always present and influence voluntarily or involuntarily the research process.

Axiology indicates values and ethics and how they influence the research process. "*This incorporates questions about how we, as researchers, deal with both our own values and those of our research participants*". (Saunders et al. 2015, p. 128) For Hiles (2012, p. 2) the axiology "*offers an important basis for making explicit the assumptions of different paradigms of research*".

Sanders et al. (2015, p. 128) consider helpful for students and researchers to write a statement of their own values in relation to the topic of the research. Performing this task can help to improve the researcher's awareness of the values that will influence the analysis of data and the drawing of conclusions. Following this piece of advice, the author of this paper reflected on his own values and how they influence his perspective of the research process. Those values include honesty and integrity (respecting other author's work making appropriate citations, not falsifying or misrepresenting data and act with authenticity), competence (trying to make a contribution to the academy and striving to gain expertise and acquiring new knowledge), and openness (being open to new ideas and embrace criticism).

In general terms, this research paper follows a relativistic perception of reality and a subjective approach to the object of study in accordance with the author's values and his background in political science. However, the author also adopts a pragmatic stand where objective and subjective elements of thought can be used to obtain useful practical outcomes.

2.2. Research Paradigm

A paradigm is a set of beliefs or views of the world built on the ontological, epistemological, and methodological assumptions (Pitard 2017). It is basically a way of viewing or thinking about the world and it is the framework for the researcher's work (Killam 2013a, p. 15).

For Saunder et al. (2015, p. 132), paradigms are "*the political or ideological orientation of researchers towards the social world they investigate*".

The researcher will select a paradigm guided by their beliefs and assumptions and there is no "*way to prove that one paradigm is superior to the others which is, in part, why they are often debated*". (Killam 2013a, p. 26)

For Guba and Lincoln (2005, cited by Killiam 2013a, p. 26) the major paradigms are positivism, post positivism, critical theory, and constructivism. Sanders et al. (2005, p. 135) focus in positivism, critical realism, interpretivism, postmodernism and pragmatism.

The paradigm that guided this research project in AI and dispute resolution is the Pragmatism.

Pragmatism refers to the study of an actual real-world situation in its context, the identification of a problem and understand how to solve it and generate practical solutions. A pragmatic researcher will identify a problem and conduct a research enquiry (process of asking questions) seeking to understand and solve the problem. (Duram 2012, p. 2)

The base of the Pragmatism is the human experience and the "*multiple factors involved in people's actions in a given situation*" (Duram 2012, p. 2). This paradigm considers concepts and ideas in terms of the "*roles they play as instruments of thought and action, and in terms of their practical consequences in specific contexts*". (Saunder et al. 2015, p. 143)

Pragmatists accept that there are multiple realities and many different ways of interpreting them. The researcher cannot see the world under a single point of view. Also, as the pragmatist is focus on practical outcomes or solutions to improve the future practice, the research will try to reconciliate objectivism and subjectivism. (Saunder et al. 2015, p. 144)

The main reasons this research paper is based in a pragmatist approach are the position of the paradigm about the perception of reality, the emphasis in practical outcomes and the reconciliation of subjective and objective methods.

As already mentioned, the author of this paper considers the reality as multiple entities with diverse interpretations according to the context and the individuals, this is because of the nature of the conflict or dispute as a social product embedded in the relationships among individuals. This philosophical stance concurs with pragmatism ideas.

Furthermore, this paper pursues a practical outcome promoting the understanding of Artificial Intelligence and its current uses in dispute resolution and how it might impact the future of the field, giving some insights that practitioners may consider during the development of their careers.

The author of this paper is conscious that for pragmatists the adoption of one philosophical position is unhelpful, however it also allows the choice between one stance or a mixture which permit the use

of quantitative and qualitative research. In this research paper a qualitative method is used in the data collection section, however, one of the research questions was answered using quantitative tools.

For a better understanding of the selection of pragmatism as the research paradigm, it is necessary to explain why the other approaches do not match with the vision and aims of the author of this paper. While it is not the objective of this section to explain in detail all the research paradigms, it is necessary to compare the pragmatism at least with the main two approaches: positivism and interpretivism.

Positivism sees a social reality independent of human influence or interpretations that can be observable using methods of traditional natural sciences and the research findings *"are likely to be considered objective and generalisable"*. (Saunder et al. 2015, p. 136) Positivist researchers focus in experiments or empiric methods to obtain pure data and objective facts. (Ibid.)

The positivism assumptions about one reality uninfluenced by individuals and observable from outside are the reason this research paper did not consider it as philosophical approach. As previously stated, the author of this research follows a relativistic and subjective vision of the world.

Interpretivism, also known as constructivism, was developed "*as a critique of positivism but from a subjectivist perspective*" (Saunder et al. 2015, p. 140). An interpretivist researcher assumes that the findings are going to be influenced by his own perspective and values, the researcher and the reality impact each other. (Pitard 2017)

In its critique to the positivism, interpretivism consider that is not possible studying the relations between individuals and the social world using the same techniques as in physical phenomena, hence social sciences and natural sciences research methods must be different. Furthermore, interpretivism considers there are multiple social realities based on interpretations, context, cultural background and experiences and there is not "*universal laws that apply to everybody*". (Saunder et al. 2015, p. 140)

Some readers might believe interpretivism is the suitable research paradigm for this paper since it follows a perception of reality and relation individual-knowledge that harmonise with the very same ontological and epistemological assumptions of the author of this paper, and the intention of interpretivist research is developing a better understanding and interpretations of social worlds and contexts (Saunders et al. 2015, p. 140) which is also one of the aims of this paper (understanding the influence of IA in the future of dispute resolution). Although the interpretivism was the initial choice as a research paradigm in the first stages of this research project, the practical purpose of the pragmatic approach and its versatility in the use of qualitative and quantitative data collection instruments were determinant in its selection as the best research paradigm for this specific paper.

2.3. Research Nature

According to Sanders et al. (2015, p. 174-176) the nature of the research can be exploratory (the purpose is observe something and try to understand or get insights about it), Descriptive (the aim is to precisely understand situation, events or persons), Explanatory (the goal is determine the causal relationships between variables) or Evaluative (the purpose is to assess how well something works).

The nature of this research paper is exploratory since it aims to understand how AI is used in dispute resolution and what is their influence in the field.

2.4. Research Approach

This research project has taken an inductive approach as it goes from reviewing and collecting concrete data to analyse it a see patterns and understand a general phenomenon.
The paper has no intention of reviewing a theory and then verify it (deductive approach) or generate a new theory and then test it (abductive approach).

2.5. Research Methodology

In a broad sense, the research methodology can be quantitative research (numeric data-numbers), qualitative research (non-numeric data-words, images, video) or a mix of both. (Sanders et al. 2015, p. 165). The selection of the adequate methodology depends on different variables, including the type of research, the researcher's assumptions and objectives, the access to data and the time available.

One research methodology might be more suitable than the others from the point of view of the paradigm chosen (quantitative research is usually associated with positivism whilst qualitative research with interpretivism), however, "*Sometimes it makes sense to use more than one method at the same time*" (SAGE 2017, p. 4), and they can be used with any philosophical paradigm. "*There is no right or wrong way here. You have to think through what will work for you*". (Ibid.)

However, the author of this paper considers that the most important decision point related to the choice of the research methodology is not connected to ontological, epistemological or paradigmatic preferences, instead, the research questions and what they try to achieve is what must govern the

selection of qualitative, quantitative or mixed methodologies. This research uses a mixed research methodology.

Most of the research questions in this project are focused in the interaction between new technologies, dispute resolution practitioners and parties in conflict. The answers to the questions will be based in perceptions, behaviour, and social interactions. For these questions, the right choice is a qualitative methodology.

However, one of the research questions ("How AI will impact the position of the dispute resolution professional in the work market?") the answer will be found gathering numerical data related to the evolution (increase or decrease) of job positions available for practitioners. A quantitative methodology is necessary to gather data and answer the research question.

In this project, three research methods or strategies have been applied to gather the necessary data to answer the research questions. Two strategies of qualitative nature (autoethnography and interview) and one of quantitative nature (statistics in secondary data).

Since all the strategies were applied within one phase using separate qualitative and quantitative methods, the project uses a **concurrent mixed methods research**. Also, the interview method was applied in direct support of the autoethnography, they both were used together to collect data. This process is known as **concurrent embedded design**. (Sanders et al. 2015, p. 172)

The advantage of this methodology is that allows the interpretation of data together, providing better understanding of the research questions (Ibid.), however, the use of multiple methods was a logistic constraint making the data collection and analysis process lengthy and complicated.

2.6. Research Strategy

Sanders et al. (2015, p. 177) affirm that a strategy is a "*plan of how a researcher will go about answering her or his research question*". The selection of the research strategy is governed by multiple variables including the research philosophy, the research approach and moreover, by the research questions and the data available. (SAGE 2017, p. 2)

The strategies "*should not be thought of as being mutually exclusive*", it is possible to "*combine a number of different strategies within mixed methods*". (Sanders et al. (2015, p. 177)

As already mention in the last section, this research paper uses a mixed methodology with three strategies: Autoethnography, interviews and statistics from secondary data. The reasons for the selection of three different strategies of data collection is due to difficulties in the access to data.

In early stages of this project, the research plan considered the use of case study as strategy, however, due to the nature of ADR as a private and confidential mechanism, it was not possible the collection of data related with number of cases settled using any computer support, or making interviews with people who had participated in a resolution using software aid.

An experimental approach was also considered, using a control group solving a dispute with a traditional negotiation and an experimental group solving the dispute using intelligent support systems. There are several companies offering services of dispute resolution using intelligent systems however, as private corporations, the services are offered with a fee. Attempts were also made to arrange interviews with representatives of these companies, unfortunately the efforts were fruitless.

