Published January, 2018 by IBM Developer Works.Written by Jennifer Sukis and Leah Lawrence.August 2020 update:We are proud to share that The Human-to-Machine Communication Model has been honored with IBM's High Value Patent Award by the IBM Corporate Intellectual Property Team — reserved for those patents deemed most critical for IP income-generating transactions for generating significant Intellectual Property (IP) income.IntroductionSo you want to build a cognitive application, but you want it to be great. You want it to be useful, exciting, and inspiring — in essence, to create a truly cognitive experience. You might be wondering what is a cognitive experience? Should the application I'm designing be cognitive? If it should, can I measure how cognitive it is?Cognition is the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses. Cognition describes how humans process thoughts to communicate with one another. For computers, cognition describes a system that simulates this human thought process by using algorithmic models that are intended to augment human cognitive capabilities. A cognitive computer's goal is to interact with humans in a way that feels natural to us — to augment our own human cognitive capabilities.This, in turn, raises a fundamental question: How does the cognitive system simulate human cognitive processes? The answer is it must activate our human senses (sight, sound, touch, and so on), it must create a motivating experience, and it must inspire our thought processes — all with the goal of enabling us to acquire knowledge and shape our understanding. We call this presence. The most compelling cognitive solutions are ones that create a presence in our lives and through that presence, augment our own cognitive capabilities.When compared with non-cognitive systems, cognitive applications go beyond what we experience today in transactional apps (for example, push a button, get a determined response). They are distinguished by IBM as systems that have the ability to understand, reason, learn, and interact naturally. To accomplish this, cognitive systems analyze massive quantities of data to compose insightful, contextually aware, and continuously improving relationships with users. Their growing knowledge of a user's needs, goals, and values allows them to provide individualized responses, suggest relevant insights, and reveal contextually significant discoveries.To understand, reason, learn, and naturally interact, there are five elements of human thinking and communication that cognitive systems must be able to recognize, understand, analyze, and simulate:PerceptionMotivationReasoningLearningKnowledgeThe Communication Model for Cognitive Systems. IBM Patent Application 15843302.There are different levels of cognitive function depending on the autonomy of the application. A low-level cognitive application needs a lot of assistance from the user or programmer, while a higher-level application behaves more on its own. A brand new application might start out with low cognitive function because a programmer must train knowledge and behavior until the application responds reliably. Over time, it will have more advanced cognitive functions. To get to more advanced functions faster, IBM Watson™ provides a base framework to build upon. Each cognitive capability can also have different levels of functions depending on the amount of programmer or user intervention.One interaction between a user and a cognitive application might not need every one of these capabilities, but the application itself will need every capability to complete a wholly cognitive experience — something that has presence with the user.The human-to-machine communication model ties the components necessary for cognitive systems together into a methodology for creating cognitive experiences. Its purpose is to guide and inspire intentional innovation, and provide a structure for making responsible design decisions based on humankind's needs, values, and expectations.Part 1. Input: Understanding the worldHumankind's impetus to interact with technology — a hammer, microwave, or quantum computer — aligns directly with the technology's ability to improve human lives, to extend our strength or reach. For cognitive computing, the improvement that lures us to interact with it is its ability to process and synthesize vast amounts of data that augments our thinking, allowing us to make better decisions and make new discoveries faster than humanly possible. It's this wholly unique capability that's helping doctors spend less time researching and more time caring for patients, creating targeted lesson plans for every student's unique needs, helping companies serve millions of customers simultaneously, personally and proactively.Knowledge is the summation of everything a cognitive system knows — from the ground-truth data that it's originally trained with to the learnings of every interaction it experiences. Cognitive systems can be trained on any topic if given a model for that domain. They are especially good at reading, identifying, and remembering massive amounts of unstructured information in a way that would be impossible for the human mind to process. They can analyze thousands of pages of content and summarize highlights, or listen to hours of music then compose their own songs, or browse terabytes of images to reveal relationships and patterns across previously unrelated research. They improve their ability to provide us with personalized responses, relevant insights, and new discoveries with every new piece of data they add to their knowledge base.Knowledge is the application's ground truth and ever-growing expertise and skill set:Good — The application has subject-matter expert knowledge that makes the application a skillful tool for problem solving.Better — The application allows a user or programmer to update the knowledge base with trained or live data.Best — The application updates its knowledge base on its own using live sources.Perception and motivationTo respond to input from the outside world, cognitive applications need to understand context — the circumstances surrounding an event, a statement, or an idea — for the system to fully comprehend the meaning of a user's intent at the moment of interaction and provide insightful, timely, natural responses.For instance, recognizing the date, author, quality