A theoretical model for the Virtual Personal Assistant

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1 Extended abstract

The theoretical model for a Virtual Personal Assistant (VPA) is part of a larger research program to develop a new model for a Decision Support System (DSS) that learns from interactions with an individual to build a personalized relationship [1]. We have hypothesized within this research program that end user supporting technologies that develop a personal relationship with will provide unique benefits to the user by providing a way to contextually explore a problem space with the user [2]. The purpose of this poster is to visualize how the proposed VPA would interact with other services, and to highlight who is in control of the end users personal data.

The VPA will utilize natural language processing, learning capabilities and response variance such as simulated emotions to explore a problem space with a professional individual. Natural language processing and learning capabilities have been used in a number of modern technologies to provide more refined and useful outputs to the end user. Examples of this can be found in systems such as *Apple's Siri* [3], *Microsoft's Cortana* [4], *Amazon's Alexa* [5] and *Google Assistant* [6]. The difference with these technologies is that they categories the end user based upon the information they gather and give suggestions based upon other users within this category. While there are benefits to this approach in a casual context, a system such as the VPA that learns entirely from a professional individual is able to form its own perspective which is an imitation of the perspective of the unique user. With this perspective the system is able to analyze and explore uncertain or ambiguous problem spaces and still provide a relevant and useful discussion with the end user. The inclusion of response variance steps the VPA away from technologies such as *IBM's Watson* [7], where the response to an input is always what the system deems as the most "correct" output. The issue with question-answering systems such as this is it doesn't account for uncertain or ambiguous situations where there may be many equally valid correct answers, or there may be none.

The poster associated with this abstract has been produced as a first step in visualizing the differences between the proposed VPA style of DSS in comparison to other intelligent agents such as Siri and Alexa. Where previous posters have focused on the internal process of a VPA's functionality [8], this poster looks at how the VPA stores data and interacts with external entities using a graph theory approach. To that end, we have produced two models: one for a Virtual Personal Assistant, and one for other intelligent agents.

The format of this model is based on a previous model produced by Bednar, Welch and Graziano [9] and has a number of notable changes. Most significantly, the rise in intelligent agent style technologies has introduced metadata as a significant data collection in any area that hosts this type of technology. This can be seen in both of the new models in the form of 'user metadata', 'third party metadata', and 'content metadata'. On the VPA model a dotted line has been added to highlight the boundary between the end user's control and centralized control of data.

The 'Other Intelligent Agents' model is a generalized representation of contemporary alternatives such as Amazon's Alexa, Google's Assistant and Apple's Siri. Although each of these systems has differences in their functionality, they all interact with an end user, learn from the interactions, but retain control of the user's data for use by the organizations that develop them. They also generate metadata based on the user's activities that allow them to align recommendations and outputs to those that are relevant to other similar users, but also opens the doorway to a level of metadata analysis that can expose information that the end user would rather keep private [10]. The VPA would allow for a more personalized and contextually relevant response variance.

These models show the difference in control the end user has when using the VPA over the other intelligent agents. When intelligent agents are centralized, giving other stakeholders control over the content, some of the usefulness of the systems responses is lost as the relationship with the user becomes less personal. This kind of relationship can also open the door to security and privacy issues with other stakeholders in control of what data is being collected on an individual. The usage of a VPA minimizes these risks by keeping all of the data and metadata produced by the intelligent agent under the control of the end user.

So what does this mean for future technologies? In essence, supporting systems like the VPA will mark a change in how supporting intelligent agents are used. In place of providing personal assistants or decision support systems that are supporting users through bounded problem spaces, the VPA offers a solution to supporting professional individuals in an uncertain or ambiguous problem space, allowing the professional to explore possible solutions with their expert knowledge.

In practice, this means that a professional individual would be able to discuss an uncertain or ambiguous problem space with the VPA and the VPA would give responses that are contextually relevant to that individual user. This provides prompts or considerations that reflect not only the problem space but also the approach to problem solving that the professional utilizes. The idea isn't to provide a "best guess" solution (as there may be many equally valid solutions, or there may be none), but to help the professional explore different alternatives to make an informed decision based upon their own personal expertise [11].