After discussions with one of the companies (Smartsettle) that offer computer-based dispute resolution, the author of this paper was granted permission to use the software (single user permission as a beta tester) and he was invited to tutorial sessions and an online conflict resolution simulation where new and prospective clients of the company would negotiate with each other using the support of the computer.

The access to the simulation using the software of the company that recently "*became the first (…) to resolve a dispute in a public court in England and Wales using a "robot mediator*"" (Beioley 2019), was a determining factor in the selection of autoethnography as the main research strategy for this project.

2.6.1. Autoethnography

Autoethnography is a research method where the researcher describes and analyse personal circumstances to understand cultural experience. (Ellis et al. 2011, p. 1) Personal narratives are one of the most used forms in autoethnography, the narratives are usually presented from the perspective of the writer using first person. (Bolen 2018, p. 4)

Autoethnography receives critics about its reliability and generalizability, it is overly subjective, lacks theory and proper academic research form. (Bolen 2018, p. 4)

The experience object of description and analysis used for this paper is a negotiation simulation conducted using the support of the computer software SmartSettle ONE. During the simulation, 18 people from different countries tried the features of the program in several negotiation rounds for 2

hours, using a hypothetical case impersonating the parties in conflict. After the rounds, the participants had a videoconference, where perceptions and opinions were exchanged. The software is available for commercial use and the company provider organises the simulations to promote the characteristics of their product.

The main limitation of the autoethnography as a research strategy in this paper is the position of the author in relation with the experience. "*Usually, the author does not live through these experiences solely to make them part of a published document*". (Ellis et al. 2011, p. 3). In autoethnography the researcher describes experiences lived in their past. However, due to data collection limitations, the author of this paper took first the decision to perform an autoethnography and then live the experience object of description. Furthermore, the negotiation process taken as an object of the narrative was a simulation, not a truly recall of experience.

2.6.2. Interview

In this paper, the aim of the interview method of data collection is complement the information obtained in the autoethnographic experience. The interviewees had to be persons with at least one previous experience using any computer-based dispute resolution system.

Due to difficulties in the access to this data, the author decided to conduct a quasi-experiment (absence of control group and sample techniques) with a group of 10 students of the Dispute Resolution program in Independent Colleges, Dublin, mixed from all the semesters, were divided in pairs which used the system *Adjusted Winner* to resolve hypothetical cases. The aim of the exercise is not the collection of numerical data, its purpose is the perform interviews to the students and use their experience to complement the autoethnography strategy. The exercise was partially inspired by

the work of Swaab (2004, p. 67-68) where negotiation simulations were carried out using university students in The Netherlands.

The students were given three short hypothetical cases, the first is a divorce where the couple only have to divide property, the second is also a divorce but custody of a child is also in negotiation, and the third consisted in flatmates moving out of the property separately, they had to divide the shared goods. Those three cases were created to make the students assume the perspective of family negotiation with only monetary issues and other with a perspective of the custody. The last case seeks to add a less subjective matter. The three exercises aim to engage the students in the activity and broader their experience solving then using software.

After the exercise, the students would have a semi-structure interview with the author, however, timetable coordination with the students was not possible, changing the format to a structure interview sent via email. The questions to be answer by the students at the end of their negotiation were:

1. Did the results match your expectations?
2. Do you think it was a fair outcome? Why?
3. Would you use a system like this or similar in future disagreements?
4. Can you think of any advantages and disadvantages of this system?

The students were told to write down their expectations before the start of the exercise, question number 1 aimed to know if the participants were satisfied with the suggestion presented by *Adjust Winner.*

Question 2 wanted to know if the students consider that a computer software can provide fair solutions to disputes.

The third question was also related to the satisfaction levels with the outcome. If the students were eager to use a similar system again in a real personal dispute, then they consider this a positive experience.

The last question wanted to ogive the opportunity to make an objective assessment of their experience using the software.

The impossibility of the discussion with every student in a face-to-face format limited the scope of the exercise. The answers of the students were shorter than expected and in some cases the meaning of the question was misunderstood.

The objective of the interviews was the support of the autoethnography research strategy. The author of this paper wanted to discuss his experience using computer-based dispute resolution with other individuals with a similar experience.

2.6.3. Secondary Data

The quantitative methodology used in this project aims to answer one of the research questions which is better verified using statistical information. To answer the research question *How AI will impact the position of the dispute resolution professional in the work market?* is necessary Information

related to the substitution of labour for machines and predictions on the future status of the work market.

The statistical information was extracted from the report Jobs Lost, Jobs Gained: "Workforce Transitions in a Time of Automation" published by McKinsey Global Institute (Manyika et al. 2017), one of the most prestigious consulting firms worldwide. (Byrne 2017)

A second report was used to obtain statistical information, "Will robots really steal our jobs?: An international analysis of the potential long term impact of automation", from PricewaterhouseCoopers (PwC) (Hawksworth et al. 2018), another internationally recognised consulting company. (Forbes 2019)

Both reports were selected not only because of the reliability of the organisations which published them, but also these two studies are the most updated and with the major variety of information available regarding the subject of artificial intelligence and the future of the work market.

The limitations of this method sit on its original purpose. As secondary data, the reports had a different objective and perspective than this research paper. Also, the information and projections provided by the reports about the future composition of the work market are categorised by country, gender, education, industry sector and by jobs, which seems to be a rich source of information, however, the job "dispute resolution practitioner" or similar terminology is not included precisely in the reports.

Professional jobs

As already mentioned, in studies, analysis and forecasts related to the impact of AI in the workforce and the workplace, there is no specific mention to negotiators, mediators, arbitrators or in general, dispute resolution practitioners. The publications usually use economic sectors (agriculture, construction, financial services, manufacturing, among others) and job groups (administrative, engineering, medical, social services, among others).

One of the categories found in reports and government statistics refers to Professionals or Professional Jobs. According to Sako (2020, p. 26), Professionals are "*defined as possessing an expertise, a body of knowledge, and a service ethic*" and include doctors, lawyers, scientists, accountants, and other jobs that require domain of expertise.

This research paper considers the dispute resolution practitioner is included in the broader category of "Professional" or "Professional jobs"

2.6.4. Time Horizon

Following the definitions of Sanders et al. (2015, p. 200), a research project can be cross-sectional or longitudinal. The former refers to research of a phenomenon in a particular time, and the latter is the study of change and development or "*the representation of events over a given period*".

This research paper follows a cross-sectional time horizon due to time and resources constraints.

Chapter 3 – Presentation of the data

3.1. Autoethnography

The vision of a future where machines or robots will make most of our work while we just enjoy life has been always an interesting idea for me. Not because I don't want to do anything or I want to escape responsibilities, but for a fascination over what we, humans, can do and where our curiosity and innovative imagination will take us. During the past twenty years, we have become better using computers, improving their capacity, and giving to them many of our simple tasks. Computers cannot perform any cognitive activity in the same way we do, or at least not yet.

As computers get better at cognitive activities, I wondered if they could be used in a negotiation table and what role they would have in the resolution of a dispute. Some articles talk about "robot mediators" (Beioley 2019) and I wanted to know more about how maybe we will have an Amazon Alexa style mediator or arbitrator helping us resolve our differences. It seems that we are already taking the first steps to make that happen.

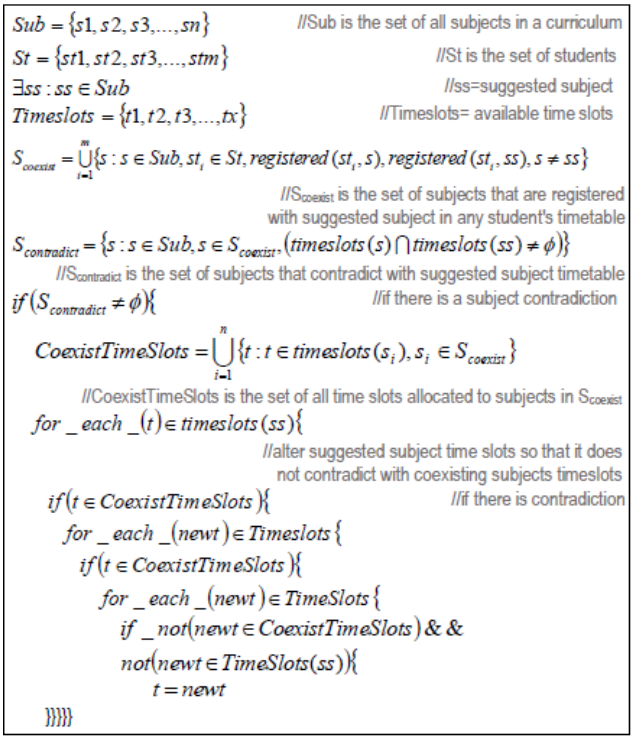
There are some companies that offer software with complex algorithms promising the solution of disputes faster and with better results than a normal resolution process would produce. I was fortunate enough to have the opportunity to use one of these systems, not in a real dispute though, but in a simulation where people from different countries interested in the technology interacted representing fictional parties in a hypothetical conflict.

The name of the company is Smartsettle. They continuously organise online simulations to showcase the technology of their products ONE (for single issue-disputes) and Infinity (multi-issue complex disputes). During the simulation, we used the single-issue program in a dispute between two

businesses regarding payment of lost equipment. We were 18 participants and we could represent any of the two parties in conflict as many times as we pleased during almost two hours, after that we had a conversation (via video-conference) about the experience and the organisers answered our questions.

Before that session, I was really curious about how a computer can "think" and suggest a solution for a dispute, how an algorithm "knows" if it is being fair, how easy or difficult using a system like that could be, how far we are from that Amazon Alexa mediator, and I also wanted to know the impressions of others. I tried to understand more about algorithms but, I majored Political Sciences in college and the last time I saw an equation or something similar was back in school about 20 years ago, so, when I looked up how they work and I found something like this: (see image 1) I thought, well it is better to know what they do and not how they do it.

