Chatbots in the humanitarian field

Concepts, uses and shortfalls

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by

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Methodology

This report began as a combination product review and experimental research paper on how organizations can build a humanitarian chatbot. The scope of the report changed due to a limited amount of field data available and time constraints. The objectives were modified to address the questions: (1) what is a chatbot; (2) what purpose can it serve in the humanitarian sector; (3) what are the key design concepts; (4) what humanitarian chatbots currently exist; and (5) what are the shortfalls.

The report uses elements of a narrative literature review. It is not exhaustive in nature but synthesizes information gathered across sources. Searches were conducted on electronic databases and organizational websites, using authoritative texts and article reference lists. The searches used several select terms and excluded articles focusing in depth on the technical aspects of machine learning, natural language processing and development. The specificity of this topic also required the inclusion of sources outside of peer-reviewed papers, journals and academic texts. It is acknowledged that sources from corporate websites, news and media outlets and independent authors may exhibit bias.

The report is limited in addressing the long-term benefits of chatbots in the humanitarian sector. A detailed product review or case study is recommended as well as an investigation into the lifecycle of a humanitarian chatbot.

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Brief Overview

Conversational agents and personal assistants are now more commonplace in a digital citizen's daily life. 2018 had an estimated global population of about 7.7 billion people[1]. Facebook, a prominent social media platform, had 1.47 billion daily users that same year.[2] Users could interact with over 300,000 unique chatbots on Facebook Messenger by May 2018, an increase from the 100,000 chatbots reported by Facebook in April 2017.[3] Twitter estimated 139 million users by the end of June 2019 with 5 per cent of the estimated Twitter population comprised of automated accounts.[4] Advancing technology is making it difficult to label such interactions as with a human or machine.

Organizations would be remiss to ignore the potentials of conversational agents given the increasing number of people accessing mobile devices and the rising global interest in artificial intelligence (AI). Consumer enterprises and local governments have acknowledged the benefits of using conversational agents to interact with their customers and constituents. However, non-profit and non-governmental organizations have not experienced the same chatbot growth as other sectors. This paper does not recommend all organizations embrace this growing trend, but explores why a conversational agent is of interest for humanitarian purposes. It also introduces points of consideration for those interested in implementing this tool.

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1 Population Reference Bureau. 2018. http://www.worldpopdata.org/

2 Facebook. Number of daily active Facebook users worldwide as of 2nd quarter 2018 (in millions). https://www-statista-com.proxy.library.nyu.edu/statistics/346167/facebook-global-dau/

3 Facebook. 2018. "F8 2018: David Marcus' Keynote." May 1, 2018. https://www.facebook.com/business/news/david-marcus-f8-keynote-2018; Johnson, Khari. 2017. "Facebook Messenger hits 100,000 bots." VentureBeat, April 18. 2017. https://venturebeat.com/2017/04/18/facebook-messenger-hits-100000-bots/

4 https://www.sec.gov/ix?doc=/Archives/edgar/data/1418091/000156459019027504/twtr-10q_20190630.htm

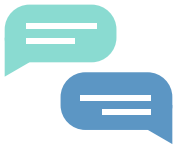
What is a Chatbot?

A chatbot, at its core, is a computer program that can recognize text and/or voice-based inputs and produce outputs to interact with a user. Modern chatbots appear "human" in their interaction. They provide answers, perform tasks, give guidance and carry a dialogue.

The Turing Test helps to identify how well AI chatbots can mimic human behavior and exhibit "intelligence". Alan Turing proposed the concept of a thinking machine in 1950 and the possibility of being indistinguishable from a human.[5] The Loebner Prize is a competition following the Turing Test format where an individual guesses if they are communicating with a machine or human. The chatbot Mitsuku won four years in a row for its "human" behavior.[6] However, the scientific community continues to discuss if a chatbot has passed the Turing Test or if new testing criteria are required to reflect modern technology.

Conversational agents are not new developments. The first recognized chatbot, ELIZA, was created by Joseph Weizenbaum in the 1960s.[7] It is a psychotherapist-like agent that follows scripts to "speak" with the user. ELIZA is still active online today.

Chatbots have come a long way if comparing ELIZA to the modern-day Mitsuku. But some chatbots still emulate the first conversational agent.



Low-level

Low-level chatbots do not contain an AI component. They reply on specific decisions and inputs by the user to produce a simple output. They are easily utilized in FAQ or basic "if-then" situations. These chatbots can contain predetermined buttons or options for users to select. One of the cons

5 *Turing, A. 1950. Computing Machinery and Intelligence. https://www.csee.umbc.edu/courses/471/papers/turing.pdf*

6 *https://www.aisb.org.uk/events/loebner-prize*

7 *Landsteiner, N. 2005. https://www.masswerk.at/elizabot/*

with low-level chatbots is their inability to handle complex requests. Users can become frustrated if they are asked multiple questions by the conversational agent with no clear option or solution for their problem. This is similar to a touch-tone automated customer service line. While these chatbots are limited in their capabilities, they can be ideal for expediting processes or providing quick answers to common questions.