of information, and validity of sources regarding an incoming article allows a cognitive system to determine what priority to give the new information. Similarly, the state of the world at the moment of interaction also provides important context for understanding a user's needs. If negative press comes out regarding a company's product, the CFO might want to immediately begin analyzing possible repercussions in stock prices. A cognitive system could couple the news alert with significant insights and stock analysis, knowing it's a priority for the CFO.Context comes from any source that affects the system's ability to provide intelligent responses to a user and should be considered from two viewpoints that correspond to human thought processes.Perception"Hey computer, where is Jones?"If a cognitive system knows that the user is at home rather than in his car, it might infer he's likely asking about his dog, Jones, rather than Jones Street. Furthermore, if the system knows that the vet recommended that Jones goes outside every 2 hours because Tom received the instructions in his email, and that following the vet's instructions was important to Tom in the past because he set medication reminders by using the last email from the vet, then it can deduce that it would be valuable to alert Tom when Jones needs to go outside and where he is in the house, rather than waiting for him to ask.Perception is the application's ability to consume, organize, and classify information about the user's physical and digital, and current and historical context. Perceptual data includes things like location, date, time, mood, expression, environment, physiological responses, connected applications, networks, and nearby devices. It uses APIs to stream information about the world, including weather, traffic jams, delays, events, and social media. The more data a cognitive system can collect surrounding perception, both historically and in the moment, the more insightful and natural its response can be.Perception is the application's ability to consume, organize, and classify information about the user's physical and digital context:Good — The application classifies and organizes information according to its pre-training.Better — The application is able to classify and organize new information from live sources and from what it has learned.Best — The application infers information based on other information. For example, if Mary is in the hospital and her doctors have instructed her to drink fluids, a cognitive system can see that she has a glass that she's drinking from and can inform her doctors that she is staying hydrated.MotivationUnderstanding motivation gives cognitive applications knowledge about a user's priorities, goals, and values so it can customize an insightful response that meets the user's expectations for interaction with the system. Data that defines a user's motivation can be sought out through their setup experience, preferences, responses, expressions, and interactions over time. As the user's interaction history grows, so does the system's understanding of the user's needs and behaviors, improving this knowledge with each interaction.Motivation allows the system to understand and prioritize behavioral and personal information about the user that reasoning can then use to create a valuable response. It does this by evaluating the success of past responses when the user was in similar circumstances that defined his needs and values in that moment. For example, a cognitive system can decide not to interrupt a call with a work notification because in the past, the user has dismissed similar notifications when on the phone with his mom. It can choose to alert a user to a news feed he isn't subscribed to because the user has recently been focusing on this new topic at work. Or it could listen in on a meeting and decide to send the team feedback for improving how they run stand-ups along with the meeting minutes, knowing their manager's goal is to improve agile practices.Cognitive systems also must account for why a user is asking a question of that specific system. What would the expectations be for interacting with a system that is built by an athletic clothing brand versus a system that is built by a music-reviews brand? If a user asked each system what to do on a Saturday night, he'd rightfully expect a range of answers based on the values the brand of that system represents. Cognitive systems have goals and values that are defined by their creators that need to be accounted for and expressed in their responses to meet the user's expectations.Think of perception and motivation as the core components for making a user feel understood. The system should reflect ways that it knows the user, remembers past interactions, and anticipates needs without being directed. It should reduce friction and cut the number of steps it takes to complete a task. When done well, a cognitive system should feel like it really knows you and understands your needs.Motivation is the application's ability to understand the user's intent, priorities, goals, and values:Good — The application knows the demographic factors and business focuses of its users and surfaces information accordingly.Better — The application identifies individuals and their specific behaviors. It recognizes user's emotions and responds with the most appropriate emotion.Best — The application proactively interacts with the user, based on how he is likely to respond. For example, an assistant knows who he is assisting and plans ahead of time on how to accommodate their needs.Part 2. Output: Responding naturallyAn application can have intelligent interactions with a user simply by providing the ground-truth information that is stored in its knowledge base. However, by using what it has learned about the context of a user, the cognitive application can go beyond a literal translation and respond with a more valuable, big-picture answer.Reasoning is the application's ability to have cognitive interactions by considering all of the information available through perception, motivation, and knowledge. Even if a solid knowledge base alone produces intelligent responses, it does not feel cognitive if the application does not also serve the individual and consider his context in some way.By applying confidence scores to potential answers based on contextual