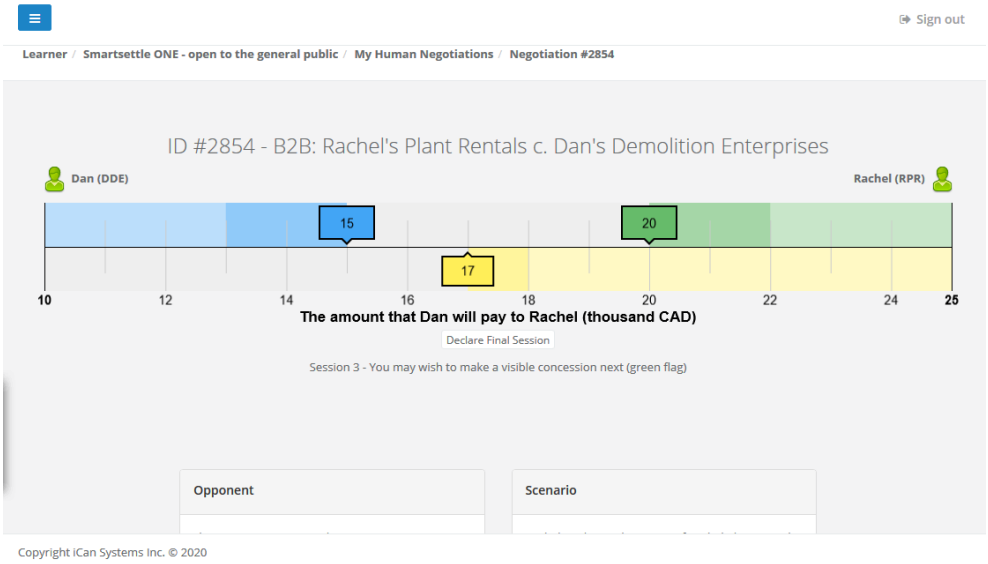
Image 1: Algorithm DSS



The system we used during the negotiations is based in visual blind-bidding, where each party add to the system two proposals (or bids) to settle de dispute, one of the proposals is public and visible to

the other party, and the other is private, only the person who made that proposal can see it. (Graph 1) The public bid indicates what I would like to receive, my ideal scenario, and the hidden represents what I am willing to accept to settle the dispute. Each negotiation can take three rounds, if there is no agreement, then the case is decided by a panel of human experts.

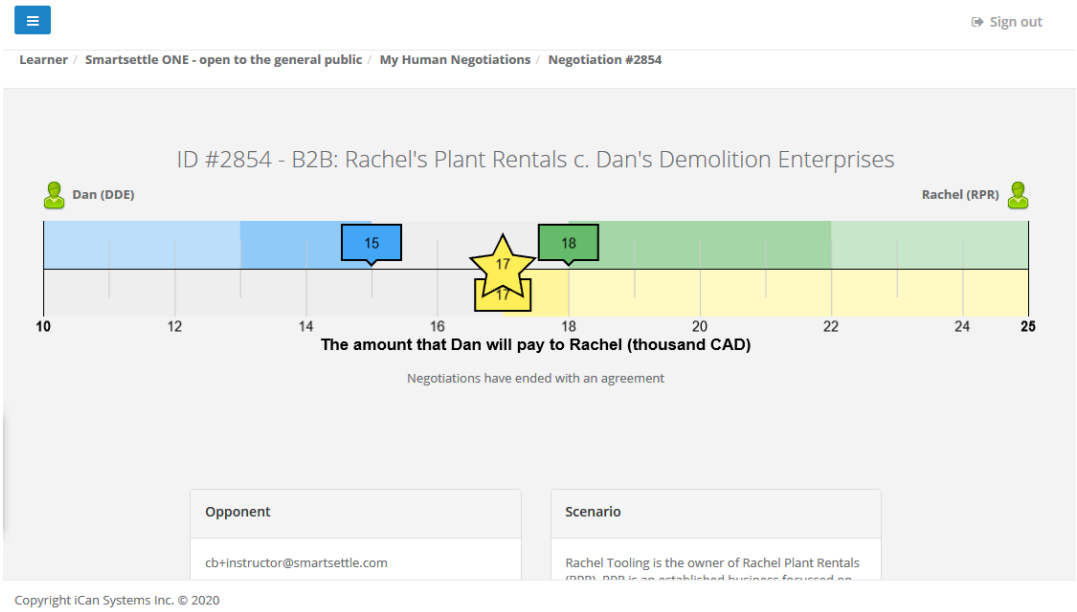
Graphic 1: Smartsettle ONE



In the graph, the public proposals are on top, the yellow one is hidden to the counterpart.

After the exchange of proposals, when the bids overlap or they are at a certain close range (zone of agreement ZOA according to Smartsettle terminology), the algorithm starts to work, settling the issue not by splitting the difference, but by rewarding the party whose first bid was close to the ZOA in the last round. Why should the algorithm reward one of the parties? Why not just split evenly after the bids overlap? were the questions of a fellow negotiator during the simulation. Because the parties would say "*you know it's no point for me to get to a fair solution, I just going to hold back, it's no different at the end*" was the answer one of the two moderators of the activity. (appendix 2)

Graphic 2: Smartsettle 2: Settlement



That was a quite interesting point! if the algorithm encourages the parties to engage in the process and not "hold back", then we have a principled negotiation (Fisher and Ury 1991), where the parties will not just keep their initial positions, but they will work in underlying interests. I wanted to verify if the algorithm indeed reward the parties and I checked all the 26 negotiations I held during the simulation. I used different strategies during the session, from a tough guy making the minimum concession possible, to the most generous person in the world, and yes, the algorithm rewarded (and punished) me. While I was more aggressive, the final settlement was closer to my counterpart proposal and vice versa.

I have to say the system is quite easy to use and the interface is good looking as well but, to be honest, we were just negotiating a single monetary issue, nothing complicated about that. At the end of a real process, the system generates a negotiation agreement and send it to the parties who decide if it is binding or not.

During the final meeting we had after the simulation, we discuss interesting points regarding the use of the system in different cultural context, in more complex situations, the human factor during the process and the receptivity from disputants of an algorithm settling their conflict. Most of the people who took part in the simulation were sceptical about the system during the whole session. The majority were mediators, except for 3 lawyers and a couple of students including myself. The main concern they have was how to make the parties use the system and trust a decision from a computer.

I had not thought about trust and why people should have confidence in a machine taking decisions for them in important issues that might have a deep impact on their life. To be honest, I was completely biased, I was just excited about the future and how we would be solving our disputes with the help of an anthropomorphic robot, I trusted a system that doesn't even exist yet.

The moderator's suggestion about how to make people trust the algorithm was simply indicating that mediators should explain the system to their client and use simulations like the one we were in. That is indeed an option, but I believe we should first understand what trust is and why people trust others. For me, the cornerstone of trust relies on consistency and a feeling of safety. Consistency will produce reliability which then, produce that safe feeling, nonetheless, a deep philosophical discussion out of the scope of these lines.

I think, people will trust systems like Smartsettle once they get familiar with it and they hear about cases of successful settlement using the program. People have a selective trust in algorithms (Hosanagar and Cronk 2016, p. 3), we don't trust that much driverless cars yet, but we follow recommendations about what products buy or what TV series or movie to watch next. Maybe dispute resolution algorithms, like the driverless car, need some time to make a reputation.

The human still holds a preponderant role in the Smartsettle system, not only to introduce and convince people to use it but also in the crafting of pre-mediation and pre-negotiation agreements and post negotiation arrangements. The system is automated, but not that much.

One of the participants, from Israel, commented that in the country they have a tough approach to negotiation and that is simply part of their culture. The comment made think about not only cultural constraints but also socio-economic ones, it is not the same the receptivity of a computer-based negotiation system in a developed country that in another where there are constant problems with the food supply.

The simulation was an important experience to me because I had a first-hand encounter with one of the most advanced algorithmic dispute resolution systems (Beioley 2019), I could try it and understand its features as well as its limitations and even though it was during a simulation without a real dispute, I could share opinions with real mediators.

Once the simulation ended, I still wanted to know and discuss more about the receptivity of computer-assisted conflict resolution, however, finding people with previous experience was quite hard, to say the least. So, I decided to arrange a simulation and then discuss with the participants their insights and their disposition or rejection of solving their issues helped by a computer.

I recruited a small group of students and organised them in pairs, they would represent a party in three short cases, we did not use the Smartsettle software because we needed a license for that, however, we manage to use another algorithm named *AdjustedWinner,* which use a different approach than blind-bidding, instead, this system distributes issues or items in dispute according to preferences

expressed by the parties before the negotiation process. This system also allows for multi-issue disputes.

After the exercise finished, the students expressed a variety of opinions ranging from "*I would not trust the tool at* all" to "*Better than expected*".

Most of the comments were related to fairness, several students considered the division made by the system favoured the counterpart, others believe negotiation face-to-face is more effective and some added that the solutions were only partially fair. Students also considered systems like this are not able to resolve effectively subjective non-monetary issues, like family disputes. Finally, the majority of the students manifested they would not use the system in the future, only two would consider it as a complement of traditional negotiation mechanisms.

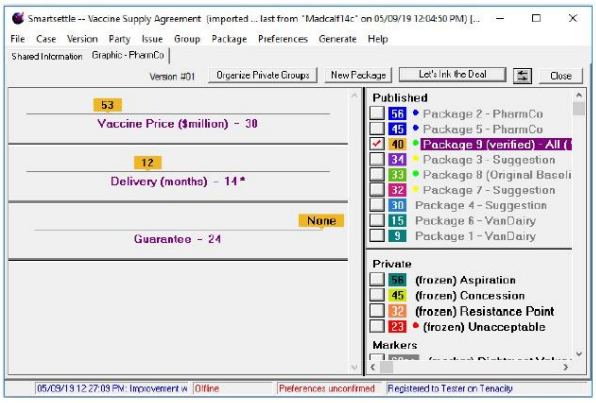
I was not expecting such as bad perception (I still have to work on my biases), but I consider the system is not completely at fault. The design of the exercise was not the optimal, the discussion with the students was in written form via email, and they were not fully engaged in the exercise.

