DIGITAL ASSISTANT OF A SENIOR WITH SOCIAL INTELLIGENCE

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Abstract

The paper proposes a study focusing on a proposal and basic design of a digital assistant serving for senior citizens living separately in a house of flat. The digital assistant will address basic communication needs arising because of necessary meeting of certain perceived daily basic or imperative needs whose absence would deteriorate the quality of life of such seniors by in so significant degree that it could pose a threat for their health or life. The digital assistant ensures a proper recognition and assessment of the senior behaviour and offers suitable information and resources based on principles of social intelligence.

Keywords

Senior Citizen, Senior Citizen Living Separately, Digital Assistant, Social Intelligence, Social Environment

I. Introduction

The scope and volume of human interaction with various information technology systems have been increasing rapidly and it seems apparent that, based on recent IT progress, this scope and range will have been increasing further. People are motivated, or even forced, to receive and process more and more information. Simultaneously, the ageing of many national populations has been observed; this is closely related to the decrease of communication abilities and competencies, primarily among senior citizens and people with disabilities, as well as increasing share of persons with various types of malfunctions in attention, learning etc (National Academies of Sciences, Engineering, and Medicine. (2017), Hunsaker, A. & Hargittai, E. (2018)). Therefore, it seems necessary that further development of interfaces of information technology systems commences with taking the social intelligence dimension into account, both the one of their users, but primarily one of the systems alone so that they can be considered as intelligent systems.

Intelligent systems could be understood as computer-controlled systems solving complex tasks that require a human intelligence for being solved by people. In their most general form, an intelligent system can combine both knowledge and model approach to achieve various typically human properties. Thus, intelligent systems will be oriented towards obtaining a social intelligence. The British psychologist Philip Ewart Vernon defined the concept of social intelligence as follows:

"Social intelligence reflects in the ability to get along with people in general, social technique or ease in society, knowledge of social matters, susceptibility to stimuli from other members of a group, as well as insight into the temporary moods or underlying personality traits of strangers." (Vernon (1987))

The term of social intelligence has been designed by the American psychologist Edward Lee Thorndike as abilities and skills in optimal social communication, sense of cooperation and non-conflicting relationships. According to Thorndike (1913), social intelligence consists of two components:

- Perception - Ability to recognize correctly and evaluate the human personality and behavior.
- Action - Ability to apply a suitable social technique towards other persons based on proper social perception.

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Social intelligence develops from experience with people and lessons learnt from successes and failures in the **social e**nvironment. This is more frequently called as "graciousness", "common sense", or "street cleverness".

If social intelligence is to be introduced into the interaction of a human with information and communication resources, then these resources have to communicate in an optimal social way, to provide information for solving the brought-up problems exclusively, to know how to solve various social interactions and conflicts. It is essential that such a system can affect its vicinity in a positive way, it can orient there ("to read between the lines" this what was hidden in social relations and interactions) and thus promptly respond to various stimuli that can be "read" this way. Amongst the most fundamental fields of social intelligence, the empathy (i.e., putting oneself in the feelings and experiences of other people) plays a key role. If the system has all the above features, then it will be called a digital assistant with social intelligence.

Digital assistant of a senior is an advanced computer software, simulating a dialogue with the senior, usually using the connection to the internet. Digital assistants apply an advanced artificial intelligence, natural language processing, understanding to the natural language and machine learning for continuous adaptation and providing customized experience in the conversation. Algorithms that combine historical information like preferences in the senior requests (e.g., when purchasing the daily needs) can produce data models identifying patterns of the senior's behaviour. The obtained patterns are refined as new data are added gradually. Thus, predictions of future needs of the senior citizen (e.g., for their next purchase) can be made. Thanks to the fact that digital assistants learn from the user's history, preferences, and other information, they can respond to complex questions, provide recommendations, perform forecasts and even to initiate conversations.

The key elements that the communication of the senior citizen with the digital assistant is based on, are the following:

- Fluency in the conversation – the digital assistant must provide the required information or an adequate response to the senior in real time.
- Knowledge in social roles, rules, and scripts – the digital assistant assumes a role of societally sophisticated and wise partner of a senior citizen.
- Efficient communication – the digital assistant does not encumber the senior user with information that were not requested explicitly, and/or are not relevant for him/her.

