



Analysis

Artificial Intelligence in Debt Collection

Lisa Phillips and Paul Moggridge



Lisa Phillips
Managing Director
ACS, Advanced
Collection Systems

Biography

Lisa Phillips MCICM, is the Managing Director of Advanced Collection Systems (www.advancedcollection.co.uk). Lisa has been involved in credit management since leaving full time education. She started her career in a debt collection agency (DCA) where she gained experience and deep understanding in all areas of agency debt recovery. After this she worked for Statoil, a global energy company, now named Equinor. The knowledge and understanding of the energy and utilities sector she gained at Equinor enabled her to start Advanced Collection Systems (ACS) – a DCA specialising in UK utilities debt. Over the almost twenty years Lisa has been at the head of ACS she has grown the company into a fully regulated and accredited DCA.

Today ACS provides UK and overseas debt recovery and cash flow services for sole traders, SME's, and multi-national corporations as well as providing specialist debt recovery services to the UK's water, electricity, and gas utility providers.

Lisa is still leading ACS from the front. Lisa has put technology at the heart of ACS's debt collection process. A proprietary collection platform was at the core of the business when it was started and Lisa has constantly sought to ensure that ACS has the latest tools available. To equip it with the tools it will need to provide customers with competitive solutions into the next decade and beyond Lisa with her co-directors have identified the need to integrate big data and artificial intelligence based debt collection solutions into the business. As a result she has partnered ACS with AI development company Insight and the University of Hertfordshire in a KTP (Knowledge Transfer Partnership) awarded by the Department for Business Energy and Industrial Strategy (DfBEIS) to develop an AI based solution for debt collection.



Paul Moggridge
Head of AI
Development
Insight

Paul Moggridge is head of AI development at Insight. Paul gained his Bachelor of Science honours (B.Sc. Hons) first class in Computer Science specialising in Artificial Intelligence from the University of Hertfordshire in 2016.

He subsequently joined the University staff and later took on the role of head of development for AI development company Insight where he provides the technical lead on AI for the development of an Adaptive Virtual Agent for debt collection.

Paul is also completing a Ph.D. in Data Mining.

Keywords Artificial Intelligence (AI), Big Data, Chatbot, Debt collection, Debt recovery, Knowledge Transfer Partnership (KTP), Virtual agent

Paper type Research

Abstract

Artificial Intelligence is making its way into all parts of our business and private lives. The debt collection sector is no exception. Advances in AI technologies mean that it is now possible to build a virtual agent that can take on a real-time customer facing role in debt recovery and autonomously negotiate debt repayment. Armed with the virtual agent a company will be able to reduce its overhead costs, improve collection rates, and provide a 24/7 service. In this article Lisa Phillips, MD



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of ACS, and Paul Moggridge from AI development company Insight provide a framework in which these developments can be understood, describe what is needed from a debt collection virtual agent, present the status of development of such an agent, and enumerate the benefits a virtual agent will bring to a business.

Introduction

Artificial Intelligence and its abbreviation AI are the buzz words of today. Companies use them to explain what they do and to make solutions and products sound smarter and more sophisticated than they are. AI is a broad and complex subject. In the broadest sense AI can be described as building computers and robots to do human tasks which we consider require intelligence such as to build human like machines, to collect data, and to analyse data. The consequence is that AI can be used to describe almost anything. However, the overuse of the terms makes it near impossible for the layman to separate what is a true AI based solution from what is hyperbole.

In the world of debt collection the techniques used to gather and process “big data” to classify debtors and recommend actions regularly use AI and machine learning technologies. These solutions are established and growing. They are back office solutions used by credit management departments and Debt Collection Agencies (DCAs) to enhance productivity or support business growth.

An emerging application of AI in this sector is to build virtual agents for debt collection. Virtual agents are customer facing and are already being deployed in other sectors. The growth in their sophistication is likely to result in solutions more similar to the popular concept of an artificial intelligent system seen in the movies than will the back office AI solutions.

One of the programmes for developing a virtual agent for debt collection is the work funded by the Department for Business, Energy & Industrial Strategy through its Knowledge Transfer Partnerships (KTP)¹ programme and carried out by a partnership of AI development company Insight, the University of Hertfordshire and debt collection agency, ACS². The aim is to build an AI enabled solution to negotiate debt repayments.