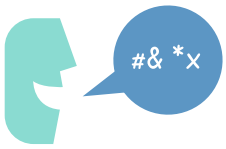
Mid-Level

These chatbots use keywords to identify user intent much like how a search engine analyzes user text. Keyword-based chatbots are more sensitive to user inputs and require more programming than low-level chatbots. The chatbot may not recognize a request if the user misspells a word, uses slang or uses a variant of a word unknown to the conversational agent. For instance, an agent will recognize "good-bye" but not "see you" or "ciao" unless it is programmed to do so. Most social media chatbots are keyword-based.

Advanced

Advanced chatbots make use of natural language processing (NLP). NLP is an arm of AI focusing on how computers can analyze and understand human language. An advanced chatbot is programmed to recognize intent from current and previous interactions with the user. In this instance, the chatbot gets "smarter" through more interactions with a subject. One of the challenges facing the creation of advanced chatbots is the lack of data for languages other than English. Researchers are developing new ways of modeling for uncommon languages while also mitigating NLP bias.

Additional capabilities



Voice

Chatbots are often imagined as text-based conversational agents. However, technological advances are allowing chatbots to recognize voice inputs and respond in the same manner. Microsoft's "full duplex" Chinese AI social chatbot XiaoIce revealed in 2018 shares this capability. "Full duplex" refers to two-way communication ability where an agent can send and receive information. While text is the primary mode of conversation with XiaoIce, the agent is developing the ability to call users and interact via voice. Microsoft's chatbots Zo (United States), Ruuh (India) and Rinna (Japan) are expecting a XiaoIce-like upgrade as well. Google presented Google Duplex the month after Microsoft's release. Google Duplex is a voice-based personal assistant with scheduling capabilities. The agent was released to select Pixel phone users in November 2018.[8]

Image Recognition

Most conversational agents have the capability to receive images as attachments from users. Thumbnails, gifs, videos and other media can be sent to the user in return. Image classification, image detection and image recognition are all making strides in the field of machine learning. The healthcare sector is using AI mobile applications, in conjunction with remote healthcare professionals, to allow users to upload images for analysis and diagnosis. Websites such as Captionbot.ai indicate systems can provide descriptive responses to images. Conversational agents will be able to handle more complex dialogues surrounding images in the near future.

8 *Wiggers, Kyle. "Google's Duplex is Rolling Out to Pixel Owners — Here's How It Works." 2018. VentureBeat, November 21, 2018. https://venturebeat.com/2018/11/21/googles-duplex-is-rolling-out-to-pixel-owners-heres-how-it-works/*

Why does this matter and what is being done?

The decreasing cost of equipment and data plans has spurred the growth of mobile phone users. It is predicted that 2019 will see 4.78 billion mobile phone users worldwide.[9] In 2016, the United Nations amended Article 19 of the Universal Declaration of Human Rights indicating access to the Internet as a human right.[10] Several organizations, such as IEEE, launched initiatives to bring Internet access to the majority of people in developing and developed nations.[11] The end of 2018 saw a little over half of the world's population, 3.9 billion people, using the Internet. 90 per cent of the global population use a 3G or higher network.[12] More digitally connected people means more opportunities for organizations to connect with the communities and individuals they serve.

Using AI for social good and humanitarian approaches is a growing movement. Microsoft and the UN Human Rights Office entered a five-year partnership in 2017.[13] In 2018, the company announced its AI for Humanitarian Action initiative to support disaster response, assist refugees and displaced persons, prevent human rights violations and meet the needs of children around the world.[14] Google also started its AI for Social Good initiative in 2018.[15] The company has created and sponsored various projects which address societal and environmental problems. IBM held its first Call for Code Global Challenge in 2018.[16] Partnering with the United Nations Human Rights Office and the American Red Cross' International team, developers created solutions to complex problems occurring in emergency situations and times of crisis.

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9 eMarketer. Number of mobile phone users worldwide from 2015 to 2020 (in billions). https://www-statista-com.proxy.library.nyu.edu/statistics/274774/forecast-of-mobile-phone-users-worldwide/ (accessed 10/25/18).

10 https://undocs.org/A/HRC/32/L.20

11 IEEE. 2018. "About." https://internetinitiative.ieee.org/about

12 International Telecommunication Union. 2018. "Measuring the Information Society Report 2018." https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2018/MISR-2018-Vol-1-E.pdf.

13 Microsoft News Center. 2017. "Technology for human rights: UN Human Rights Office announces landmark partnership with Microsoft." May 16, 2017. https://news.microsoft.com/2017/05/16/technology-for-human-rights/

14 Microsoft. 2019. https://www.microsoft.com/en-us/ai/ai-for-humanitarian-action

15 Google. 2019. "AI for Social Good." https://ai.google/social-good

16 Call for Code. 2018. https://callforcode.org

In the Philippines, USAID worked with the Philippine Central Bank to develop a Facebook and SMS chatbot to address customer complaints and reduce employee workload.[17] New algorithms are improving chatbots for education (IBM Watson Tutor), chatbots for emergency communication (Rescue from Rescue.io) and chatbots for mental health support (Tess from X2AI).

These movements are proving chatbots are not just for marketing and commerce purposes. They have the potential to be utilized as a means to foster community engagement, a means for monitoring and evaluation and as a means of education. They can reach overlooked populations such as the illiterate and semi-literate and people with disabilities.