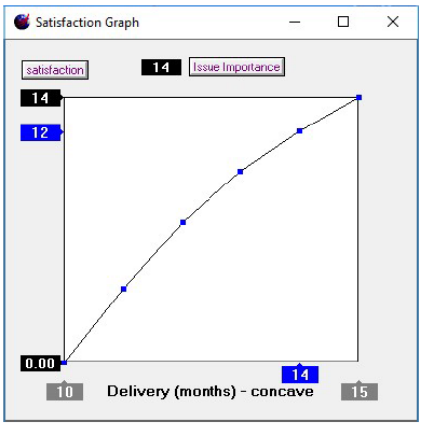
I had one more experience with computers solving people's problems, again with Smartsettle but this time with their multi-issue software called Smartsettle Infinity. They were very kind organising a virtual meeting only with me to teach me how to use the software.

It was not a simulation where I would represent a party and use the system against another person, this time they took a dispute example a showed me the features and how to operate the program. For Smartsettle ONE I said it was easy to use and the interface was looking, well, I can't say the same for Infinity. It is way too complicated and not really intuitive. They, of course, are well aware of that, the

facilitator told me during the tutorial: "*mind Smartsettle Infinity is not very user friendly yet, (…) right now you would need a trained facilitator to help you model a complex problem*".

Image:3 Smartsettle Infinity





The system is powerful and can handle complex disputes but still has a long road ahead. I see multimillion-dollar corporations using this system for commercial disputes, but I see it far away from a regular negotiation and mediation sessions.

After these three experiences with computer-assisted dispute resolution where I hear the opinion of professionals and students, and I could use the most advanced software available, I think I will not see anytime soon that Amazon-Alexa style mediator I mentioned some paragraphs ago, but I believe that systems like these will be supporting every day more settlements. They will not replace mediator; they will support them.

3.2. Interviews

Explained in the Chapter 2, after a negotiation simulation exercise using software as support system, it was not possible to conduct the unstructured interviews in a face-to-face manner, thus a structure written interview (or questionnaire with qualitative answers) was applied to 10 students of a Dispute Resolution Master's programme.

Negotiation simulation

Exercise statement presented to the students:

In each exercise you will impersonate one of the parties in disagreement, you have 100 points to divide among the items/issues in dispute according to what ***you consider is the most important*** to get.

Along with the point allocation, please write down your expectations and what is your best-case scenario and worst-case scenario and send this email back to me.

Exercise 1

Hank and Betty are getting a divorce, but they cannot agree on how to divide their assets. Their lawyers have suggested the use of computer-based dispute resolution tools and reach a final agreement. The goods the couple must divide are the Retirement Account, the house, a holidays apartment, and their investments.

Please indicate how much you value obtaining the different goods, by distributing 100 points across them.

Retirement Account	
Home	
Holiday apartment	
Investments	
Total	**100**

Exercise 2

Phillip and Julia have decided to get a divorce, there are many issues to be resolve during the settlement and each party's attorneys have suggested the use of aid from computer-based conflict resolution tools in order to settle the major issues to be resolved and advance in a final agreement.

The major issues are custody, alimony, and the house.

Alimony: a husband's (or wife's) provision for a spouse after separation or divorce; maintenance

Custody: The couple have one son

House: The property was bought through a mortgage and it is fully paid.

Alimony	
Custody	
House	
Total	**100**

Please indicate how you value or perceive as important the different issues, by distributing 100 points across them.

Exercise 3

Hanna and Marie have been flatmates four years while both studied English language and then College in Ireland. After finishing their studies, Marie decided to move close to the city centre and Hanna wanted to move with her boyfriend. Now they must divide up the items that were purchased while they lived together.

Please indicate how much you value obtaining the different goods, by distributing 100 points across them.

Furniture	
Clothes	
Books	
Kitchen Items	
Total	**100**

Each student impersonated one of the parties in each of the three exercises, the allocation was random. After they submitted their point distribution, the data was loaded into the *Adjusted Winner* algorithm, which made the division of the items based on its algorithm and the information given by the students.

The algorithm representation was as follow:

Exercise 3 (example)

Hanna

Furniture	30
Clothes	20
Books	20
Kitchen Items	30
Total	**100**

Marie/

Furniture	40
Clothes	10
Books	20
Kitchen Items	30
Total	**100**

INITIAL ALLOCATION

Item	**Hanna**	**Marie**
Item 1	0	40
Item 2	20	0
Item 3	20	0
Item 4	30	0

Hanna's initial point total: **70**

Marie's initial point total: **40**

ADJUSTMENTS

1. Initially Hanna's point total is greater, so we must transfer some goods to Marie.
2. Order the goods that Hanna initially receives according to their ratios (x/y where Hanna receives x and Marie receives y) from smallest to largest:
    1. Item 3 with ratio 1
    2. Item 4 with ratio 1
    3. Item 2 with ratio 2
3. To achieve equitability we must transfer part of Item 3 to Marie. Let *p* be the portion of 3 that will be transferred to Marie. We must solve the following equation for *p*

$70 - 20p = 40 + 20p$

This yields $p \approx 0.75$.

CALCULATED POINT ALLOCATION

Item	**Hanna**	**Marie**
Item 1	0	40
Item 2	20	0
Item 3	5	15
Item 4	30	0

Total points assigned to each player: **55**

Distribution suggested by algorithm

-Hanna keeps the clothes and the kitchen items

-Marie keeps the furniture

-The books are divided 75% for Hanna and 25% for Marie

After each student received the results of their negotiation round, they had to answer 4 questions:

Answers to Questions, arrange by Question number

Participant	Answers to Q1 Did the results match your expectations?
1	In some of the examples
2	Not at all
3	In most of cases.
4	Yes it did but it would be fine to know anything about the value of those things.
	1. Exercise 1
	I dont think the results matched my expectations. However, as long as the net value of everything was divided fairly, I'd be happy with the results.

	Hank is keeping the holiday apartment and 70 per cent of the money from the house and this is only fair if the 30 per cent Betty gets from the house together
5	with the retirement account and investments represent the same money compared to what the husband gets.
	Exercise 2
	The results would be ok if Julia got the custody of her son or at least if she could share the custody.
	Exercise 3
	Surprising result.
6	Absolutely, if it were a real case I would be really happy with the agreement.
7	-------

Participant	Answers to Q2 Do you think it was a fair outcome? Why?
1	No, it’s difficult to really know the priority of the people
2	No, I did not expect those results, I was open to negotiating a fair result, but the other party is definitely advantageous.

3	Not in all the cases. On the second exercise, for example, the outcome is out of my expectations in relation to the custody of the child and consequently the alimony payments
4	yes it was because most of the answers are equals.
5	It wasn't fair because kitchen items were very important to Mary and she didnt even get half of them. Hannah got more... kitchen items and clothes all for herself whereas Mary only got the whole of the furniture for herself.
6	Yes it was. In all cases it was equal for both sides.
7	Better than expected in the 3 cases. Specially in the first 2

Participant	Answers to Q3 Would you use a system like this to resolve any disagreement? Why?
1	Not sure
2	I am not sure because I disagreed with the outcomes
3	I don't think so. Even though the system have showed a reasonable outcome for the disputed I still believe that a negotiation in person is more effective, specially if the subject is related to family issues.
4	I think it is a good idea but it shouldn't be the only one.
5	I wouldn't use a system like this to resolve a dispute were kids are involved. I dont think such systems have the sensitivity needed in such cases.
	I would use this kind of system if I wanted a quick solution which all parties agreed to be compliant with regardless of the outcome but not if the dispute was really important.

6	Yes, I believe it could be very helpful because it's an impartial way to divide the items. However, it could be necessary to complement this tool with proffesionals' cooperation due to some cases (f. e. custodies) sometimes are too complicate.
7	Not really, I think it was really beneficial for me but, specially in the second exercise I kept the house, have no kid to take care of and still dont have to pay for nothing. And in the first one, I practically kept everything except the house. The 3rd one was pretty fair I think as furnitures are expensive and I kept basically everything else.

Participant	Answers to Q4 Did the results match your expectations?
1	It is hard to put in a system the whole situation I think
2	Advantages One of the benefits of the system is for people that are busy or nervous about meeting in person, you can take time online to reflect and propose a solution. Disadvantages I would not trust the tool at all, the outcome could be unfair and it means we should restart again until both parties are happy with the results, I guess it might be waste of time and money.

3 the system try to give a reasonable solution and for practical issues I believe that is a good tool, but when it comes to personal / family cases a system cannot consider emotions and more deep characteristics of a human relationships. At least not yet.

4 Ad: fast, equal and objective.

dv: some items are not easy to value like the custody of your child.

5 Advantages

The system offers quick solutions that could represent an alternative to traditional solutions. I would use it for second opinions as it could help boost creativity when finding innovative solutions to disputes

Disadvantages

The system cannot understand the subjectivity of human beings and this could be quite troublesome. I.e. keeping a house could be very important for a mother who wants to give stability to her family.

6 Advantages: it is based on the preferences of both sides, so it makes easier to get a satisfactory agreement.

Disadvantages: it doesn't work with monetary and sentimental values that could be essential sometimes.

7 As it is not a real person people might not take it as a real decider. But it might actually help in certain cases so why not give it a try. Maybe it gives better ideas than the one we can think of. And I guess that the more people use it the program can identify which cases and solutions were effective and use that data base to be more effective.