The purpose of this paper is to discuss AI in debt collection. It provides an overview of AI and looks at chatbots and their relevance to AI in debt collection. It also describes the work being carried out to build a virtual agent for debt collection, and reviews the benefits of the virtual agent to the debt collection process and business.

What is Artificial Intelligence (AI)

AI is the application and merging of many different sciences. These include mathematics, statistics, machine learning, data mining, programming, philosophy, psychology, control theory, computer engineering, and bio-computation – the list is almost endless.



Artificial intelligence engenders a range of views as to its efficacy and safety:

Steven Hawkins backing both horses commented “(AI) could either be the best or the worst thing for the human race.”

Elon Musk is more partisan and believes “AI is our biggest existential threat.”

Whilst Huw Price, Professor of Philosophy at the University of Cambridge said, “the potential benefits of creating intelligence is huge” and it will “transform every aspect of our lives.”

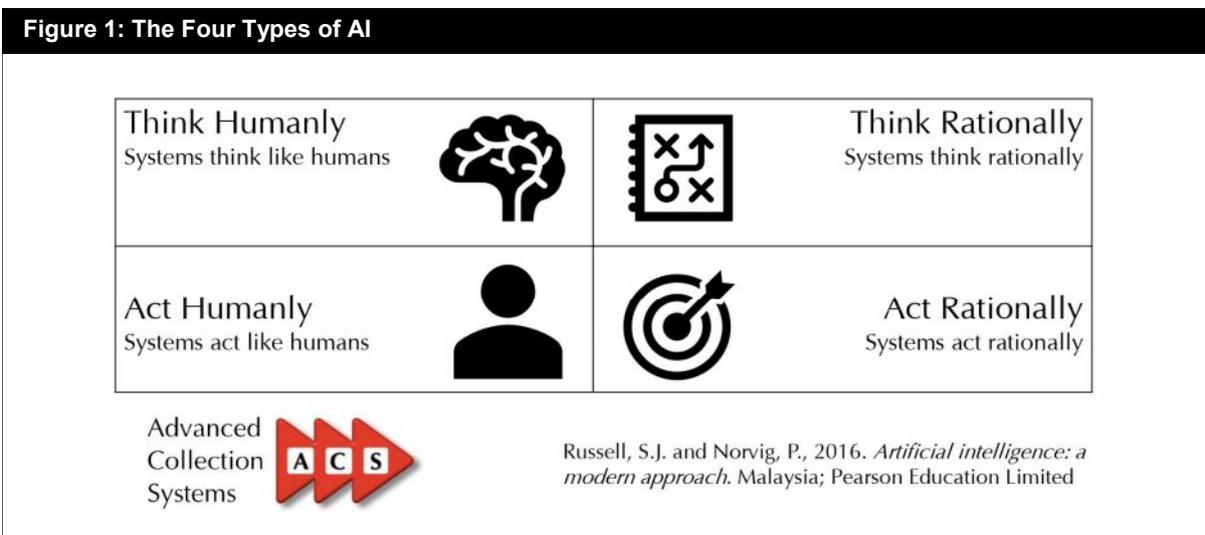
... and Sundai Pichar, Google’s CEO, called it “one of the most important things humanity’s working on. It’s more profound than... electricity or fire.”

Artificial intelligence is jargon heavy and multifaceted but in general all AI solutions can be described as belonging to one of two types General and Specialised.

- General AI:** These are learning systems and all round performers. Systems which fall into this category are synonymous with the AI of popular culture – that is the C3P0, R2-D2, and iRobot AI incarnations. There are few if no true general systems around today.
- Specialised AI:** These are the workhorses of AI. They are designed to perform specific tasks and be very good at those tasks. This type of AI system is commonplace. Some of the applications which use a specialised AI include smart phones, smart homes, and robot vacuum cleaners. Other applications which use AI but its use is not obvious are Duolingo and Netflix.

How to understand AI and its capabilities

Understanding how AI can help us in our jobs means having an appreciation of the types of AI that are available, the nature and benefit of the AI solutions which can be built with these, and how they may be combined to create a powerful tool.