Community Engagement

UNOCHA defines "community engagement" as "a two-way dialogue between crisis-affected communities, humanitarian organizations and, where possible, within and between communities. It should enable affected people to meet their different needs, address their vulnerabilities and build on their pre-existing capacities".[18] Chatbots can fill the gap where community members lack direct access to organization members because of location, local cultural norms or a shortage of staff. Although the interaction is more limited than personal face-to-face interaction, it still allows community members to obtain information, provides the organization with feedback and fosters a sense of inclusivity.

Chatbots can help organizations communicate with those considered vulnerable and underserved. The Singapore Red Cross (SRC) partnered with KRDS Singapore and MullenLowe Singapore to release Ella, a healthcare bot for seniors.[19] UNICEF operates U-Report, a social messaging tool connecting over 6.5 million users from around the world.[20] Refugee Text, InfoAid, and Refunite all use their platforms to assist refugees in unification, obtaining information on services in a new country and/or assisting in legal processes.[21] During the Zimbabwe Fuel Shortage and Crisis, citizens formed

17 Paul, Amy, Craig Jolley, and Aubra Anthony. 2018. Reflecting the Past, Shaping the Future: Making AI Work for International Development. https://www.usaid.gov/sites/default/files/documents/15396/AI-ML-in-Development.pdf

18 OCHA. n.d. "Community Engagement." https://www.unocha.org/es/themes/community-engagement.

19 Coppola, Martin. 2017. "Red Cross - ELLA / The messenger bot with a heart." Behance, June 14, 2017. https://www.behance.net/gallery/53783325/Red-Cross-ELLA-The-messenger-bot-with-a-heart.

20 U-Report. n.d.."About U-Report." https://ureport.in/about/.

21 Refugee Text. 2016. http://www.refugeetext.org/.; Migration Aid. n.d. https://www.migrationaid.net/infoaid/.; Refunite. 2018. https://refunite.org/.

groups on WhatsApp and created Twitter hashtags to inform others about fuel prices and queue wait times. In response, Intelli Africa Solutions created a WhatsApp chatbot for the city of Harare.[22] Users could quickly gain information about the fuel stations nearest them.

Chatbots are versatile in that they can interact not only with those receiving or searching for aid but also with those seeking to help. In 2016, charity:water developed a Facebook Messenger chatbot that allowed Facebook users to make a monetary donation.[23] The organization has since developed Yeshi, an interactive story-based chatbot.[24] Users can gain a better understanding about living with water scarcity through their interactions with the digital agent. NeedsList operates a chatbot that allows organizations to text their need for supplies or tasks.[25] The information is registered into NeedsList's database allowing community members and others to donate money, supplies or their skills.

Organizations wanting to implement chatbots can use this tool to better inform local community members on ongoing situations, recruit volunteers and connect those seeking assistance with those offering assistance. However, organizations need to consider spreading their actions across various outlets and not rely solely on conversational agents. While the number of digitally connected people is increasing, there are still populations without the ability to connect or the digital skills to effectively use such tools. Conversational agents should work in tangent with traditional methods of encouraging community engagement and replace existing effective methods.

Monitoring and Evaluation

The increase in mobile ownership and the growing development of a digital community create new channels to users. Organizations can leverage this direct access to people in the field, vulnerable persons and local community members to gather relevant data. Conversational agents, such as chatbots, can fill the gap where standard face-to-face surveys cannot be easily performed. This can include the surveying of new populations, receiving visuals from hard-to-reach areas or areas in conflict and establishing a presence in underserved regions. The survey chatbot method is growing

22 *Ro, Christine. 2018. "Zimbabweans Are Using Social Media to Find Fuel During One of the Country's Worst Gas Shortages." New York, November 7, 2018. http://nymag.com/developing/2018/11/zimbabwe-whatsapp-chatbots-social-media-fuel-shortage.html.*

23 *Lake, Howard. 2016. "Charity: water takes donations via Facebook Messenger bot." UKFundraising, August 12, 2016. https://fundraising.co.uk/2016/08/12/charity-water-takes-donations-via-facebook-messenger-bot/#.XFNZmFxKjIV.*

24 *AKQA. 2019. Walk With Yeshi. https://www.akqa.com/work/lokai/walk-with-yeshi/.*

25 *https://needslist.co*

to the point where platforms such as Wizu focus solely on the development of chatbots for survey purposes.[26]

SMS surveys have been used in the humanitarian sector for many years. Survey chatbots share the same characteristics of low cost development, high response rate and ease of use. Where conversational agents with NLP capabilities differ from SMS surveys is in the personalization of the experience. Surveys can mimic a "natural" conversational flow, allowing for organizations to gather more data and insights from their users. SMS surveys and survey chatbots can be designed to provide quick, low-level interactions. Their capability to handle images and interface buttons allows illiterate and semi-literate community members to participate in the evaluation effort. Displaced persons who do not share the language of the region can also benefit from the pictorial method.

Education

Conversational agents are channels for disseminating information, not just collecting it. While they can be used to get the public involved with a cause or movement, chatbots can provide the public with valuable long-term knowledge for their careers, personal lives, and future emergencies.

India and several countries across Africa have organizations communicating with and educating farmers through their mobile phones. Farm.ink provides information on local prices and buyers to African farmers through the African Farmers Club chatbot.[27] FarmChat was designed for rural Indian potato farmers to help address questions about plant protection, pests, weather, and other concerns.[28] Providing farmers with easy to reach information can help with product yields, help set fair prices for crops and help educate new farmers on best practices for long-term benefits.