Appendix A shows a reduced image of the associated poster.

References

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Appendix A

Theoretical model for the Virtual Personal Assistant

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What is it?

The Virtual Personal Assistant (VPA) is a new theoretical model for a decision support system that uses natural language process, learning capabilities and response variance to provide contextually relevant support to professional individuals.

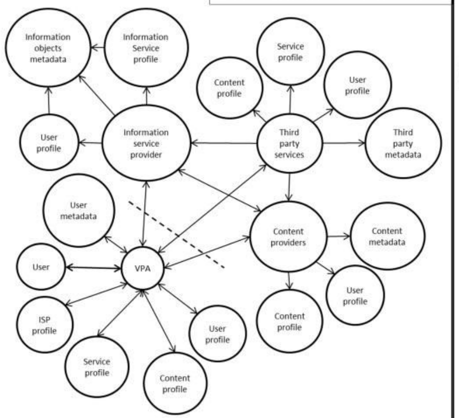
What is different?

Unlike conventional intelligent assistants like Siri or Alexa, each instance of a VPA focuses on building a metadata profile that is unique to that end user rather than placing users into categories.

What is the benefit?

By keeping the metadata produced about the end user within the end users control, the VPA and end user are able to develop a personal relationship. This allows the VPA to provide a method of exploring problem spaces using prompts that are explicitly relevant to the end user, rather than a category of users.

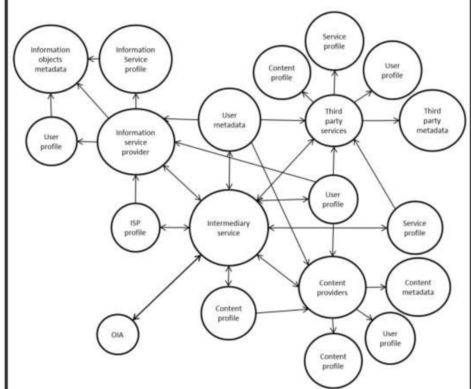
Virtual Personal Assistant (VPA)


Information objects metadata
Information Service profile
Service profile
Content profile
User profile
Information service provider
Third party services
Third party metadata
User metadata
Content providers
Content metadata
User
VPA
ISP profile
Service profile
Content profile
User profile

The user is in control of their data

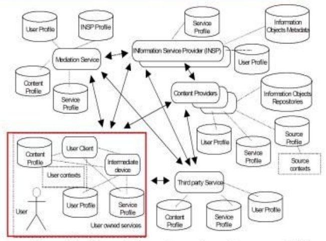
The model for the VPA shows that metadata build for interacting with the end user is held by the VPA itself, a system that the end user has control of. The relationships between the VPA, Information Service Provider, Content providers, and Third party services marks the points where data would leave the end users control.

Other Intelligent Assistants (OIA)


Information objects metadata
Information Service profile
Service profile
Content profile
User profile
User metadata
Third party services
Third party metadata
Information service provider
User profile
ISP profile
Intermediary service
Service profile
Content providers
Content metadata
Content profile
OIA

Intermediary services control the users data

This model is an example of what current intelligent assistants relationship with the end user may look like. The users metadata and profiles build about all of the external systems that the end user interacts with are all held by an intermediary service. This service would be under the control of an external organization and therefore that organization will have the ability to use the end user's data and metadata for other means.


User Profile
INSP Profile
Mediation Service
Information Service Provider (INSP)
Service Profile
Information Objects Metadata
Content Profile
Content Providers
Information Objects Repositories
User Client
Intermediate device
User contexts
Third party Service
User owned services
Source Profile
Source contexts
User

Visualization of the categories of support [1]

In 2007 Bednar, Welch and Graziano first proposed their visualisation of categories of support. This served as a foundation for our work into identifying and visualising how end users interact with external services.

Our models have been restricted to take a graph theory approach to showing relationships between datasets and data controllers with the aim to give a clear picture of where data is being stored and collected. Beyond this, the introduction of metadata gathered by intelligent systems has been introduced to full capture what data is being stored and where.

References

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