findings and previous interactions, the system can reason about how to compose a response that is personalized and predictive. A single interaction might not always have all of the capabilities in use at the same time, but a cognitive application can compose its response based on what it's learned to date, then aim to improve that response in the future based on the user's reaction to that response.For a first-time use case, a cognitive application will not have enough information about the user or the context to form a response relevant to them. This is where the application will need to present a default set of information based on assumptions about the user. For example, if John is a new sales manager at IBM browsing for leads, all the application knows is that John is usually a male's name, his role-based goals, and IBM's values as a company. The app will suggest content that is statistically preferred by sales managers and provide direction in a tone of voice that aligns with IBM's values. As John clicks options, the app starts to understand his behaviors and preferences. Perception and motivation capabilities collect the contextual information about John so the application can use reasoning to provide personalized and intelligent interactions.The purpose of reasoning is to intelligently tailor large amounts of information to an individual's needs and situation. An intelligent response can come from the app's knowledge base alone, but to feel like it truly understands the user, it has to consider and apply what it's learned about their context and historic interactions.Reasoning is the application's ability to have intelligent interactions based on contextual and historic knowledge of the user:Good — The application will generate predetermined responses that are specific to the domain or targeted problem space. It does not necessarily use perception or motivation capabilities when forming responses, but relies heavily on pre-trained knowledge.Better — The application generates creative responses, and relies on perception, motivation, and knowledge capabilities when forming responses.Best — The application anticipates the user's need, responding to him directly, and making recommendations that benefit his specific needs and context beyond anything they stated explicitly.LearningWith every interaction, cognitive applications update their knowledge about a user, new data, and the world based on the user's response. Maybe the user immediately clicked the link the system suggested, or perhaps they dismissed it without reading the content. Learning, the application's ability to improve interaction over time, updates a matrix of information about the user, the context, and the app's expertise and skill set. Cognitive systems are constantly updating the way that they interact with people based on their findings from individual and collective historic experience. They remember past interactions and adjust responses based on those learnings by making adjustments to the confidence scoring of content in the matrix.Consider a cognitive system that's intended to behave as an educational companion with a child as they progress from elementary to high school. The system would recognize when the child's interaction capabilities improved as they started making faster decisions or absorbing more complex content. The system could adapt to respond to the child's evolving needs by changing its tone, providing more challenging queries and drawing on its knowledge base of childhood development needs to provide customized exercises that support the child's learning goals.Through constant interaction and user feedback, a cognitive application learns to train itself for a specific user, increasing the system's accuracy and value.The improvement of cognitive systems by learning over time is similar to how humans develop. When first started, the system is learning and absorbing large amounts of new information, but it's not knowledgeable enough to be personalized, insightful, or predictive. Over time, with more interactions and feedback, the system improves and becomes increasingly intelligent and skilled at perceiving and predicting what users need and value. As it ages, it continues to become progressively more sophisticated and knowledgeable.Learning is the application's ability to interpret user responses and apply that knowledge to improving interactions over time:Good — The application allows the user to train pre-packaged information in the interface or code. It does not necessarily train the perception or motivation capabilities, and its purpose is to create more trained knowledge.Better — The application learns through user interaction and behavior and explicit feedback. It trains perception and motivation capabilities.Best — The application updates or trains its own information, without user intervention.ConclusionFor those of us designing cognitive human-to-machine experiences, it's easy to be overwhelmed by the speed and volume of incoming developments — quantum computing, algorithms for nonverbal communication, anthropomorphic embodiments; not to mention the avalanche of speculation around possibilities and implications, both good and bad.Technology revolutions like the one we're experiencing today can dazzle and blind us when we begin looking for opportunities to apply them. The more buzz and hype, the greater the pressure to rush into creating something using whatever new features have caught our imagination. The benefit of moments like these comes in failing fast, the discovery of realizing what we don't know, and rediscovering what will continue to hold true for years to come.With the dawn of AI, we need a best-practices guide for what a cognitive relationship with machines — ones that can hold a conversation, interpret our emotions, predict our needs, and draw from the entirety of human knowledge — could and should look like. When we find ourselves in such unfamiliar territory, the best way to begin is by reminding ourselves of the purpose for any technology innovation: to improve the quality of human life.It is the key to taking a first step in the right direction — asking not what could it do but what it should do. With AI, we have decades of data and research into human thought processes and communication to use as a blueprint. To simulate human relationships, we begin by observing and better