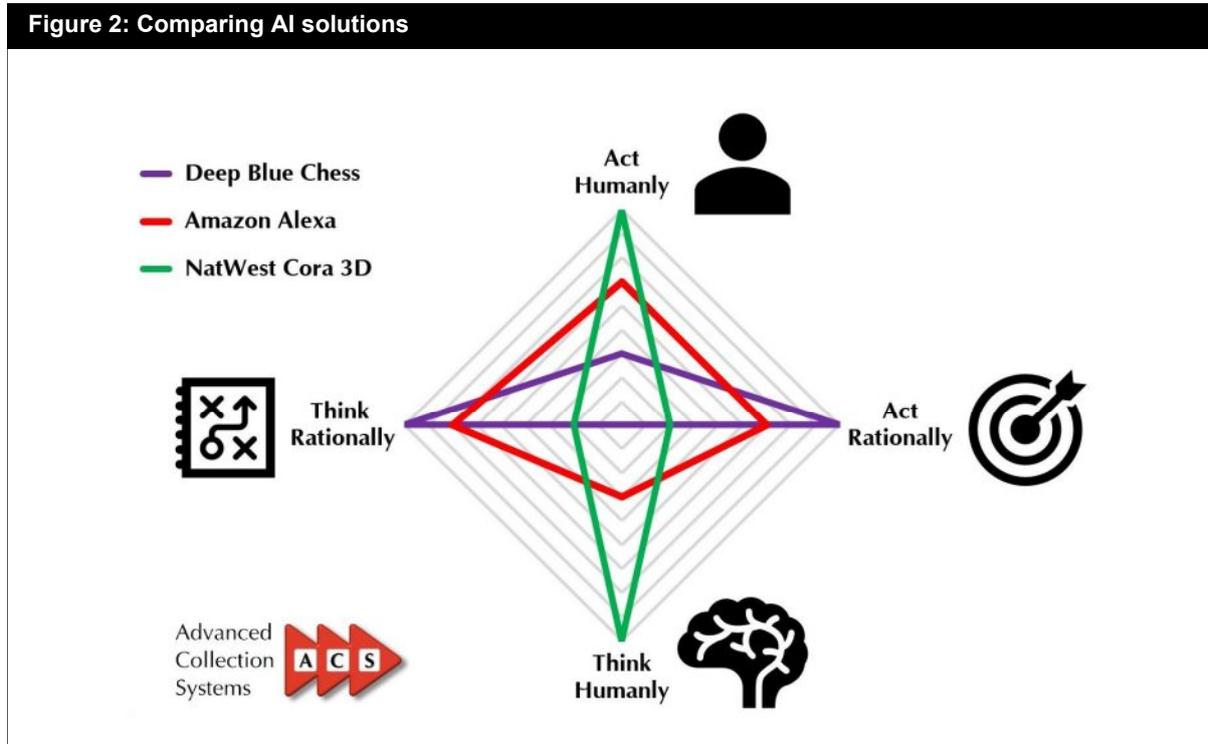


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A practical tool for thinking about AI and explaining its capabilities are the definitions proposed by Russel and Novig in their seminal book *Artificial intelligence a modern approach*³. This has become the de facto encyclopedia of all things AI and one of the most popular books in the field.

Russel and Novig proposed that AI systems could be described by how they were designed to achieve their function. They proposed that solutions which used AI to achieve a function did so by either thinking humanly, acting humanly, thinking rationally, or acting rationally.

Figure 2: Comparing AI solutions



In practice AI based solutions show a combination of these characteristics in their design. This is illustrated by comparing three AI applications Deep Blue, Amazon Alexa and NatWest Cora. Each exhibits a different combination of these characteristics:

- **Deep Blue:** One of the earliest examples of AI was IBM's Deep Blue. Designed to play chess Deep Blue worked by exploring every possible move and always choosing the action with the most possible win scenarios. It was primarily designed to act and think rationally. It did not think in a human way and did not act in a human way. Deep Blue used a brute force approach, and one of its developers even disclaimed that it was artificial intelligence at all.
- **Amazon Alexa:** Amazon Alexa produces an illusion of being a human and acts somewhat humanly. It performs certain tasks well in a human fashion but



behind the scene pre-programmed functions are being called to achieve a lot of the functionality. Amazon Alexa relies primarily on acting rationally and thinking rationally.