Answers arrange by positive and negative experience (same answers, different arrangement for better analysis

Question	Positive In most of cases.	Negative Not at all	Undetermined In some of the examples
Q1	Yes it did but it would be fine to know anything about the value of those things. Absolutely, if it were a real case I would be really happy with the agreement Better than expected in the 3 cases. Specially in the first 2	I dont think the results matched my expectations It wasn't fair because kitchen items were very important to Mary and she didnt	

		even get half of them.	
Q2	Yes it was. In all cases it was equal for both sides.	Not in all the cases. On the second exercise, for example, the outcome is out of my expectations in relation to the custody of the child and consequently the alimony payments	
	yes it was because most of the answers are equals.	No, I did not expect those results, I was open to negotiating a fair result, but the other party is definitely advantageous.	
		No, it’s difficult to really know the priority of the people	
		Not really, I think it was really beneficial for me but, specially	I am not sure because I disagreed with the outcomes

		in the second exercise I kept the house,	
Q3	Yes, I believe it could be very helpful because it's an impartial way to divide the items	I wouldn't use a system like this to resolve a dispute were kids are involved.	I think it is a good idea but it shouldn't be the only one.
	I would use this kind of system if I wanted a quick solution which all parties agreed	I don't think so. Even though the system have showed a reasonable outcome for the disputed I still believe that a negotiation in person is more effective, specially if the subject is related to family issues.	
		No, I did not expect those results, I was open to negotiating a fair result, but the other party is	

		definitely advantageous.	
			As it is not a real person people might not take it as a real decider. But it might actually help in certain cases so why not give it a try.
	it is based on the preferences of both sides, so it makes easier to get a satisfactory agreement.	it doesn't work with monetary and sentimental values that could be essential sometimes.	
	The system offers quick solutions that could represent an alternative to traditional solutions fast, equal and objective.	The system cannot understand the subjectivity of human beings and this could be quite troublesome. some items are not easy to value like the custody of your child.	
Q4	the system try to give a reasonable solution	when it comes to personal / family	

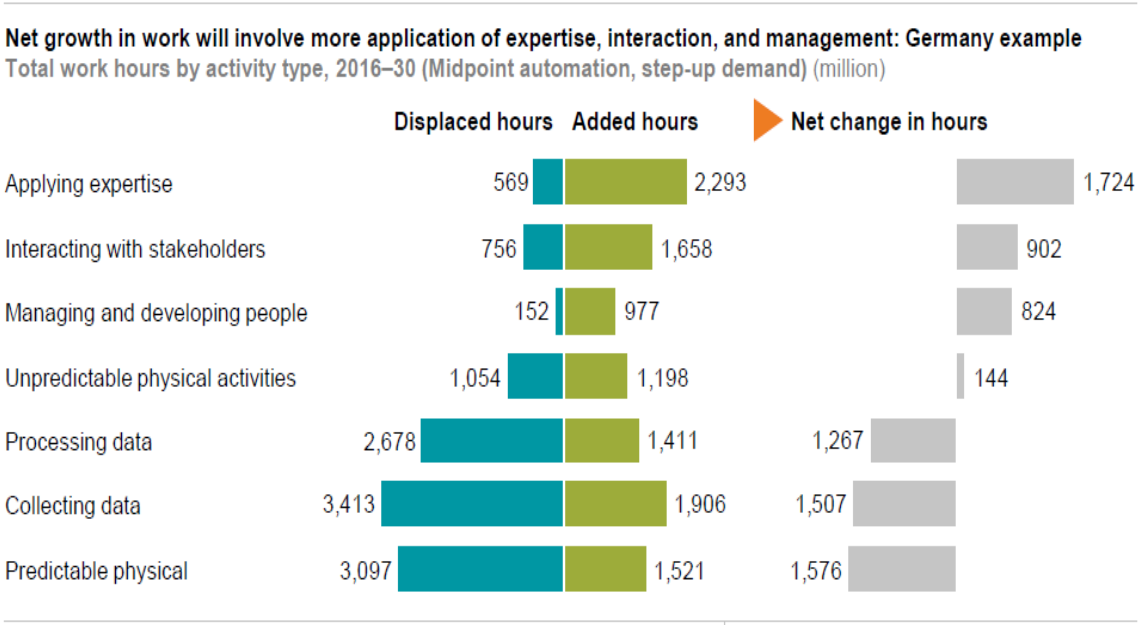
and for practical issues I believe that is a good tool	cases a system cannot consider emotions and more deep characteristics of a human relationships. At least not yet.
One of the benefits of the system is for people that are busy or nervous about meeting in person, you can take time online to reflect and propose a solution.	I would not trust the tool at all, the outcome could be unfair and it means we should restart again

3.3. Secondary Data

1. McKinsey & Company

Data compiled by World Bank and the US Bureau of Labour Statistics and used by McKinsey & Company for analysis and projections. Report projected automation adoption rates analysing more than 2,000 work activities per occupation in 46 countries. Projections through 2030s. (Manyika et al. 2017, p. 137)

1.a. Net growth in work meassure by hour worked



Source: McKinsey & Company (2017) Jobs Lost, Jobs Gained: Workforce Transitions in A Time Of Automation. (Manyika et al. 2017, p. 16)

2. PricewaterhouseCoopers (PwC).

Data compiled by Organisation for Economic Cooperation and Development (OECD) used by PwC for analysis and projections looking over 200,000 jobs in 29 countries (27 from OECD plus Singapore and Russia). (Hawksworth et al. 2018, p. 1)

Data collected: Proportion of jobs (estimated) at risk for automation by 2030s, divided by industry, occupations, gender, ages, and education level.

Estimation based on technical feasibility of automation (actual extent of automation may be less, due to economic, legal, regulatory, and organisational constraints)

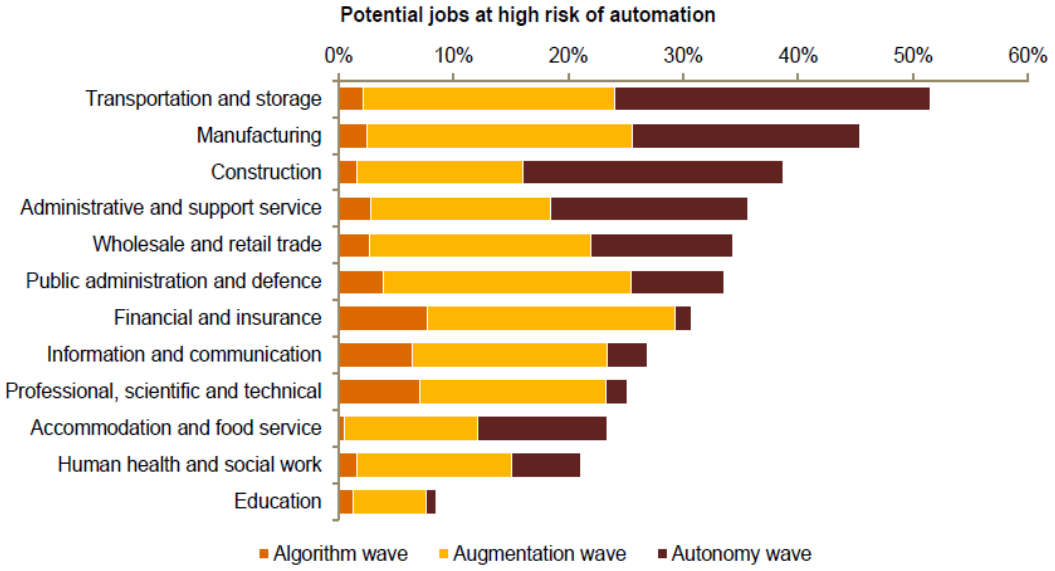
PwC identifies three overlapping phases of automation process: (Hawksworth et al. 2018, p. 1)

1.Algorithm wave: automation of simple computational tasks and analysis of structured data.

2.Augmentation wave: automation of repeatable tasks through technological support, and statistical analysis of unstructured data.

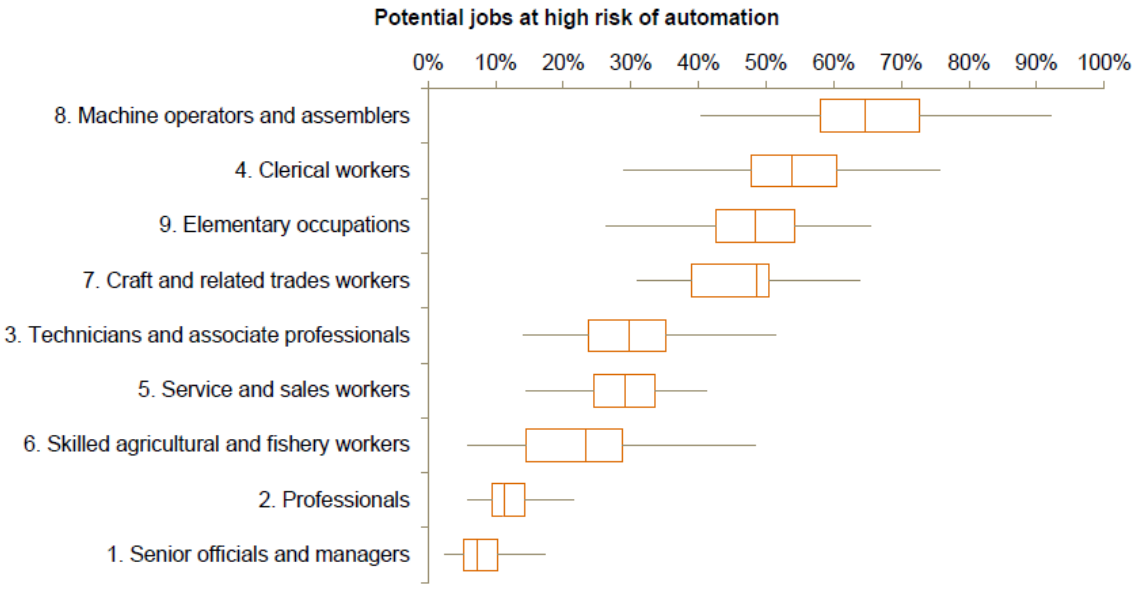
3.Autonomy wave: automation of physical labour and manual dexterity, and problem solving in dynamic real-world situations that require responsive actions.