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26 https://www.wizu.com/

27 https://farm.ink/

28 Vota, Wayan. 2019. "FarmChat: Using Chatbots to Answer Farmer Queries in India." ICT Works, January 2, 2019. https://www.ictworks.org/farmer-chatbot-india/#.XGWTxjNKjIU

When a topic is too taboo or too personal in nature, people can be misinformed or unaware of the issue. Chatbots can act as a discrete channel through which individuals become better informed. Public Good Projects created a chatbot to help inform the public about the opioid crisis.[29] Ask Marlo is a LINE chatbot created by UNAIDS Indonesia to help educate youth about HIV and AIDS.[30] Girl Effect developed two chatbots, Big Sis and Springbot, to educate girls on sexual and reproductive health.[31]

Chatbots can assist with emergency preparedness by re-educating the public on what to do in an emergency and how to prepare for an impending event. This can include guiding a user in developing a family emergency plan, making recommendations for emergency supplies and making suggestions on how to act during an emergency situation.

29 *The Public Good Projects. n.d. "Opioid Chatbot." https://publicgoodprojects.org/opioid-crisis/#opioid-chatbot*

30 *Ulung, A. Kurniawan. 2019. "Curious about HIV/AIDS? Just Ask Marlo." The Jakarta Post, January 22, 2019. https://www.thejakartapost.com/life/2019/01/22/curious-about-hivaids-just-ask-marlo.html*

31 *Handforth, Calum and Kecia Bertermann. 2018. How Girl Effect built a chatbot. https://www.researchgate.net/profile/Calum_Handforth/publication/329924130_How_Girl_Effect_built_a_chatbot/links/5c23e8cb92851c22a3484a98/How-Girl-Effect-built-a-chatbot.pdf?origin=publication_detail*

Considerations before Implementation

Is this right for the organization's needs?

The first item an organization must consider before developing an AI conversational agent is if this solution is right for their needs. As the saying goes: Just because you can, doesn't mean you should. Situations requiring complex responses may be better served by a human instead of a computer. Jared Jaskot makes this criticism in his 2019 article "Imagining Lucia 2.0: Chalk Full of AI". In discussing the ability of chatbots to generate documents for legal purposes, he writes, "In the legal field, the question of whether one should take a particular action is frequently more important than whether one can take that action. At this point in the technology's maturation, bots struggle mightily with strategic thinking and with asking important questions. Filing a legal document that leads to damage to a client is a catastrophic failure."[32]

Funds, skill and time to build and maintain an agent are all factors for consideration. Organizations with the staff skilled in the software and languages of chatbot development have the option of building their own conversational agent in-house. Those that do not have knowledged-staff must search to retain such an individual or local agency. Organizations must also factor in long-term maintenance and regular updates to the agent.

Conversational agents can be built in-house when commercial services lack features or have limited capabilities as required by the organization. This includes items such as the language of the users (multi- or uni-lingual) and the format of the message (social media vs. SMS). Organizations need to be aware of the potential buy-out of conversational agent builders and hosting platforms. For instance, Google acquired API.ai, Facebook acquired Wit.ai, and recently SAP acquired Recast.ai. Acquisitions can cause problems as data policies change, projects may require migration to different platforms, and projects and their data face possible deletion. Organization should also decide where the conversational agent will "live". This can be on an existing platform (such as the organization's website) or on a new platform which requires additional development.

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32 Jaskot, Jared. 2019. "Imagining Lucia 2.0: Chalk Full of AI." January 18, 2019. https://chatbotslife.com/imagining-lucia-2-0-chalk-full-of-ai-c4bf92467ec

Platforms such as Amazon Lex, IBM Watson Assistant, and Microsoft's Bot Framework can provide a more stable service.[33] However, the cost and complexity to build the chatbot increase. Open-source platforms such as Rasa and TensorFlow are alternative options.[34] Organizations should be mindful that open-source tools can potentially lack development and troubleshooting support in the long term.

Most importantly, organizations should have a firm understanding of what the chatbot will do for the organization and its members. Even if an organization has the means to develop a conversational agent, if it does not enhance or improve on an experience then the agent may not be necessary.

Where is the data?

The most effective conversational agents are built using existing data. This "training data" is a necessary component of chatbot development as it "teaches" the conversational agent to provide correct and appropriate responses to a user.

Organizations must consider how the user will interact with the chatbot and what keywords are they likely to use in their interactions. On a basic level, chatbots can provide standard answers to frequently asked questions. While this is easy for most enterprises to construct, such a list is more difficult to find in the humanitarian sector. Part of this stems from the changing environment of a response situation. An enterprise setting has more stability and predictability. When customers buy a product or partake in a service, the problems they encounter may be the same regardless of geographic location. In an emergency situation or crisis settings, multiple factors can lead to varying responses.

Organizations interested in creating a more robust conversational agent require more data and a more complex structure. Developers and designers need to be aware that data can be limited because of the vulnerable population they are interacting with. Government or local institutions may be reluctant to share information with other parties if there is a perceived danger to the population. Chatbots used in one-on-one conversation are typically meant to provide a personalized experience. While personal data can help in the training of the conversational agent, holding onto that data may not be in the interest of the user. In some instances, data from a population or regarding a certain topic is not available because it was never collected.