understanding ourselves.We initiated our research by looking forward — imagining what we wished human-to-machine relationships looked like. We spent time with robots, observing the thoughts, feelings, and expectations they evoked. We realized that the more human-like the computer's embodiment the more it's expected to respond like a real human. Anything less is a disappointment.Simultaneously, we began this work by looking back, pulling research publications from past decades to rediscover what science could confidently state about the nature of human cognition. What we found were core elements of thought processes and communication that computers would need to simulate to develop a cognitive relationship with humans. We evolved elements into the components of the human-to-machine communication model with the purpose of defining a process that can be used to strategically design and measure cognitive interactions rooted in known truths about human needs and values to contribute to global efforts of improving the quality of human life as we enter a new era of technology, relationships, and possibilities.Download PDF of this content from IBM Developer Works.Jennifer Sukis is a Watson AI Practices Design Principal at IBM based in Austin, TX. The above article is personal and does not necessarily represent IBM's positions, strategies or opinions. In our comprehensive guide on Human to Machine Communication, we delve into the fascinating world where technology and human interaction converge. This guide offers a rich array of communication examples, showcasing how we communicate with devices in our everyday lives. From voice-activated assistants to gesture-controlled systems, we explore various forms of digital dialogue, providing insightful examples and practical tips. Embrace the future of communication as we unravel the complexities and ease of human-machine interactions. What is Human-Machine Communication? – Definition Human-Machine Communication (HMC) is the interaction between people and technology. It involves using various devices, from simple tools to complex computer systems, that understand and respond to human input. This type of communication can be as straightforward as pressing a button on a remote to as advanced as giving voice commands to an AI assistant. The essence of HMC lies in the effective exchange of information, ensuring that machines interpret and act on human instructions accurately. It's a rapidly evolving field, incorporating elements of technical communication, digital communication, and communication technology. What is the Best Example of Human to Machine Communication? The quintessential example of Human to Machine Communication is the use of voice-activated virtual assistants, such as Amazon's Alexa or Google Assistant. These assistants embody advanced HMC through their ability to understand and process human speech. When a user gives a command, like "Alexa, what's the weather today?" or "Hey Google, play some music," the assistant recognizes the voice, deciphers the words, and performs the task or provides the requested information. This interaction showcases verbal communication examples, where technology comprehends and responds to human speech, making it an excellent illustration of practical and sophisticated HMC. These assistants are not just standalone examples but part of a larger ecosystem of integrated marketing communications and smart technology, representing the future of interpersonal communication examples in the digital age. 50 Human to Machine Communication Examples In this section, we present 50 examples of Human to Machine Communication (HMC), each accompanied by a brief explanation and sample communication sentences. These examples span a wide range of applications, from everyday gadgets to sophisticated systems, illustrating the versatility and advancement of HMC in our daily lives. By exploring these diverse scenarios, we gain insights into the ever-evolving landscape of digital communication, verbal communication examples, and communication technology examples, enhancing our understanding of how we interact with machines in various settings. Turning on a smart light via a smartphone app: Use an app to control the lighting in your home. "Turn on the living room lights." 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"Check my heart rate." A simple command for wearable health monitors, showcasing seamless health tracking. "Show the latest stock market updates." Direct your smart display to provide real-time financial information. "Record the TV show tonight at 9 PM." Schedule your smart TV to record your favorite program effortlessly. "Find the closest electric vehicle charging station." Efficiently navigate to nearby facilities using your car's smart navigation system. Human to Machine Speech Communication Examples Explore the dynamic realm of Human to Machine Speech Communication with these examples. They highlight the natural and intuitive way we can interact with machines using our voice. These examples are perfect illustrations of verbal communication examples and digital communication in the context of modern technology. "Play the latest album by Coldplay." Command your smart speaker to play music, showcasing the ease of voice-controlled entertainment. "Translate 'Thank you' into Japanese." Utilize a translation device or app for instant language translation. "How long will it take to drive to downtown?" Ask your GPS for real-time traffic updates and route information. "Add carrots and milk to my shopping list." Update your digital shopping list with voice commands for convenience. "What's my schedule for tomorrow?" Inquire about your daily agenda from a virtual assistant for efficient planning. Human to Machine Verbal Communication Examples Human to Machine Verbal Communication is pivotal in today's tech-driven world. These examples showcase how spoken words can effectively control and interact with various devices, emphasizing the importance of communication technology examples and effective communication in a digital setting. "Switch to night mode." A command to your smart home system to adjust lighting and temperature for the evening. "Start the dishwasher." Instruct your smart home appliance to begin its cycle with a simple verbal command. "Read my new emails." Ask your digital assistant to verbally go through your