2.a. Potential jobs at risk of automation



Source: Pwc 2018: Will robots really steal our jobs?: An international analysis of the potential long term impact of automation (Hawksworth 2018, p. 3)

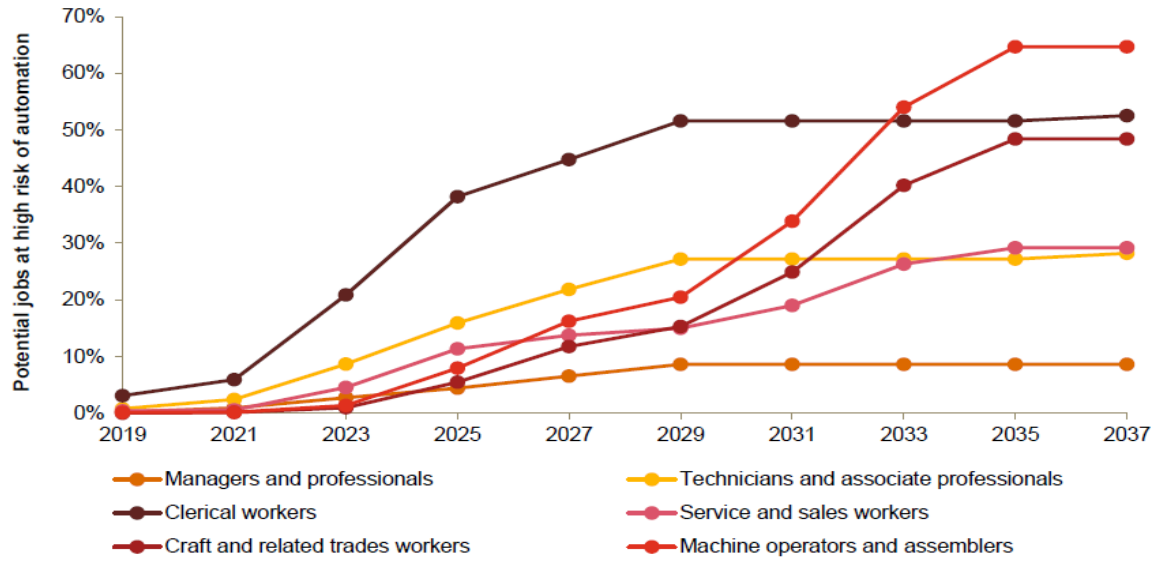
2.b. Potential jobs at high risk of automation



Source: Pwc 2018: Will robots really steal our jobs?: An international analysis of the potential long term impact of automation (Hawksworth 2018, p. 23)

2.c. Potential impact of job automation over time across occupational categories

Figure 5.2 – Potential impact of job automation over time across occupational categories



Source: Pwc 2018: Will robots really steal our jobs?: An international analysis of the potential long term impact of automation (Hawksworth 2018, p. 24)

Chapter 4 - Data Analysis/Findings

After the review of relevant literature, the collection and analysis of data, the project findings are listed below:

1. Development of dispute resolution support systems is a private initiative.

There are only a few of the early projects in support systems still in use. The current software is commercially promoted.

2. Computer-based resolution systems are not autonomous.

The systems analysed in this research, including one of the most important currently available, still need human data input. DSS and NSS use algorithms and variables loaded into their system by a human operator. Machine learning technologies are not currently in used in dispute resolution support systems. Current systems do not learn and adjust themselves autonomously.

Systems like Smartsettle ONE and Infinity, which are among the most advanced currently ready to use, need input and management from trained operators (in Infinity) to produce suggestion in a dispute.

3. User friendly systems only solve the most basic disputes.

Adjust Winner, Smartsettle ONE and other systems based in similar principles, are only capable to support the resolution of simple issues. Adjust Winner is capable of handling multi-issue disputes, but its results were not completely satisfactory during its test in this study.

More advanced systems like Smartsettle Infinity, capable of handling multi-party and complex multi-issues disputes are complicated. A facilitator is necessary along with guided demonstration session.

4. There are issues related to confidence in resolution systems.

Some participants in this study, including post graduate students and professional mediators are sceptical over the use of computer-based systems. Some participants see these systems as a confirmation method for traditional ADR mechanism.

5. The substitution of cognitive jobs by robots is unlikely in the short term.

The substitution rate between robots and professional jobs is close to 10%, increasing steadily slow for the next years until the late 2030s. Cognitive jobs, those requiring interpersonal skill and critical thinking are difficult to automate.

6. Blind bidding is the most advanced AI application currently in used in decision support systems.

Smartsettle (visual blind-bidding) and Cybersettle (double blind-bidding) are the most advanced systems and they based their algorithms in blind bidding variables.

Chapter 5 – Discussion

5.1. AI as a support system

The idea of computers able to learn autonomously and offer real and effective solutions to humans has been in development during the last 40 years. Pioneers gave the first steps in this direction during the late 1980s creating the first automated support systems. Several initiatives were launched I tried during those first years of intelligent systems in the field of dispute resolution. Those first initiatives seemed to have stopped growing. By the late 1990s, must of the programmes were already obsolete. The boom of early 2000 in e-commerce might have brought back the same force that influences the first projects a few years back. However, only a small number of projects dedicated to the development of intelligent e-mediators or e-negotiators survive.

Many reasons could explain why almost half of the 21st century, developments in intelligent systems in dispute resolution have not had the same level than in other fields. Technical difficulties can be the main reason, but issues related to trust and fairness might have the answer.

5.2. Technical difficulties?

Dispute resolution, seen in a broader sense (including law) has benefitted from computing technologies like other fields. Machines help with everyday repetitive tasks, like processing, classifying and analysing data, and allow instant communication and exchange of information. AI has elevated the capacity of computers, making them capable of executing some task better than humans and serving as support in the decision-making process or giving advice in negotiation. However, creativity, critical thinking and interpersonal skills are out of scope for an AI-powered system. The current most advanced AI system available use blind bidding techniques, a quite simple

one, far away from cognitive human abilities. It seems that the development of new technology for the field of dispute resolution has stopped with mechanisms that only allow quick settlements of commercial-monetary transactions. The development of new projects is now a predominant private initiative, where funds are assigned to ideas that generate solutions, in the dispute resolution field the current technology powered by blind bidding or following the same format that the famous eBay resolution system, might be enough commercially speaking.

One of the most advanced algorithmic negotiation system, Smartsettle Infinity, is a powerful but extremely complicated software with an archaic-looking interface, that could be able to resolve complex international trade conflicts, but still need important improvements and it is only well known in academic circles.

Clearly, replicating human cognitive processes is difficult to achieve, but it seems that the current developers in the field might not be even trying.

The first research question this paper aimed to answer: "How algorithms and Computer Technologies are currently used in ADR?" transcended from its initial descriptive focus on simply knowing what computer programs are in use, to a deeper meaning, trying to know how the systems are in use if they are in development or stagnation and what is the function they perform. Unfortunately, that will have to be the topic of another research paper.

5.3. Thinking about trust

It could be easy to conclude that people would be comfortable interacting with intelligent support systems while solving their disputes if a comparison is made on how they use technology nowadays (mobile phones, laptops, smartwatches, personal assistants) however, after the data collection in this

study, it could be concluded that people might be reluctant to use support from a machine during a negotiation. One of the research questions is related to fairness and how an intelligent system would deal (if possible) that concept. But fairness is a value, and its definition will be always different depending on the perspective of an individual. How the people who participated in the data collection section of this study understand fairness, affects how they think a computer system decision was fair.

In that perception of fairness from the people to the machine, there is another intrinsic and underlying notion, trust. In the exercise with the students using the system Adjusted Winner, one of the answers was "*I would not trust the tool at all, the outcome could be unfair*". Here the lack of trust makes the perception of the machine as unfair. Other answers were: "*I don't think such systems have the sensitivity needed in such cases*", and "*I wouldn't use a system like this to resolve a dispute were kids*". They do not believe the system could be fair in handling sensitive cases because they don't trust it.

Similar situation the author of this paper could see during the simulation with Smartsettle. One participant asked why to trust the system, the machine can give more to the other part. Again, the trust conditions the perception of fairness.

So, "how computer-based systems manage issues of justice/fairness in dispute resolution?". Apart from the technical answer about algorithms rewarding interest-based positions, the main point here is it does not matter how the machine deals with a dispute fairer than a human, if there is no trust in the system, the machine will always be unfair.

5.4. Where do we go?

The last two research questions are related to the future of the dispute resolution profession and how practitioners must react.

As discussed already, the most advanced dispute resolution support systems able to process complex multi-party issues, still have to improve. However, there are less complicated systems that are easy to set up and use, like Smartsettle ONE, and other systems which objective is not to resolve a dispute but help with smaller tasks like information retrieval or communication support, like chatbots. As technology is improving and more people have access to it, the dispute resolution practitioner should keep himself updated with new developments not only in his field but
also, in computing sciences, law, customer service (which is constantly presenting solutions to clients that include automated ways to solve claims) and others.

In the marketplace, as seen in the graphs, a disruption of AI and automated technologies in professional jobs or any related with cognitive process, it is not expected during the next 10-20 years. There will not be a robot taking the place of negotiators, mediators and arbitrators in the medium term.

6. Conclusion

This research project was conceived to understand how new technologies like Artificial Intelligence are evolving and impacting the field of dispute resolution and how practitioners should prepare for the future of their professional careers. Previous researches with the same topic focused in technical explanations of the algorithms and technology underlying the performance of intelligent systems, other studied the use of a computer system applied in a particular case, and others referred to the use of the system in courtrooms.