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33 Amazon Web Services. 2019. "Amazon Lex." https://aws.amazon.com/lex/.; IBM. n.d. "Watson Assistant." https://www.ibm.com/cloud/watson-assistant/.; Microsoft. 2019. "Microsoft Bot Framework." https://dev.botframework.com/

34 Rasa Technologies Inc. 2019. https://rasa.com/.; TensorFlow. n.d. https://www.tensorflow.org/

Who has data ownership?

Data collection is a growing concern among individuals and nations. The concerns involve what kind of data is collected, from whom, by whom and for what purpose. Although data collection for humanitarian purposes is done with good intention, security breaches can harm the most vulnerable of individuals. Recent scandals from Facebook and Google have proven that even the most powerful companies are not immune to cyberattacks.

As mentioned, chatbots targeted at vulnerable populations will have access to sensitive information. It is important to understand who has full access to this data and how it is used. Most conversational agents built and hosted on a third-party website will fall under that party's data privacy policy. In many instances, this means the users should have access to the organization's privacy policy to understand what information is being collected, how it is being stored and how the information will be used. The user should also be able to consent to providing the organization with their personal information and, in the case of the General Data Protection Regulation (GDPR), users should have the right to have their information forgotten.

Organizations also need to consider what will happen to the data after collection. Conversational agents get "better" the more data input they receive. The science community is aware AI algorithms have a bias problem. The information the algorithms process and the people who create these algorithms have been known to ignore poor and minority groups, cause miscommunication with individuals using an accent or slang and lead to racial stereotyping. Microsoft's Tay is the most famous example of what can happen when the "wrong" data and not enough "correct" is used to develop an AI agent. In less than 24 hours, the Twitter chatbot became racist, sexist, and genocidal.[35] Therefore, data from underrepresented populations has value. What happens to the data (sold, shared, kept, and/or destroyed) will depend on the data owner.

Is the government involved?

While not an immediate concern, government interference with Internet connectivity and social media access can impact a humanitarian chatbot's usefulness. China saw the removal of two chatbots from the Tencent QQ application when the conversational agents expressed criticism of

35 *Liu, Yuxi. 2017. "The Accountability of AI—Case Study: Microsoft's Tay Experiment." January 16, 2016. https://chatbotslife.com/the-accountability-of-ai-case-study-microsofts-tay-experiment-ad577015181f*

the government.[36] The State of California recently passed a bill making it illegal to use undisclosed bots to deceive others with the intent of having said person make a purchase or influence their election vote.[37]

During times of crisis and need, governments and corporations should act to keep lines of communication open. After the 2015 Nepal earthquake, Viber offered free service to its customers for international and domestic phone calls. Telkom offered free Wi-Fi access to emergency response teams assisting in the aftermath of the 2018 Indonesian tsunami.[38] TelkomGroup offered 24-hour free telephone and SMS packages to customers in Palu and Donggala. Even when assistance cannot reach affected areas, chatbots can disseminate important information and keep affected populations up-to-date on recovery and rescue efforts. But conversational agents can only function when there are open lines of communication. As mentioned, conversational agents should be developed to work in tangent with existing methods in the event one fails.

Design Considerations for a Conversational Agent

Design is more than just the physical appearance of an object. At its core it is how a user and the object interact with one another. Ben Shneiderman established the eight "Golden Rules" of user interface design for human-computer interaction in 1985.[39] Jakob Nielsen and Rolf Molich iterated

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36 Allen, Kerry. 2017. "Chinese chatbots shut down after anti-government posts." BBC, August 3, 2017. https://www.bbc.com/news/world-asia-china-40815024

37 California Legislative Information. 2018. SB-1001 Bots: disclosure. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1001

38 The Jakarta Post. 2018. "Telkom announces free telephone call, SMS services in earthquake-hit areas." The Jakarta Post, October 3, 2018. https://www.thejakartapost.com/news/2018/10/03/telkom-announces-free-telephone-call-sms-services-in-earthquake-hit-areas.html

39 Shneiderman, Ben and Catherine Plaisant. 2010. Designing the user interface: Strategies for effective human-computer interaction. Boston: Addison-Wesley.

upon these rules and established their nine usability heuristics in 1990.[40] The core concepts are applicable to current technology even though much has changed since the mid-1980s. The nine concepts are:

- Use simple and natural dialogue
- Use language familiar to the user
- Use simple instructions
- Use consistent system actions
- Provide users with feedback
- Provide clear system exits
- Provide system shortcuts
- Provide appropriate error messages
- Design to prevent errors

Modern technology has made it easier to address some concepts. For example, for concept number three, users with access to messaging applications have the ability to see conversation histories and save conversations. Therefore, there is less pressure on users to remember earlier parts of the conversation and to remember detailed instructions.

Providing users with clearly marked exits can mean having the conversational agent ask the user if they have any further questions, have more information to provide or if the user wants to perform another task. Users should easily leave a conversation when necessary by closing the application or having the conversation timeout after a period of inactivity and lack of confirmation.

Organizations need to consider what technology the user will have access to and will use when interacting with the conversational agent. Organizations should also understand why the user would consider this piece of technology, what does the user want to achieve and how they go about acquiring information or performing a task.