latest emails. "Order a pizza from my favorite restaurant." Use a voice-activated system to place an order, demonstrating convenient verbal commands. "Give me directions to the nearest coffee shop." Utilize your car's voice command system for navigation, making driving more convenient and safe. The Role of Human-Machine Communication The role of Human-Machine Communication (HMC) is pivotal in the modern technological landscape. It serves as a bridge between human intuition and machine efficiency, enhancing our ability to interact with and control technology. HMC plays a crucial role in various sectors, including healthcare, where it allows for remote monitoring of patients, and in the automotive industry, where voice commands and autonomous driving are becoming more prevalent. In the realm of home automation, HMC facilitates convenient and personalized control over home environments. Its significance extends to effective communication in workplaces and communication in education, where interactive software and AI assistants are becoming indispensable tools. Overall, HMC is integral to making technology more accessible, intuitive, and user-friendly, thereby improving productivity and quality of life. Challenges By Human-Machine Communication While Human-Machine Communication has made significant strides, it also presents various challenges. One of the primary issues is the accuracy and reliability of machine interpretation of human input. Misunderstandings or errors in voice or gesture recognition can lead to frustrations or even hazardous situations, especially in critical applications like healthcare or transportation. Additionally, the privacy and security concerns surrounding the data collected through HMC devices like virtual assistants and wearable tech are significant. There's also the challenge of designing interfaces that are intuitive and accessible to people of all ages and abilities, ensuring inclusive technology use. Addressing these challenges involves ongoing research and development in areas like natural language processing, communication technology examples, and digital communication security. What is a Type of Machine to Human Communication Machine to Human Communication (M2HC) is the process where machines convey information to humans. This communication type is integral in environments where machines provide feedback, alerts, or data for human interpretation. One common form is notifications on smartphones or computers, where the machine informs the user of updates or reminders. In industrial settings, machines communicate through control panels and alerts to inform operators of system statuses or safety warnings. In healthcare, wearable devices communicate vital health data to users and medical professionals. M2HC also includes the feedback received from AI in digital communication platforms, where algorithms suggest actions or provide analytics. This communication type is essential for effective human-machine collaboration, ensuring that humans can make informed decisions based on machine-provided data. In conclusion, our guide on Human to Machine Communication provides a thorough understanding of how we interact with technology in our daily lives. From practical examples to addressing challenges and exploring machine-to-human communication types, this guide offers valuable insights and tips for navigating this dynamic field. Embrace these advancements for a more efficient and connected future. In our comprehensive guide on Human to Machine Communication, we delve into the fascinating world where technology and human interaction converge. This guide offers a rich array of communication examples, showcasing how we communicate with devices in our everyday lives. 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Gesture-controlled smart TVs: Navigate channels or apps with hand movements. "Swipe right to browse Netflix." Smart oven voice control: Adjust cooking settings by speaking. "Set oven to 350 degrees for 30 minutes." Automated pet feeders: Schedule feeding times for pets. "Feed the cat at 8 AM and 6 PM." AI personal finance advisors: Get financial advice and analysis. "Analyze my spending for the past month." Smart mirrors for fashion advice: Receive outfit suggestions and grooming tips. "Show me casual outfit options." Automated garden irrigation systems: Water plants based on environmental data. "Water the garden every morning at 7 AM." Voice-controlled music streaming: Ask to play songs or playlists. "Play my 'Morning Chill' playlist." Programming smart alarm clocks: Set alarms via a phone app. "Set an alarm for weekdays at 6:30 AM." Digital art with stylus input: Create art on digital platforms. "Draw a sunset scene with watercolors." Voice command for smart home blinds: Open or close blinds with voice. "Close the blinds in the bedroom." Fitness band sleep tracking: Monitor and analyze sleep patterns. "Show my sleep quality report." AI shopping assistants online: Get recommendations for online shopping. "Suggest gift ideas for a 10-year-old." Telehealth remote patient consultations: Conduct medical appointments virtually. "Schedule a video consultation for Tuesday. Human to Machine Communication Sentences Examples Discover the simplicity and innovation in Human to Machine Communication through these sentence examples. Each example demonstrates how concise and clear communication can effectively command and interact with various technologies. From smart home devices to advanced software, these sentences embody the essence of practical communication examples in the digital era. "Set the alarm for 7:30 AM tomorrow." Use this command to program your smart alarm clock. It shows the ease of scheduling with technology. "Check my heart rate." A simple command for wearable health monitors, showcasing seamless health tracking. "Show the latest stock market updates." Direct your smart display to provide real-time financial information. "Record the TV show tonight at 9 PM." Schedule your smart TV to record your favorite program effortlessly. "Find the closest electric vehicle charging station." Efficiently navigate to nearby facilities using your car's smart navigation system. Human to Machine Speech Communication Examples Explore the dynamic realm of Human to Machine Speech Communication with these examples. They highlight the natural and intuitive way we can interact