II. Status of senior citizens in present society

Ageing of population in (not only) developed countries is an unstoppable process. The significant improvement of living conditions related to the human well-being and the development of sciences have enabled the rapid increase in life expectancy. European union countries including the Czech Republic have been preparing systematically for ageing of their populations for several years. This is confirmed both national (see e.g. Strategy of preparation for ageing of the society 2019-2025 (MPSV 2019); National action plan supporting positive ageing for the period from 2013 to 2017; Report on meeting the National action plan supporting positive ageing for the period from 2013 to 2017 for year 2016 (see MPSV 2017) and international (e.g. Madrid International Plan of Action on Ageing – see United Nations(2002)) strategic documents as well as the fact that the year 2012 was declared the European Year of Active Ageing and Solidarity between Generations (see Tymowski 2015) as well as the Information on the implementation of the European year of active ageing and solidarity between generations in the Czech Republic (MPSV 2012).

Primarily in the field of social work with senior citizens and consequently in the area of social services for senior citizen target group, measures are and will be implemented supporting widening of forms and ways of providing such social services. In EU countries, in-field social services are one of crucial elements of a care for senior citizens; those services enable to solve the current situation of a client in accordance with their individual needs as well as allowing them to stay in their natural environment

as long as possible. Likewise, the goal of the Czech social policy is to assume such measures that senior citizens can stay in their natural social environment even in the terminal part of their lifespan being aided and supported by their family and relatives as well as in-field social services. The declared goal would be significantly contributed by broader and deeper usage of new information systems and technologies resulting in an increase in efficiency and consequently in an improvement of the quality of the system of social care for senior citizens as a whole, emphasizing providing the care in the natural environment of the clients and thus preventing their separation from families into institutions.

Through an active support of both senior citizens depending on care from other people, and informal care providers, one can achieve that people are going to conclude their life in their natural social environment surrounded by their intimates and relatives. Among others, purpose-developed information and communication systems can contribute achieving this goal in the current information society; such systems will mediate the more efficient mutual communication to senior citizens, informal caregivers, and social service staff, as well as arrange contacts with broader social environment. Purpose-developed information and communication systems will also preventively counteract the social exclusion of both senior citizens and informal caregivers. It is known that the longer the period of care and the more intense the care is, the more significant risks affecting their quality of life exist (see Robinson-Whelen et al. 2001).

For the purpose of this study, the following categories have been defined.

A "senior citizen living separately" shall be defined as senior citizen in the age above 65 years who live in a separate dwelling unit. This definition allows to identify properly enough such portion of the senior citizen population where the need of independent performing communication with offers from the public sector is a necessity. Regarding their separate living as well as expectable gradual decrease of self-reliance, the need to cope with certain (often even critical) situations independently (without being aided by other persons) is highly likely.

When determining the lower age boundary (here 65 years), current results of research of the health status of the senior population in the Czech Republic, summarized e.g. in Vrabcová et al. (2017), should be taken into account. The latter cited source demonstrates that while the average life expectancy in the Czech Republic gradually increases (similarly to other new EU member states), the health life years (HLY) in in the Czech Republic stagnates long-term under the age of 65 years (while this value fluctuates significantly among authors in accordance to different sources of data about health status, as documented by Vrabcová et al. (2017), Therefore, the lower age boundary at the age of 65 years as defined above, should be considered as rather indicative, bearing in mind that the occurrence of moderate till medium health limitations will be decisive for being included into the target group.

In the group of senior citizens living separately, worries about life circumstances that are difficult to cope with are likely; such worries often strengthen tendencies to abandon separate dwelling in so-called senior's natural environment towards an institution with permanent care. The tendency to abandon their independent dwelling in a natural environment due to limited ability of coping with certain circumstances without other person's aid could be present even in seniors belonging to other segments. However, it can be supposed that the results of investigation among senior citizens living separately and proposals of IT communication tools for solving circumstances experienced by them could be applied for similar seniors not living separately, with a reasonable consideration.

"Public sector offerings" are understood (just for the scope of this study) as services of public sector relevant to either everyday or unexpected circumstances in the life of a senior citizen living separately.