40 Molich, Rolf and Jakob Nielson. 1990. "Improving a Human-Computer Dialogue." Communications of the ACM 33, no. 3 (March): 338-348. https://pdfs.semanticscholar.org/8e67/d5075db82691aad39743d3414019ab4e38c0.pdf

Infrastructure

Infrastructure is a never ending challenge. It cannot be assumed that all regions of a country are equally connected to broadband Internet or that all people in the region have access to Internet connectivity. The quality of access, the type of access and the amount of time for interactivity occur in varying degrees. In 2015, 75.8 per cent of the population in North America was using the Internet. Over 88 per cent of Canada's population had access compared to the United States' 74 per cent and Mexico's 57 per cent. That same year, the Democratic Republic of Congo had 3.8 per cent of individuals using Internet and South Africa had about 52 per cent.[41] Therefore, when considering the usage of conversational agents it is necessary to evaluate the kind of technology the audience has access to.

While some individuals can easily access a mobile messaging application such as Messenger, WhatsApp, or Viber, other portions of the populations are reliant on SMS and standard phone calls. It is estimated that 96 per cent of the world's population lives within reach of a mobile-cellular network with 90 per cent of the population having access to the Internet through a 3G or higher network.[42]

Communities reliant on physical structures need to consider alternative means of communication should those structures fail in times of disaster. Radio remains one of the more reliant means of communication as it has a wide reach, equipment is inexpensive, and it does not require a constant electric source. In 2002, analog radio had an estimated global coverage of 95 per cent.[43] Although the popularity of radio is decreasing in favor of television, radio remains a solid means of communication for information.

Infrastructure can impact the kind of information that gets passed on and to whom. For instance, a community with a central Internet centre may have a liason who receives information and disseminates it to the residents through more traditional means. This is opposed to a community where residents have Internet connection in their homes and have access to a home computer. When designing the conversational agent, an organization needs to consider who is interacting with the

41 Ritchie, Hannah and Max Roser. 2019. "Technology Adoption." https://ourworldindata.org/technology-adoption#internet-access-technology.

42 International Telecommunication Union. 2018. "Measuring the Information Society Report 2018." https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2018/MISR-2018-Vol-1-E.pdf.

43 International Telecommunication Union. 2010. "Target 8: Ensure that all of the world's population have access to television and radio services." http://www.itu.int/ITU-D/ict/publications/wtdr_10/material/WTDR2010_Target8_e.pdf

chatbot and through what device. This can help to determine what public platforms can be used to build the bot or if the organization needs to build the bot in-house.

Considerations need to be made for rapid technological advances. While not all mobile phone users have a smartphone, feature phones are getting a "smart" upgrade. KaiOS announced its continued partnership with Google and the integration of Google Assistant, with voice input, into its smart feature phones.[44]

Design and Approach

Humanitarian bots need extra care in terms of building personality, emotion and empathy into the conversation style. Some affected communities are distrustful of humanitarian workers during initial contact. It takes time and continuous in-person engagement before a community welcomes aid workers. Conversational AIs present a unique problem as they are machines with the growing capabilities of appearing human in their speech and overall programed personas. This is evident in the way people refer to Siri and Alexa as "she" instead of "it" and the growing number of AIs with person names.

Children are also likely to perceive an AI device as having feelings and adults will anthropomorphize the device when describing their interactions with it. Studies in human-computer interaction led to the "Computers Are Social Actors" (CASA) paradigm recognizing that people will interact with a computer much in the same way they would interact with another human being.[45] As the researchers of FarmChat discovered, "FarmChat by design was not anthropomorphic, as the researchers did not introduce any human-like features such as name or character. In spite of that, they found participants to have a high tendency to anthropomorphize the bot…[P]articipants were very polite in their interactions. Questions usually began with 'please listen …', 'can you please tell me …', and ended the conversation with 'thank you for the help', as if talking to an agri-expert".[46]

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44 Metz, Tim. 2019. "KaiOS Technologies Expands Integration with Popular Services from Google." February 25, 2019. https://www.kaiostech.com/kaios-technologies-expands-integration-with-popular-services-from-google/

45 Lee, Kwan Min, Younbo Jung, Jaywoo Kim, and Sang Ryong Kim. 2006. "Are physically embodied social agents better than disembodied social agents?: The effects of physical embodiment, tactile interaction, and people's loneliness in human–robot interaction." International Journal of Human-Computer Studies 64, no.10 (October) 962-973. https://doi.org/10.1016/j.ijhcs.2006.05.002

46 Vota, Wayan. 2019. "FarmChat: Using Chatbots to Answer Farmer Queries in India." ICT Works, January 2, 2019. https://www.ictworks.org/farmer-chatbot-india/#.XGWTxjNKjIU

Conversational agents can be fully text-based or incorporate voice. Once organizations decide on the platform to use (SMS, Messenger, Viber, Line, etc.), they need to consider the look. Will the conversational agent allow for buttons? Will "cards" be used? What persona will the conversational agent take on? Aspects such as these can change over time, but it can save an organization time and money to consider the design and potential design early in the development process. Knowing the chatbot's role and goal aid in the decision-making process. For instance, an infrequently visited decision-tree style conversational agent can benefit from buttons. On the other hand, a social conversational agent like XiaoIce has more robust capabilities for complex interactions and long-term conversations.