with machines using our voice. These examples are perfect illustrations of verbal communication examples and digital communication in the context of modern technology. "Play the latest album by Coldplay." Command your smart speaker to play music, showcasing the ease of voice-controlled entertainment. "Translate 'Thank you' into Japanese." Utilize a translation device or app for instant language translation. "How long will it take to drive to downtown?" Ask your GPS for real-time traffic updates and route information. "Add carrots and milk to my shopping list." Update your digital shopping list with voice commands for convenience. "What's my schedule for tomorrow?" Inquire about your daily agenda from a virtual assistant for efficient planning. Human to Machine Verbal Communication Examples Human to Machine Verbal Communication is pivotal in today's tech-driven world. These examples showcase how spoken words can effectively control and interact with various devices, emphasizing the importance of communication technology examples and effective communication in a digital setting. "Switch to night mode." A command to your smart home system to adjust lighting and temperature for the evening. "Start the dishwasher." Instruct your smart home appliance to begin its cycle with a simple verbal command. "Read my new emails." Ask your digital assistant to verbally go through your latest emails. "Order a pizza from my favorite restaurant." Use a voice-activated system to place an order, demonstrating convenient verbal commands. "Give me directions to the nearest coffee shop." Utilize your car's voice command system for navigation, making driving more convenient and safe. The Role of Human-Machine Communication The role of Human-Machine Communication (HMC) is pivotal in the modern technological landscape. It serves as a bridge between human intuition and machine efficiency, enhancing our ability to interact with and control technology. HMC plays a crucial role in various sectors, including healthcare, where it allows for remote monitoring of patients, and in the automotive industry, where voice commands and autonomous driving are becoming more prevalent. In the realm of home automation, HMC facilitates convenient and personalized control over home environments. Its significance extends to effective communication in workplaces and communication in education, where interactive software and AI assistants are becoming indispensable tools. Overall, HMC is integral to making technology more accessible, intuitive, and user-friendly, thereby improving productivity and quality of life. Challenges By Human-Machine Communication While Human-Machine Communication has made significant strides, it also presents various challenges. One of the primary issues is the accuracy and reliability of machine interpretation of human input. Misunderstandings or errors in voice or gesture recognition can lead to frustrations or even hazardous situations, especially in critical applications like healthcare or transportation. Additionally, the privacy and security concerns surrounding the data collected through HMC devices like virtual assistants and wearable tech are significant. There's also the challenge of designing interfaces that are intuitive and accessible to people of all ages and abilities, ensuring inclusive technology use. Addressing these challenges involves ongoing research and development in areas like natural language processing, communication technology examples, and digital communication security. What is a Type of Machine to Human Communication Machine to Human Communication (M2HC) is the process where machines convey information to humans. This communication type is integral in environments where machines provide feedback, alerts, or data for human interpretation. One common form is notifications on smartphones or computers, where the machine informs the user of updates or reminders. In industrial settings, machines communicate through control panels and alerts to inform operators of system statuses or safety warnings. In healthcare, wearable devices communicate vital health data to users and medical professionals. M2HC also includes the feedback received from AI in digital communication platforms, where algorithms suggest actions or provide analytics. This communication type is essential for effective human-machine collaboration, ensuring that humans can make informed decisions based on machine-provided data. In conclusion, our guide on Human to Machine Communication provides a thorough understanding of how we interact with technology in our daily lives. From practical examples to addressing challenges and exploring machine-to-human communication types, this guide offers valuable insights and tips for navigating this dynamic field. Embrace these advancements for a more efficient and connected future. Technologies and computer systems are assuming important tasks in everyday life and industry – visibly or behind the scenes. Sensors and interfaces allow them to be operated. But how do users and computers communicate with and respond to each other? Machines can be controlled by touch, voice, gestures or virtual reality (VR) glasses. Different cultures prefer different manners: While formal information is expected in Japan, friendliness is particularly important to users in the US. In Germany, a chatbot may sometimes answer curtly. Chatbots and digital assistants Personal organizer, reserving tickets for events and shopping online: Users see advantages in chatbots in a variety of services. In addition to making daily life easier in general, users are also hoping for less wait when calling hotlines thanks to the growing use of voice assistants. Do you want to drive innovation in Human Machine Interaction? Then have a look at our job profiles. Gesture control has a number of advantages over touch screens: Users don't have to touch the device, for example, and can thus issue commands from a distance. Gesture control is an alternative to voice control, not least in the public sphere. After all, speaking with your smart wearable on the subway might be unpleasant for some and provoke unwanted attention. Gesture control also opens up the third dimension, away from two-dimensional user interfaces. Google and Infineon have developed a new type of gesture control by the name of "Soli". They use radar technology for this: Infineon's radar chip can receive waves reflected from the user's finger. That means if someone moves their hand, it's registered by the chip. Google algorithms then process these signals. That even works in the dark, remotely or with dirty fingers. The same uniform hand movements apply to all Soli devices. The Soli chip can be used in all possible devices, such as loudspeakers or smart watches. "Mature algorithms that trace patterns of movement and touch, as well as tiny, highly integrated radar chips, can enable a large range of applications," says Andreas Urschitz. This technology could dispense with the need for all buttons and switches in the future. Opportunities and challenges Even complex systems will become easier to use thanks to modern human-machine interaction. To enable that, machines will adapt more and more to human habits and needs. Virtual reality, augmented reality and mixed reality will also allow them to be controlled remotely. As a result, humans expand their realm of experience and field of action. Machines will also keep on getting better at interpreting signals in future – and that's also necessary: The fully autonomous car must respond correctly to hand signals from a police officer at an intersection. Robots used in care must likewise be able to "assess" the needs of people who are unable to express these themselves. The more complex the contribution made by machines is, the more important it is to have efficient communication between them and users. Does the technology also understand the command as it was meant? If not, there's the risk of misunderstandings – and the system won't work as it should. The upshot: A machine produces parts that don't fit, for example, or the connected car strays off the road. People, with their abilities and limitations, must always be taken into account in the development of interfaces and sensors. Operating a machine must not be overly complex or require too much familiarization. Smooth communication between human and machine also needs the shortest possible response time between command and action, otherwise users won't perceive the interaction as being natural. One potential risk arises from the fact that machines are highly dependent on sensors to be controlled or respond automatically. If hackers have access to the data, they obtain details of the user's actions and interests. Some critics also fear that even learning machines might act autonomously and subjugate people. One question that has also not been clarified so far is who is liable for accidents caused by errors in human-machine interaction, and who is responsible for them. Human-machine interaction is far from reaching the end of the line with voice and gesture control and virtual, augmented and mixed reality. In future, more and more data from different sensors will be combined to capture and control complex processes as well (sensor fusion). At the same time, there will be fewer of the input devices that are customary at present, such as remote controllers, computer keyboards or ON/OFF switches. If computer systems, devices and machines keep on learning and obtain access to more data, they will also become more and more like humans: They can then take over the tasks of sensory organs. A camera will allow them to see, a microphone will let them hear, and clothing fitted with sensors will convey touch. Infineon is working to replicate the human senses increasingly better with the aid of sensors, as Andreas Urschitz explains: "A gas sensor will be able to 'smell', a sensor can interpret air pressure, a 3D camera enhances the 'eyesight' of a device." Machines will analyze what is going on around them with the aid of sensors. The result is completely new forms of interaction. Urschitz names one example: The mobile phone with a gas sensor "smells" a burger being grilled nearby. The digital assistant then recommends taking a look at the menu because a certain burger is currently on offer. At the same time, devices can also interpret and respond to the user's body language thanks to perception-oriented sensors. Machines will become smarter and smarter thanks to artificial intelligence. In machine learning, computers deduce findings from data on their own. That's already possible today, as evidenced by digital assistants like Amazon's Alexa. Yet if the technology is able to process more and more data in a shorter time, the ability of machines to "think" on their own increases. What types of human-machine interaction are there? Switches, levers, steering wheels and buttons were the main elements used to control machines before the advent of information technology. A new means of operation was added with the invention of the keyboard: Text input in command lines gave an instruction to the system. The mouse permitted a means of graphic control for the first time. It made it possible to click on certain fields on a screen and thus activate them. We are now in the age of the touch screen: People use their fingers to perform actions directly on the device. Multi-touch input is a first step toward gesture control. You spread two fingers to enlarge something on a display. In wearables, body sensors automatically collect data, analyze it and supply information to the user. At the same time, voice control continues to evolve. Digital assistants such as Amazon Alexa, Microsoft Cortana or Google Home carry out commands when the user issues them. More intuitive means of operation are available with gesture control: You simply make a gesture in the air in order to switch on the TV. Araujo, T.