- **NatWest Cora⁴**: A solution believed to use AI which thinks like a human and acts like a human is the virtual reality chatbot Cora. Developed by Soul Machines⁵ for UK bank NatWest this system acts very humanly and models the way humans think, simulating aspects of the human brain. The bank has used Cora since 2017. The new Cora prototype draws upon advances in neuroscience, psychology, computing power and artificial intelligence. It is a highly life-like digital human that customers can have a two-way verbal conversation with on a computer screen, tablet or mobile phone.

Chatbots – what are they and why are they important

A chatbot is a computer program which conducts a conversation via text or voice interactions. Typically a user asks a chatbot a question or gives it a command, and the chatbot responds or performs the requested action. In business they are used to deliver customer service or for information acquisition. These are the automated self-service portals we encounter every day.

Chatbots vary in their sophistication. Some use sophisticated natural language processing (NLP) systems. Simple chatbots scan for keywords, then give a reply with the most matching keywords, or the most similar wording pattern.

Virtual agents: When combined with AI chatbots can be made into powerful virtual agents. Virtual agents vary in their sophistication. Some are capable of completing complex tasks and exhibit human like interaction. Cora is an example of sophisticated AI used in a chatbot.

Examples of virtual agent (VA) solutions we encounter every day, with arguably a less sophisticated AI than Cora, are Google Assistant, Siri, Cortana and Alexa. Although many of these “people facing” virtual agent solutions seemingly act in a human way they are like Amazon Alexa in that they give the appearance of being human but think and act rationally.

Conversation via text or voice interactions: In some applications virtual agents which conduct a conversation via text offer greater flexibility for communication than those which rely on speech. Virtual agents which use text can show information, offer selectable options as well as holding a text based conversation with the customer. Hewlett Packard have used this versatility to build its “Virtual Assistant” which will help you select the correct supplies for your printer in much the same way as a human assistant.

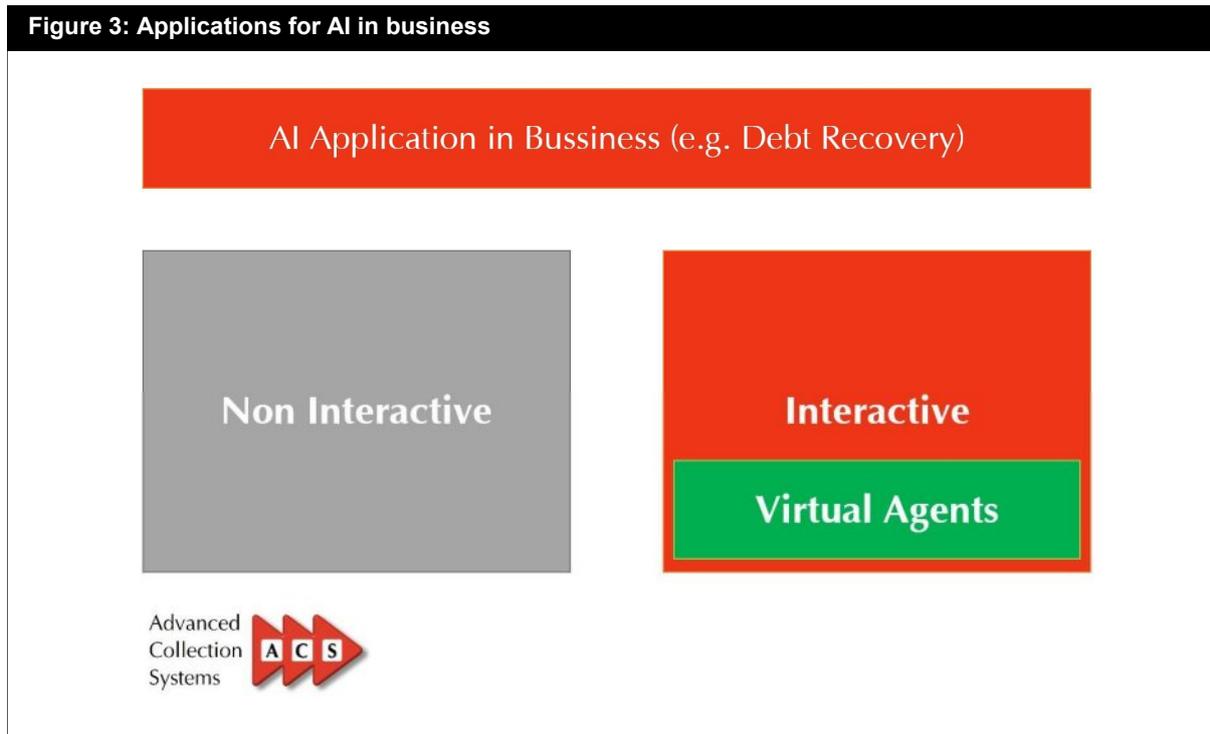
AI and Virtual Agents for debt collection