Design includes what the conversational agent will say (questions, facts or jokes), how it will state a message (the written language being used and whether it is formal vs. informal) and how the conversational agent responds to questions or statement it does not know (does it ask for more information, does it direct the user to a human agent or does it not respond). Some of this can be determined from the data an organization has on the target population. Assumptions can be made on what the user wants to know and how the conversation will flow. However, not everything can be assumed. Good designs are tested and iterated upon. Organizations that lack the required data may need to approach the target population and gather said data before doing further technical design work.

In the conversation design, it is important to note where a breakdown of communication can occur. Understanding where a problem can arise will reduce instances of users becoming frustrated with poor interaction. Inadvertently, this frustration can be projected onto the helping organization or the team of aid workers the users have physical contact with. It is best to "avoid jargon, technical terms or euphemisms" when designing the conversation and conversation flow.[47] It can be difficult for the user to understand if they are unfamiliar with technical concepts or have a different level of education. While some users utilize slang and colloquialisms in their messaging, developers and designers must understand language can vary among age groups and geographic location. It is appropriate to develop a conversational tool which can understand such phrases but may be inappropriate to use in responses.

47 Howard, Amanda, Kylie Agllias, Miriam Bevis, and Tamara Blakemore. 2017. "'They'll tell us when to evacuate': The experiences and expectations of disaster-related communication in vulnerable groups." International Journal of Disaster Risk Reduction 22 (June):139-146. 10.1016/j.ijdrr.2017.03.002

Organizations considering visual messages should evaluate the appropriateness of the image. Images can be effective for users who are illiterate, semi-literate or who have difficulty typing responses. The images or icons must be familiar to the users and not just to the organization providing assistance. Depending on the service provided, users may have the capability of taking and sending photographs to the organization. The organization then needs to determine how the images are stored and how the images are used.

Developing a tool is one thing, having it be used is another. There are many instances where products get deployed but rarely are fully utilized. It is important to understand the needs of the intended audience and their willingness to interact with a conversational AI. Although business customers are accepting of conversational AIs in their inquiry requests, the same is not always true of those seeking aid after a disaster or seeking long-term assistance.

In the aftermaths of Hurricanes Irma and Maria, it was vital to provide the people of Antigua and Barbuda and Dominica with assistance on multiple levels.[48] Ground Truth Solutions found that a majority of people surveyed following the occurrence answered that they were not kept informed about how to access support. In both cases, affected persons preferred to receive information via phone call (Antigua and Barbuda - 42 per cent and Dominica - 49 per cent) and in-person meetings (20 per cent and 41 per cent). Individuals in Antigua and Barbuda listed a smartphone messaging app as the third choice (8 per cent) while people surveyed for Antigua and Barbuda preferred radio (18 per cent) followed by SMS (11 per cent). Smartphone messaging was ranked fifth with 10 per cent of individuals answering such. Whatsapp was recognized as the application of choice.

48 Ground Truth Solutions. (2018). Ground Truth Solutions Survey of People Affected By Hurricane Irma: Antigua and Barbuda. Round Two.; Ground Truth Solutions. (2018). Ground Truth Solutions Survey of People Affected By Hurricane Maria: Dominica. Round Two.

In a 2017 survey on refugees, asylum-seekers and migrants in Turkey, respondents preferred to receive information via SMS, social media and messaging apps.[49] Of those surveyed, 72 per cent had access to a personal smartphone while 15 per cent had shared access. When mVAM and InSTEDD were developing their food chatbot, 90 per cent of the households at the Kakuma Refugee Camp had mobile phone access.[50] However, only 20 per cent of Kalobeyei households had mobile phone access.[51]This discrepancy meant that the two communities interacted with their phones differently and had different Internet habits. If other means of communication are more effective and practical, money and time should not be put to developing a conversational agent that will go unused. As mentioned, just because you can develop a tool, does not always mean that you should.

49 Ground Truth Solutions. (2017). Mixed Migration Platform: Refugee, Asylum-Seeker and Migrant Perceptions. Izmir/ Turkey.

50 Digital Impact Alliance. 2018. Food Bot and the AIDA Chatbot Builder. May 1, 2018. https://digitalimpactalliance.org/wp-content/uploads/2019/03/mVAM.pdf.

51 Ibid

Fieldworkers as a Target Audience

Many of the conversational agents mentioned in this paper identify the user as a refugee, an individual in a developing country requiring assistance or an individual in a developing nation acting as a source of information. However, few conversational agents identify the user as humanitarian field staff. While public conversational agents can be modified to meet some of the needs of field workers, an internal agent can meet internal concerns.

A human resource-like conversational agent can act as a reporting tool for inappropriate behavior. A 2017 report by Dyan Mazurana and Phoebe Donnelly states, "Under-reporting of sexual harassment and assault is widespread. Women and LGBT aid professionals who did report were widely dissatisfied with their agencies' responses and experienced more harmful professional and personal consequences than those of their alleged perpetrators, who at times remained in their positions and continued perpetrating".[52] Input from multiple actors is necessary for this issue to be fully addressed. It is a long process requiring actionable steps, policy changes and further training of personnel. A conversational agent would not be able to accomplish such things.

However, it can be used as a centralized tool for reporting inappropriate behaviour. Spot is an AI bot first released in 2018 which allows users to report misconduct and discrimination.[53] In 2015, UNICEF's U-Report uncovered Liberian students were sexually exploited in return for grades.[54] This led to the organization working with the Ministry of Education to further address the issue.