Following a practical focus in the study of the subject, the research centred in understanding first-hand how current computer-based resolution systems work, how the technology has developed since its beginning and how the future would look like.

The project had some limitations regarding access to information, but still, valuable information could be collected and analysed.

The transition of the intelligent systems from the fourth to the third party in a mediation table will have to wait. Systems still need to solve technical, practical, and ethical issues before attempting to resolve conflicts autonomously. The systems must be improved, better capabilities and easier interacting platform with the users.

How machines handle issues of fairness is interconnected with the perception of trust from the users. If users do not trust the system, then the suggested outcome will be considered unfair, and if it is considered unfair, fewer people will trust the systems.

There will not be a robot arbitrator taking final decisions without human intervention in the foreseeable future. The current development in intelligent systems is still far from what was expected during the early days in the 1980s and 1990s, however, the negotiator, mediator and arbitrator should make good use of technological tools that allow them to perform their job faster and efficiently focusing in the wellbeing of their clients.

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Appendices

Appendix 1: Transcript. Discussion after Simulation Smartsettle ONE

Discussion after Simulation Smartsettle ONE

Moderator: you mean, if two parties have multiple issues and you are suggesting they (*unintelligible*) down for an issue to use Smartsettle ONE?

Participant 1: Yeah. If I understand correctly, there is a need of a facilitator in order to help them boil down to one issue.

Moderator: Yeah, I suppose if it is easy for the parties to figure out how to make the negotiation all about one issue, then that's one thing, but if it is not easy for them, well let's employ Smartsettle Infinity, because we like to allow the parties to bring as many issues to the table as they want, and then we just built a range.

Participant 2: But the framing of the issue is something the most difficult thing, I think you mentioned it in module two, framing the problem is a big part f resolving the problem, and in this case, basically they obviously need to be some help from outside, I think in many cases you need an outsider to help both parties framing and agree in a single text…

Moderator: You mean to build this single negotiating framework?

Participant 2: Yeah

Moderator: If you're doing, for example, I was involved in family cases for a long time helping them build their single negotiating framework and they are all different but at the same time they're all the same. So, one you've done enough of them, you would have a template for yourself like "these are the issues you agree and these are the issues you don't and we're gonna negotiate these 10, or we're gonna pull these 10 out of the template and we're gonna negotiate those ones.

So, one you have done enough of them, you'll be able to build templates. Is that make sense?

Participant 2: Yeah, makes sense, but people sometimes need to go to a process in order to agree to go, you know, and the fact that I have the experience and know, I guess I'm asking in general, a process question how do you help parties go through the process. I think all of us wanted to be collaborative in order to score well and, at least in our culture, people play very very tough negotiations. When I talk to some colleagues about, thinking about Smartsettle, they were like, "well, why the other party tell even the robot" you know it's a secret bid, so, what helps me as mediator, get to the point of collaborating there is some work that needs to be done, Maybe the turning point of that mediation, so I left with the question regarding that, regarding how can I help them being in a more collaborative mindset.

Moderator: Yeah, you're right, and these, I think we need to work more on that, I suppose. So, trust is one. You need the people to be able to trust that the Infinity algorithms work, a good way to do that is with the simulations and let the parties play a role, because if they are not transparent in the Infinity with their preferences, they won't get a good solution, so that is pretty (*unintelligible*) process. The have to trust and they do have to also want to come to an agreement. What's the point to enter a negotiation of you don't want an agreement. So, finally you need to have two

collaborative parties that want to come up with an agreement, and you (*unintelligible*) need some trust there.

(Audio disrupted for 1 minute)

Participant 3: Do you have any training (*unintelligible*)

Moderator: Yes, you just need to email me.

(*unintelligible*)

Participant 2: Can I ask another question?

Moderator: Yeah

Participant 2: I have a question regarding the expert neutral. Are in this panel really humans? And how that affect the time and the pace of the negotiation? and in the example that you gave, I think the experts in the module reach a number (*unintelligible*) and the system gave better value to the one who collaborated and again, I think that's a culture based question. In my culture people would say "well, ok if they think is fair and that's fine", why give them extra to the one who collaborated more. I hope I'm clear.

Moderator 2: Everybody will have a different idea, it's really hard to get the whole word is not going to agree in the best way to do something, you know, if you don't like. They must understand

how the expert neutral (*unintelligible*) works, if they don't like that (*unintelligible*). You know, it's optional, (*unintelligible*).

Participant 2: In the example we were given in the module, why not just cut it fair, why give one extra?

Moderator 2: well, you know, that doesn't work.

Participant 2: Why?

Moderator 2: It's because people will tend to hold back if they know it's going to be that way, they'd say: " you know it's no point for me to get to a fair solution, I just going to hold back, it's no different at the end". Right?

Participant 2: Ok, ok, that's very good answer. And regarding the first question, who are those expert neutrals? And how do you…

Moderator 2: If you bring a case to Smartsettle.com (*unintelligible*) we have a panel, there is a variety of people, they don't have expertise in any particular area but they are good people and they are trained in Smartsettle. If you need experts neutral that really have a knowledge in a particular subject area in your dispute, then we might select them specially and engage them, and you might have to pay if you really need that (*unintelligible*)

Participant 2: Ok, thank you.

Moderator 1: So that really depends on who you think (*unintelligible*)

Moderator 1: well if there is not another question (*unintelligible*) you can go and have lunch or dinner

All participants: goodbye

Appendix 2: Transcript of tutorial Smartsettle Infinity.

R: Victor Garcia

E: Smartsettle expert

(First 2 minutes missing)

E: they also agreed to arrange before getting into the negotiation so you can see here that we've got these values over here that represent the left hand side of the range and these values over here representing the right hand side as oriented the screen in such a way that teacher prefers the values on the right hand side. She wants 20 pumpkins she wants to pay just 10 francs for all the pumpkins she wants delivery tomorrow and she wants to return the seeds from zero pumpkins

R: she doesn't want to return any seeds, basically.

E: Yeah

R: OK

E: if she had a choice, she'd rather just throw it in the garbage don't bother with returning all the seeds. Now with smart settlement Infinity we always say that it's more valuable to negotiate as a package rather than issue by issue, we you negotiate a package you got room for even swaps and you've got room to harvest all the value that's on the table.

E: these values here represent a package and then I've got four other packages here so here is an optimistic package that the teachers created and it's 20 pumpkins 40 francks delivery tomorrow and returning the seeds from 5 pumpkins.

R: so, every pacjkage is a combination of propositions in each item

E: yeah, yeah

R: OK

E: every package include a value for each issue there is the optimistic and she's created a unacceptable but here is her unacceptable 1560 franks, never, and returning 12 seeds and so if she gets a package worse than this, she'd said well I'll do something else with my students,, watch a movie or just have a different kind of party.

now the one thing about that is, you see that every package here has a number?

R: yes

E: every issue here also has a number so if you add up all these numbers they add up to 360 and we call these satisfaction points. so we've said teacher which is the most important issue to you and she says well it's number of pumpkins and we say well let's give that a 200, doesn't have to be 200, it can be any scale that you want.

R: ok

E: we've given that 200 satisfaction points and then we've said OK so compared to number of pumpkins how important is the total that you pay, and she says well it's half as important and so we give that a 100, and delivery again is half as important as how much she pays.

R: OK

E: seeds return is not very important for just giving that a ten. And then behind on each of these issues is also a satisfaction graph so if I take a look at the one for the number of pumpkins you can see that it's almost linear her satisfaction drops more steeply here between 20 and 19 she'd really like to have one pumpkin per student and then it drops off more slowly after 16 she can make them go into pairs and if we look at the total paid for all pumpkins you can see there's just one dot on this line. So what this would represent it's that the school has provided her 60 francs for this, that's her budget.

R: Ok

E: She has to pay more at 16 she has to spend her own money. You can see her satisfaction drops much more steeply 60, between 60 and 80. And delivery we've got an option today in the middle so never gives her no satisfaction, today is ok and tomorrow is the best option.

Seeds return you can see here this graph is pretty steep, so if she has to return the seeds from even one pumpkin (*unintelligible*) from all the pumpkins. If she has to tell one person that they have to keep the seeds she may as well just tell the whole class keep the seeds.

We've got one constraint in this scenario. Here is our chart constraint, the seeds have to be less than or equal to the number of pumpkins that she buys. Obviously, you can't return seeds from pumpkins that you don't have.

So, this is just to show you that we have that feature and Infinity can handle very very complex constraints.

R: OK. So the teachers put that in the system? She expresses in a mathematical logic for the constraint.

E: yeah yeah, that's mind Smartsettle Infinity is not very user friendly yet, so you need to understand and you need training how to do constraints and how to model the problem, and down the road of course we have lots of class to make it more user friendly and to create Wizards but right now you would need a train facilitator to help you model a complex problem.

Ok, this is all private to the teacher, the farmer never sees this. The same with these packages here the farmer never sees these, these are all private to the teacher. So we've got our optimistic proposal we've got unacceptable we have a fair solution there, and we got an aspiration package here.

So I'm going to start by proposing the optimistic package and now Smartsettle will reveal the optimistic packages at the same time and the role of the farmers being played by the robot so their both initial proposals are going to appear up here up here at the same time now.

Because farmer was already waiting on the server, you can see that teacher's is identical to the optimistic proposal and farmer's there is 13 pumpkins, 70 francs, never, and 13th.

R: Woah!

E: yeah you can see easily because of the time that we've spent putting our preferences this is no good for us, it’s below unacceptable and it's only worth 76 point and it’s just no way, we don't even need to consider.

Other think that Infinity can do to shortcut this process like teacher and farmer could keep on sending proposals back and forth to each other, but in here we have a feature called suggestions and we can generate a suggestion.