Non-interactive non-real-time AI applications: AI based solutions are already being used in debt collection. Typically these are back office non-real time solutions used by credit management departments and DCAs to enhance productivity or support business.



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Figure 3: Applications for AI in business



Research by TechEmergence, a business providing market research and competitive intelligence for the business applications of artificial intelligence, suggested that the most disruptive AI applications in debt collection were those used to analyse large amounts of historical records (typically held by the banks and other financial institutions). The AI applications were used for driving messaging campaigns, personalising customer (debtor) service, and debt management. The most significant usage trend discovered by TechEmergence was for the personalisation of customer communications. It found that the personalisation of communications had resulted in some increase in repayment rates.

In its report TechEmergence suggested that because the effectiveness of these AI solutions depended on having access to a large pool of customer histories or a large amount of current data, small to medium sized businesses might not have sufficient scale to successfully deploy an AI solution.

Interactive real-time AI applications: Advances in AI mean that it is now possible to build a virtual agent which is able to interact with a human and autonomously negotiate debt repayment. This is not an impossible dream. Work is already well advanced in this area.

Within the next year the next step forward for AI in debt collection will be a virtual agent with human characteristics which amongst other things can detect vulnerability and negotiate repayment autonomously. This virtual agent will be generation beyond the AI based chatbots found on websites today. It will have human like emotions and characteristics and take a frontline role in collecting and negotiating debt repayments.



The human characteristics needed: Virtual agents for debt collection must be able to act and think like a human agent. This requires a sophisticated AI. The ability to detect lying, detect vulnerability and plan negotiation strategy are complex human traits. To be an excellent negotiator and handle the sensitivities of the debt conversation the AI used by virtual agents needs to have both a fixed rational system and the capacity to use emotions. These virtual agents like their human role models will need to be capable of:

- **Perception:** Good collection agents need the perception to enable them to construct a perceived model of the individual customer, to understand their mind set, and to form a view about their vulnerability and willingness to pay.
- **Adaptability:** Agents need to adapt their tone and style throughout a debt negotiation and when dealing with different customer types and debt.
- **Detecting human emotions:** Agents need to be able to detect human emotions using hidden cues such as word usage or other inputs such as the way someone is speaking or, in the case of a virtual agent conducting a conversation via text, in the way they are typing.
- **Learning and optimising:** Agents need the ability to learn the behaviours and preference of debtors from experience such that they can draw on these experiences and negotiate the best possible outcome.

This means that a virtual agent for debt collection must not only think and act rationally but also think and act humanly.

AI designed for debt collection: To give the virtual agent the human characteristics it needs for debt collection has meant that the development programme has needed to build from the ground up. The result is a highly sophisticated virtual agent solution dedicated to debt collection with the ability to think and act like a human as well as thinking and acting rationally.

The debt collection virtual agent, like its human role model, needs to be capable of detecting lying, detecting vulnerability and planning negotiation strategy. To achieve this, cutting edge research has been carried out by the University of Hertfordshire in disciplines spanning computer science and psychology such as:

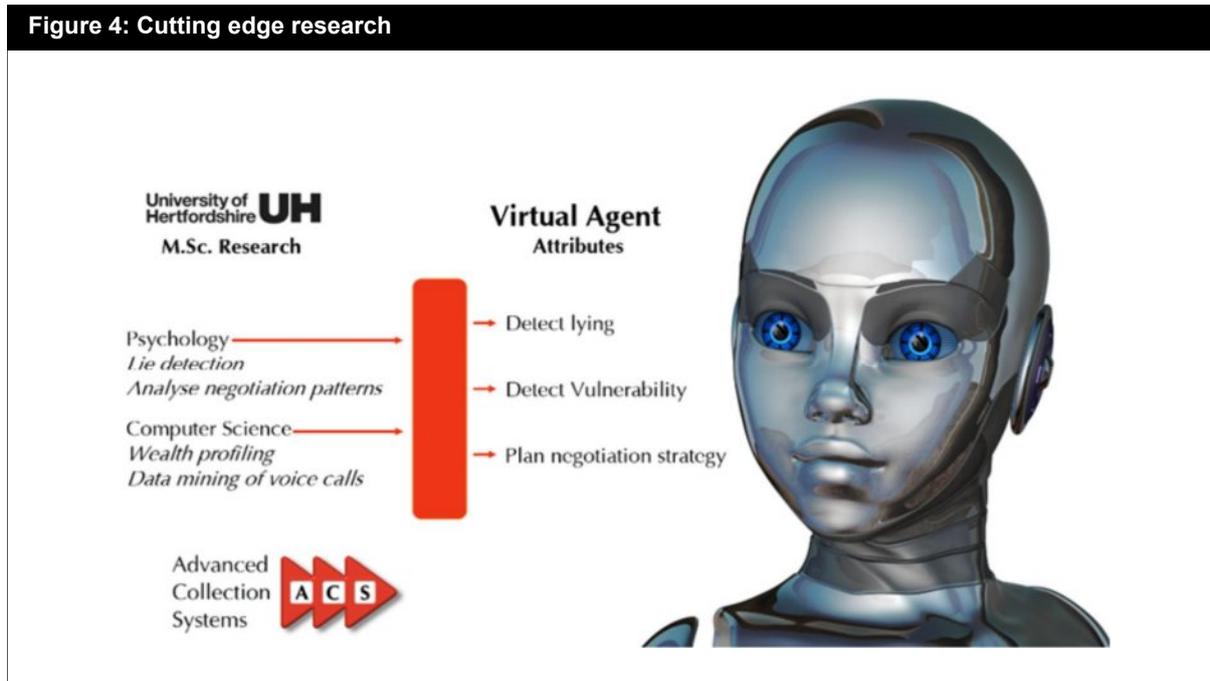
- **Negotiation patterns:** The psychology team at the university has carried out research with ACS to analyse the negotiation patterns of human debt collection agents.
- **Web page lying:** Research by the psychology team into lying during real time data entry on a web page has revealed ways to identify answers and information which could need reconfirming.
- **Wealth indicators:** Methods for using publicly available information to reveal the clues and indicators of the customer's ability to pay have been researched by the computer science team at the university.



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- **Data mining of voice based debt negotiations:** The computer science team at the university has worked with ACS to develop methods to data mine the voice negotiations of debt collection agents and harvest the hidden information.

Figure 4: Cutting edge research



Novel communication: To enable the virtual agent to lead an intelligent conversation with the customer and negotiate repayment has necessitated a rethinking of the way the virtual agent will communicate with the customer.

The text and voice based communications typically used by AI chatbots are not suited to debt collection virtual agents. As a result a forms based communication has needed to be developed by the team. The forms based agent will reduce stress for the customer and offers several advantages over the other types of communications:

- **Flexibility:** The forms based virtual agent offer greater flexibility for communication than speech based virtual agents. The forms based virtual agent can show information, offer selectable options as well as holding a conversation with the customer.
- **Reliability:** Speech based agents suffer from unreliable speech recognition in noisy environments or when the language becomes even slightly complex. They are often time consuming to use as they require you to structure your response to the virtual agent. Sometimes it can take several attempts for the virtual agent to understand the response.



- **Privacy:** Speech based virtual agents do not provide the same level of privacy that a text or forms based agent does. This can lead to a feeling of stress for the customer. Text based agents can be used discretely. There is no spoken conversation which can be overheard by others.
- **Time:** During a negotiation the customer often wants time to think and consider before replying. The timeouts built into voice based agents are a source of unwanted pressure for the customer as they are required to make a response within the timeout or are asked the question again. Text of forms based agents are able to deal with pauses for thought. The customer enters their response when they are ready and able.
- **More acceptable:** People are often unsettled when Avatars and audio/visual simulations closely resembling humans in many respects but not quite convincingly realistic are used. This is known as the uncanny valley hypothesis⁶.