Conversational agents can be a way to provide quick onboarding of staff members and as a resource for new employees. This includes quick access to manuals, handbooks and organization policies. Enterprises, such as the New York Metropolitan Transportation Authority, allow employees to use conversational agents to check schedules, manage their PTO and perform other HR-related tasks.[55]

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52 Mazurana, Dyan and Phoebe Donnelly. 2017. Stop the Sexual Assault Against Humanitarian and Development Aid Workers. May 2017. http://fic.tufts.edu/assets/SAAW-report_5-23.pdf, p. 2.

53 https://talktospot.com/

54 Sotomayor, Lucha. 2016. "Success Story: U-Report Liberia exposes Sex 4 Grades in School." UNICEF Stories, January 8, 2016. https://ureport.in/story/194/

55 https://www.auraplayer.com/wp-content/uploads/2018/12/MTA-Peoplesoft-HR-Chatbot.pdf.

In 2016 surveys of humanitarian staff in Afghanistan, Iraq, and Somalia, concern was expressed over the amount of time spent on reporting and drafting manual reports.[56] As one staff member in Somalia stated, "People believe making huge paper trails ensures greater transparency and accountability and, ironically, saves money. In the end, it diverts time from monitoring, training, and partner support activities that are critical in this context".[57] While current conversational agents cannot handle complex requests, it is possible for future conversational agents to assist with the generation of formal reports.

Employee information should be treated with the same dignity and security as that of affected persons. Providing a new employee with quick access to a publicly available handbook requires a different level of data security than a misconduct report containing personal information. Organization must still consider where an HR chatbot "lives" and how it interacts with the staff member.

56 *OECD. 2017. Survey of Affected People & Field Staff in Afghanistan. June 14, 2017. http://www.oecd.org/development/humanitarian-donors/docs/Afghanistan_Affected_people_survey.pdf.; OECD. 2017. Survey of Affected People & Field Staff in Iraq. October 31, 2017. http://www.oecd.org/dac/conflict-fragility-resilience/docs/OECD_Iraq_Affected_people_and_staff_survey_(October%202017).pdf.; OECD. 2017. Survey of Affected People & Field Staff in Somalia. http://www.oecd.org/development/humanitarian-donors/docs/OECD_Somalia_Affected_people_and_staff_survey.pdf.*

57 *OECD. 2017. Survey of Affected People & Field Staff in Somalia., p. 28.*

Future Outlook

All emerging technologies experience a "hype cycle". According to a 2018 Gartner report, Conversational AI Platforms will reach their plateau in 5 to 10 years.[58] Conversational AI Platforms were excluded from the 2019 emerging technologies report for its "mature state".[59] In the interim, businesses should prepare to deploy conversational agents as customers and employees expectations of interacting with AI for customer service and technical needs increases. There is some concern for an oversaturation of conversational agents and redundancy of these bots. While redundancy can help those in need by providing more options and outlets for information, there is no promise that the information provided is of the same quality.

In the future, organizations should consider consolidating their efforts and sharing vital information. Such partnerships can help sustain conversational agents for longer periods of time. Many current conversational agents are controlled by individuals or small entities. There is no guarantee that the bot in use today will still be functional tomorrow. Having a regular funding source and staff dedicated to the maintenance of the conversation agent can ensure users are receiving quality information and relevant information on a regular basis.

The technology itself plays an important role in how conversational agents will act in the future. Where AI conversational agents can be most helpful is in gauging user emotion. Sentiment analysis (opinion mining) is in its early stages and utilized in a handful of specialized areas. KokoBot, developed by MIT Media Lab, is a Kik chatbot providing users with emotional support through crowd-sourcing.[60] The bot analyzes the user's messages to provide support or connect them to another user for personalized help.

At this time, sentiment analysis is not built into the agent's natural language processing power but is an additional layer to the structure. Language differences, cultural differences and usage of slang and sarcasm can impact the confidence score or how positive, negative or neutral the interaction ranks. It is possible to use future chatbots with sentiment analysis to pinpoint instances where users

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58 Walker, M. (2018). Hype Cycle for Emerging Technologies, 2018. August 6, 2018. https://www.gartner.com/document/3885468

59 Burke, B. and David Smith. (2019). Hype Cycle for Emerging Technologies, 2019. August 6, 2019. https://www.gartner.com/document/3956015

60 https://www.kik.com/casestudy/koko/

need human assistance, to provide a satisfaction rating for the interaction and to provide an overall satisfaction rating between the user and the organization providing aid. In the meantime, enterprises are combining conversational agents with human monitors.

Overall, it is difficult to gauge what the future holds for conversational agents and AI. There is little doubt the future will see more mobile users and more digitally connected populations as investments are made toward infrastructure and the price of technology drops. By 2025, an estimated 5.8 billion individuals will be mobile subscribers with most new subscribers coming from the Asia Pacific and Sub-Saharan Africa regions. 5 billion individuals will also be mobile Internet subscribers by 2025. Government and enterprise funding will increase with the Chinese government expected to invest an estimated $30 billion toward AI.

In the end, organizations need to consider if a conversational agent is the right tool to help achieve its goals. While building a conversational agent is easier each year, new advances in technology require organizations to take more items into consideration. In the end, organizations need to realize a chatbot is still a machine and one method for engagement.