(2018). Living up to the chatbot hype: The influence of anthropomorphic design cues and communicative agency framing on conversational agent and company perceptions. Computers in Human Behavior, 85, 183–189. � Google Scholar Banks, J., & Bowman, N. D. (2016). Avatars are (sometimes) people too: Linguistic indicators of parasocial and social ties in player-avatar relationships. New Media & Society, 18(7), 1257–1276. � Google Scholar Brandtzaeg, P. B., & Følstad, A. (2017). Why people use chatbots. In I. Kompatsiaris, J. Cave, A. Satsiou, G. Carle, A. Passani, E. Kontopoulos, S. Diplaris & D. McMillan (Eds.), Internet science, 4th International Conference, INSCI 2017, Thessaloniki, Greece, November 22–24, 2017 Proceedings (pp. 377–392). Cham: Springer. � Google Scholar Carlson, M. (2015). The robotic reporter: Automated journalism and the redefinition of labor, compositional forms, and journalistic authority. Digital Journalism, 3(3), 416–431. � Google Scholar Cobley, P. (2008). Communication: Definitions and concepts. In W. Donsbach (Ed.), The international encyclopedia of communication Vol. II. Malden: Blackwell. � Google Scholar Couldry, N., & Mejias, U. A. (2019). The costs of connection. How data is colonizing human life and appropriating it for capitalism. Stanford: Stanford University Press. Google Scholar van Dijck, J., Poell, T., & de Waal, M. (2018). The platform society. Oxford: Oxford University Press. � Google Scholar Edwards, A., & Edwards, C. (2017). The machines are coming: Future directions in instructional communication research. Communication Education, 66(4), 487–488. � Google Scholar Edwards, C., Edwards, A., Spence, P. R., & Shelton, A. K. (2014). Is that a bot running the social media feed? Testing the differences in perceptions of communication quality for a human agent and a bot agent on Twitter. Computers in Human Behavior, 33, 372–376. � Google Scholar Etzrodt, K. (2022). The third party will make a difference—A study on the impact of dyadic and triadic social situations on the relationship with a voice-based personal agent. International Journal of Human-Computer Studies. � Google Scholar Etzrodt, K., & Engesser, S. (2021). Voice-based agents as personified things: Assimilation and accommodation as equilibration of doubt. Human-Machine Communication, 2, 57–76. � Google Scholar Fortunati, L. (2018). Robotization and the domestic sphere. New Media & Society, 20(8), 2673–2690. � Google Scholar Gehl, R. W., & Bakardjieva, M. (Eds.). (2017). Socialbots and their friends: Digital media and the automation of sociality. New York: Routledge. � Google Scholar Gentzel, P. (2019). Materialität, Technik und das Subjekt: Elemente kritischer Kommunikations- und Medienanalyse [Materiality, technology, and the subject: elements of critical communication and media analysis]. In P. Gentzel, F. Krotz, J. Wimmer & R. Winter (Eds.), Das vergessene Subjekt. Subjektkonstitutionen in mediatisierten Alltagswelten [The forgotten subject. Subjects in mediatized everyday worlds] (pp. 87–113). Wiesbaden: Springer VS. � Google Scholar Geser, H. (1989). Der PC als Interaktionspartner [The PC as interaction partner]. Zeitschrift für Soziologie, 18(3), 230–243. � Google Scholar Gunkel, D. (2020). An introduction to communication and artificial intelligence. Cambridge: Polity Press. Google Scholar Guzman, A. L. (2018). Introduction: "What is human-machine communication, anyway?". In A. L. Guzman (Ed.), Human-machine communication: Rethinking communication, technology, and ourselves (pp. 1–28). New York: Peter Lang. � Google Scholar Guzman, A. L., & Lewis, S. C. (2020). Artificial intelligence and communication: A human-machine communication research agenda. New Media & Society, 22(1), 70–86. � Google Scholar Hepp, A. (2020). Artificial companions, social bots and work bots: Communicative robots as research objects of media and communication studies. Media, Culture & Society, 42(7–8), 1410–1426. � Google Scholar Howard, P. N. (2015). Pax technica: How the internet of things may set us free or lock us up. New Haven: Yale University Press. � Google Scholar Humphry, J., & Chesher, C. (2021). Preparing for smart voice assistants: Cultural histories and media innovations. New Media & Society, 23(7), 1971–1988. � Google Scholar Jones, S. (2014). People, things, memory and human-machine communication. International Journal of Media & Cultural Politics, 10(3), 245–258. � Google Scholar Knoblauch, H. (2017). Die kommunikative Konstruktion der Wirklichkeit [The Communicative Construction of Reality, engl. translation in 2019]. Wiesbaden: Springer VS. � Google Scholar Knorr Cetina, K. (1997). Sociality with objects: Social relations in postsocial knowledge societies. Theory, Culture & Society, 14(4), 1–30. � Google Scholar Natale, S., & Cooke, H. (2021). Browsing with Alexa: Interrogating the impact of voice assistants as web interfaces. Media, Culture & Society, 43(6), 1000–1016. � Google Scholar Peter, J., & Kühne, R. (2018). The new frontier in communication research: Why we should study social robots. Media and Communication, 6(3), 73–76. � Google Scholar Rammert, W. (2012). Distributed agency and advanced technology—Or: How to analyze constellations of collective inter-agency. In J.-H. Passoth, B. Peuker & M. Schillmeier (Eds.), Agency without actors? (pp. 89–112). New York: Routledge. � Google Scholar Rammert, W., & Schulz-Schaeffer, I. (2002). Technik und Handeln: wenn soziales Handeln sich auf menschliches Verhalten und technische Artefakte verteilt [Technology and action: when social action is distributed between human behavior and technical artifacts]. In W. Rammert & I. Schulz-Schaeffer (Eds.), Können Maschinen handeln?: Soziologische Beiträge zum Verhältnis von Mensch und Technik [Can Machines act?: Sociological contributions to the relationship between humans and technology] (pp. 11–64). Frankfurt a.M.: Campus. Google Scholar Reeves, B., & Nass, C. I. (1996). The media equation: How people treat computers, television, and new media like real people and places. Cambridge: Cambridge University Press. Google Scholar Schäfer, M. S., & Wessler, H. (2020). Öffentliche Kommunikation in Zeiten künstlicher Intelligenz [Public communication in times of artificial intelligence]. Publizistik, 65, 307–331. � Google Scholar Schramm, W. E. (1954). The process and effects of mass communication. Urbana: University of Illinois Press. Google Scholar Shoemaker, P. J., & Reese, S. D. (2014). Mediating the message in the 21st century: A media sociology perspective. New York: Routledge. � Google Scholar Spence, P. R. (2019). Searching for questions, original thoughts, or advancing theory: Human-machine communication. Computers in Human Behavior, 90, 285–287. � Google Scholar Suchman, L. A. (2007). Human-machine reconfigurations: Plans and situated actions. Cambridge: Cambridge University Press. � Google Scholar Sundar, S. S., & Lee, E. J. (2022). Rethinking communication in the era of artificial intelligence. Human Communication Research, 48(3), 379–385. � Google Scholar Zuboff, S. (2019). The age of surveillance capitalism. The fight for a human future at the new frontier of power. London: Profile. Google Scholar