The value and role of Virtual Agents in debt collection

A human agent in all but name: The aim of the work funded by the DfBEIS through its Innovate UK programme is to build an AI enabled solution to negotiate debt repayments. The virtual agent will be a generation beyond the chatbots found on websites today. It will take a frontline role in collecting and negotiating debt repayments.

The debt collection virtual agent is a game changer for the sector. It will benefit the company, the process of debt recovery, and the customer. For instance, managers at all levels within a business will see it either as a strategic business asset or a powerful operational resource.

Company directors: Companies will be able to manage higher debt volumes with existing staffing levels and have more flexibility when planning budgets. For DCAs it will impact the firm's ability to compete in marginal markets, lower the cost of entry to new debt markets, control overhead costs, and offer customers a 24/7 service. Its impact will be felt on:

- **Growth:** Growth will be possible without the need to increase physical headcount.
- **Profit:** The efficiency of debt collected can be improved and profit per agent increased.
- **Business intelligence:** The ability to pre-empt default via better customer insight/intelligence can be increased.
- **Customer care:** The customer journey and care can be enhanced by better profiling and identification of the customer type, appropriate handling and communications, and providing a personalised 24/7 experience.



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Credit Managers: For credit managers managing busy departments, the virtual agent will be a powerful operational resource giving them additional staff resources and control. It will provide:

- **Flexible staff resource:** The virtual agent can be turned on and turned off as needed and with the ability to autonomously negotiate repayments the department's headcount can be matched to the volume of work on a daily basis.
- **Consistent performance:** The quality of the virtual agent's decision-making and negotiation skills remain constant.
- **Skills versatility:** With the ability to select the character and sector and debt experience of the virtual agent the collection team can be supported with specific skills as and when required.
- **Accountability:** Subjectivity is removed from the collection process. Decisions can be explained and rationalised. An audit trail of decisions made, documents presented, and negotiations concluded is an inherent feature of the virtual agent. This will assist in responding to any regulation and compliance complaint received.
- **Affordability:** The virtual agent is envisaged to be a marginal cost for a collection department thus making it economic to collect low value debt. The virtual agent can be turned on and off as required meaning there is no on-going permanent staffing cost to consider.

Recovery rates and debt collection: Anecdotal evidence from the research carried out by TechEmergence suggests that using AI solutions for personalisation of messaging can result in an increase in repayment rates. The real time AI in the form of the virtual agents being developed by the Innovate programme has the potential to deliver even greater benefits for the debt collection process including:

- **Better outcomes:** There is never a time when the virtual agent will suffer from tiredness or be unduly affected by aggressive customers.
- **Personality suited to the customer:** The personality and mood of the virtual agent can be adjusted to match the target customer type. This will aid establishing good communications and rapport and empathy.
- **Detection of vulnerable debtors:** With techniques built in to detect vulnerable customers the virtual agent will know when and when not to compromise.
- **Handle complex debts:** Like a human collector the virtual agent will learn from its experience, and as its learning progresses take on more complex negotiations.



- **Scalability:** The virtual agent offers unlimited scalability. High volumes of debt can be managed simultaneously.
- **Compliance:** The ability to build in an understanding of compliance rules mean that all negotiations managed by the virtual agent will be compliant with current regulations.

Figure 5: Corporate benefits of AI

- Enables growth without increasing headcount
- Improves efficiency of debt collected to increase profit per agent
- Increases ability to pre-empt default via better customer insight/intelligence
- Enhances customer care

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The future has arrived

The Innovate UK programme is a three year funded programme. The programme is two years in and the first prototype of the virtual agent is soon to be available. This will be trialed in early 2019. Once the trial is complete a beta version will be placed by Insight in credit management departments of selected companies.

Reference

- ¹ Innovate KTP, <https://www.gov.uk/government/organisations/innovate-uk>
- ² www.advancedcollection.co.uk
- ³ Russell, S.J. and Norvig, P. (2016), Artificial intelligence: a modern approach, Pearson Education Limited, Malaysia.
- ⁴ <https://www.youtube.com/watch?v=CrN6bQI9IWg>
- ⁵ <https://www.soulmachines.com/news/2018/2/25/press-natwest-begins-testing-ai-driven-digital-human-in-banking-first?rq=cora>
- ⁶ Mori, M., (1970), The uncanny valley, Energy, 7(4), pp.33-35.