A suggestion is a semi optimal solution that will appear between the last two proposals of the parties, you can see here now that we've got something worth 162 which is still below fair although it's above unacceptable but we're still in session one so we're not going to accept that. With Infinity one we negotiate in sessions at the end of every session will check for any…

R: one question. When the teacher published, the farmer can see. So it’s all the package or just the optimistic? So, I’m the teacher and I want to show the optimist first and if we don’t succeed in the next session I’ll show the aspirational or the system just shows all the packages?

E: Yeah, this packages here in the published pin, the farmer and the teacher both see all of these ones, and these ones are completely private and the farmer won't see those unless we publish them.

R: Ok, ok, good.

E: so I'd say 205 is because this is session one I don't want to accept that one yet so I'm gonna generate another suggestion and see if we can get something better and you can see that every time I generate a suggestion like 2 are appearing and that's because farmer is generating some suggestions as well.

R: OK

E: Now we've got one worth 266, that's even better than our aspiration so let's right click and accept that, say yes to that, and now you can see that…

R: A yellow dot

E: A yellow dot appears which is a secret acceptance marker.

R: What the blue means? The blue dot.

E: The blue dot means that that's my proposal.

R: Ok

E: Now I'm gonna end session one and check to see if there's any overlapping agreement. No mutually accepted packages yet. So now we're in session two and we're going to keep negotiating in session 2.

So let's propose this aspiration package, that again will come up here at package 7 teacher now, there it is, and I want to propose my fair package too, but I don't want farmer to know yet that that's a proposal from me. So what I'm gonna do is I'm gonna do what's called a masquerade and I'm gonna

say publish suggestion here and then instead of looking like a proposal, that package is gonna look like a suggestion.

R: Ok

E: You can see that it came up here as package 9 suggestion, and then I still need to right click and accept that again. I'm gonna accept that one and then logic dictates dictates that I should also accept package 6 and package 3.

R: That's better

E: Yeah, they're better, I'm gonna accept that one. So in a real negotiation this happens sometimes right, where you've accepted this package but you look at this one and you say actually that was worse and I don't want to accept that one and in that case but you have to do is you have to go back and look at your preferences and examine why it's worse and fix your preferences. Because our final algorithm right, which is maximized the minimum gain, that one takes a very close look at preferences and finds all the value that's been left on the table but it can't do that unless you've got accurate preferences. It is very very important to have the preferences accurately modeled.

OK so now we've excepted quite a few I think I should end session two again and check for an agreement. End session 2… look at that, we've got an agreement in package 9, and that was our fair package.

R: Yeah

E: It’s not great but it’s ok, so let's try now to see if we can improve it. I’m gonna go and try an improvement. And look at that package 10 which is a great idea

R: Yeah, even better

E: yeah even better than our aspiration package so, we also have algorithm which is called fairness equalization what that does is it makes sure that the benefits that are on the table are divided fairly between the teacher on the farmer so that means that this package that was so much better for us is also so much better for the farmer.

R: Ok

E: So that's the end of the teacher farmer simulation and then I can show you so if you open your Infinity build and go to the help menu, you can get tutorials here, we've got the user guide tutorials and other documentation. If you go to tutorials the place to start is here at TOO index and you’re your way up through T10 and then we also have examples under other documentation

R: Other documentation, OK.

E: So we have some examples in there and these are really good we've got quite a few examples and they're much more complicated than the negotiation that I just sent you and you can just pick which one interests you.

R: OK great

E: Take a look at that. Now do you want me to do an overview with you of a more complex negotiation?

R: Yeah, yeah, that would be great.

E: Lets' open up, I think, this one.

So, this is a strap case and say a supply agreement case and this is a real case that was given to us by a PriceWaterhouseCoopers so if we open up the suppliers POV here…

R: Woah!

E: yeah you can see there's a lot of issues here and you can see some are in purple and some are in black and only the ones in purple are included in the preferences.

The reason is because of the constraints behind them, these issues are all included in those issues. So, if I show you the constraints, here are the constraints so let's see profit (not sure if I can)

R: so that is correlated? if you solve one of issues for example profit

E: well what's gonna happen is if I make a new package here some of them are going to bounce around, you see how that one moved and these ones moved out of range, because they are obeying the constraints that are behind the scenes, it's saying if this then that has to happen because of the constraints the supplier has, right?

R: Ok

E: so, you can see that when I move these different ones comes around, so if I change the invoicing frequency to 79 days that profit at the top of my screen is going to be affected. it went down to 587. Return on sales was also affected and went down a certain percentage, same if I move that up, then the invoicing another invoicing frequency stayed the same probably some other ones. If I move the order (*unintelligible*) up and return on sales goes down, let's see what happens if I move (*unintelligible*) and if you took a close look at those constraints you would be able to see exactly how those work, the point is, we can put in very complex constraints depending on the client's needs

R: OK

E: So, let's take a look this is a linear graph, dollar graphs are most often linear, there's some good reason like debt and borrowing to change that. See in this graph here, the supplier is pretty happy even up to 9% on sales and starts dropping, the satisfaction starts dropping more steeply at 6% payment terms, basically anything after 100 or anything lower than 121 days is great. Satisfaction drops there. This was modeled on a real case and real data.

This is kind of a cool graph, so the best outcome is 3 the three months for the price index interval and then drops. it's bad lower than that and is bad higher than that.

R: So, the user is always the right side?

E: Yeah, so the buyer's point of view will be flipped. The Smartsettle facilitator can model this, there is many ways in here where you can change these things and manipulate that. You'll learn all that as you go through those tutorials in the help menu.

R: Great.

E: So, what we did in this case is we modelled the prior contract if we can do better than this, right. So this was their prior contract and so we started with an optimistic, like this will be great if we can get here, but we don't think we can actually do this well, this is better than what we would expect to get.

We generally recommend the same process, you know, do your optimistic proposal, generate some suggestions, work through a couple of sessions and see where you go, right. In simulation and demonstrations, we don't usually go very much past three sessions, but you can agree with your counterpart, as however many you want to do.

R: Ok

E: So, we have, let's see. Two suggestions here, 1206 and 995, 1206 is better than the prior contract but lower than the resistance level and lower than the concessions, so, let's generate one more, and you'll notice that it takes Infinity a little bit longer, we have very complicated algorithms running in the background, this case is much more complicated than pumpkins.

R: Yeah, a lot of issues and constraints

E: Yeah, exactly. So here we've got one this is this one's really good, so I'm going to accept this one, and will end session one, of course I don't really expect a solution here with session one because the only the only opportunity is F fired agreed to our proposal or also accepted package 5. So, let's generate another suggestion, oh I probably should've ser my concession first, that's ok

R: So, both parties, for example in this real case, like one of the clients went to the Smartsettle with this problem and said: I have this problem, can you help me out solving this problem?, So, you have to go and teach the counterpart, the counterpart have to accept going to this online negotiation, to the eNegotiation platform and then the have to be taught how to use it, and then they start to interact to each other. How is this process?

E: this is our biggest hurdle is getting both sides to agree to a product that doesn't have, we don't have, we have a very very good academic reputation right now a lot of endorsement in universities and among academics that we are the best in this field but we don't have a lot of actual marketplace testing, we don't have a lot of real cases to back up. Let's see, so, I forgot to propose the concession, let's do that now. It's package 8 there, let's accept the hatch. Let's see, we could send the resistance level out, let's end session 2 and see if anything happens first. No packages were accepted yet. Let's send the resistance package, resistance level, we can generate a few more suggestions. I could let you try to solve it, that would be pretty hard without, unless I gave you the case first and let you take some time and figure out where can be right.

Let's see 1213, looks like "farmer" generated another suggestion here as well, let's accept that one. I'm moving through this pretty fast, and if you are confident In your preferences you can move through quite fast, right, you can negotiate by the numbers, once you're set some packages that show

where you are, so anything better than 1180 is good, then if you have done than very well, you can negotiate by the numbers.

R: you have to study every suggestion, no? every package if you are not feeling confident, with the…

E: Yeah, then you should look at it, right, and you should go through, we have a method called "even swaps", where you go try to find your preferences and that's in the tutorials as well.

R: Ok

E: I think I have accepted quite a few, let's see if we have a deal yet. Oh, we do! And it's package 5 imagine that. So, you know maybe in the buyer's preferences probably package 5 is down here. Let; see, even our baseline, you know, because suggestions are semi-optimal as well, right, they look at the preferences and they come in a (*unintelligible*) between the proposals of the parties.

R: Ok

E: Let' see, so, this is already, 1412 is already quite a lot better than our resistance package, sorry, than the prior contract, so we haven't even tried to find an improvement yet.

Let's see if we can find anything in there.

R: Because it's even better than the concession package, so

E: Yeah, yeah it is, we've done really well here. So here is an improvement.

R: Package 12

E: Yeah, package 12, so, let's take click. Look at that! I think what we've got here profit in the thousands, you have a thousand scale, so, every point here is worth a thousand dollars, so that means that this package is an improvement over the prior contract of about 300.000 dollars and that is for each side, so, really is 600.000 dollars.

You can see that Smartsettle infinity has a lot of power and can add a lot of value to negotiations.

This is real data, we didn't manipulate this at all, we just took the data that was given to us and modelled in here and then said ok algorithms do your job.

You can see it's quite simple for us to just go through here and find 600.000 dollars in what took us 20 minutes, 10 minutes.

R: Yeah, saves time. I was reading an article about the Smartsettle one and the use in court, like last year in February…

E: Yeah, that in the UK?

R: Took like few minutes in comparison with what they were doing, so imagine that.

E: Yeah, huge time savings and better agreements.

We think we are pretty great; we just have to wait for the world to catch up.

R: Hopefully soon. For how long did you develop all the algorithms, years no?

E: Years, yeah. I think we've been working at this for about 20 years.

R: Woah!

E: So, they're very complex and it's a lot of (*unintelligible*) they have to work together, and they have to give the right solution all the time, so, yeah, lots of work.