"Communication needs of senior citizen living separately" originate as a result of the necessity to ensure the meeting of certain apperceived everyday fundamental or imperative needs, whose not-meeting would decrease the quality of life of the persons up to such a level that their health or life could be threatened. As indicated above, if a person expects that meeting those needs could be difficult in their natural environment, they can prefer to move to an institution providing social

services. A senior citizen living separately tries to meet his/her communication needs through his/her individual "communication usances" that can be more or less efficient/successful regarding to meeting the senior citizen's everyday and/or imperative needs. The communication usances are a resultant of numerous factors including the level of physical and cognitive abilities that were maintained in the senior citizen's personality, his/her orientation in public sector services, the size of the place of residence where the senior citizen lives, economic possibilities and the level of equipment of the senior citizen's household, etc. The communication usances will differ among individual senior citizens; moreover, one can suppose that a single person will apply different communication usances depending on what sort of apperceived need is he/she trying to satisfy. A component of many communication usances will be represented by so-called communication nodes, i.e., persons, www pages or institutions that have an extensive know-how in the field of public sector services and are able and willing to mediate the subsequent communication, to ensure satisfaction of a specific need or specific needs of a specific senior citizen.

III. Digital assistant of a senior

The digital assistant of a senior makes use of data from multiple online sources and puts them into a context. An advanced natural language processing (NLP) enables processing all what was told or written by the senior. In addition, an advanced natural language understanding (NLU) allows to analyze what was told or written, and generate exact responses subsequently. The advanced natural language understanding can analyze complex sentences and separate parts forming the whole multi-part request/question thus returning a correct response.

Specific functions of the digital assistant of a senior for public sector services can be expressed a schematic relationship between "everyday/imperative needs", "communication needs" and "communication usances" of a senior citizen living separately that is illustrated in Figures 1 and 2. The amount of the senior citizen's needs that are satisfied is indicated schematically by a triangle or trapezoid. It the base of the triangle/trapezoid, all needs of the senior are indicated. The length of the triangle/trapezoid base illustrates the high number of **all** their **needs**. In the opposite vertex of the triangle (or the upper base of the trapezoid), **satisfied needs** are indicated; the single vertex (shorter length of the upper base) indicates that the number of satisfied needs is much smaller than all needs. Figures 1 and 2 illustrate two extreme variants of the relation between the "apperceived everyday/imperative needs", "communication needs" and "communication usances", respectively, when Fig. 1 illustrates disproportional relation between "apperceived everyday/imperative needs", "communication needs" a "communication usances" that results into disfunctions of the public sector in the field of satisfying the needs of senior citizens living separately. On the contrary, Fig. 2 illustrates a significant improvement in this field through the development and application of the digital assistant. The optimal situation would happen if the triangle transformed into a rectangle; however, this cannot be expected to happen in practice because certain needs of senior citizens living separately can be satisfied by their own activity; such apperceived needs do not cause any origin of a communication need.

The goal is to develop such a solution that ensures maximization of satisfied needs, i.e., it offers satisfying of imperative needs as well as communication needs to the senior citizen. Moreover, such a solution has to be in accordance with principles of social intelligence specified above. Therefore, use of so-called digital assistant looks to be suitable.

The main goal in building the digital assistant is to broaden the range of apperceived needs of the senior citizen living separately that can be satisfied using adequate communication usances, and thus to draw near to the situation that is illustrated in Fig. 2 by the quadrangle ae much close to the rectangular as possible. As a result, the period when the senior citizen living separately is able to continue living in his/her natural environment is likely to be extended (see Figure 2). The application of the digital assistant should result in broadening the awareness of seniors about what apperceived non-satisfied needs can be satisfied by a communication to public sector (i.e., increasing the volume of the senior's communication needs). Simultaneously, the digital assistant should increase the

efficiency of communication usances of senior citizens significantly (primarily because of communicating more relevant contents to relevant subjects in a way understandable for all participants in the communication), and thus, as a consequence, an increase in overall confidence in satisfaction of apperceived everyday/imperative needs of senior citizens living separately.

Figure 1 Relation between "apperceived everyday/imperative needs", "communication needs" and "communication usances" of a senior citizen living separately

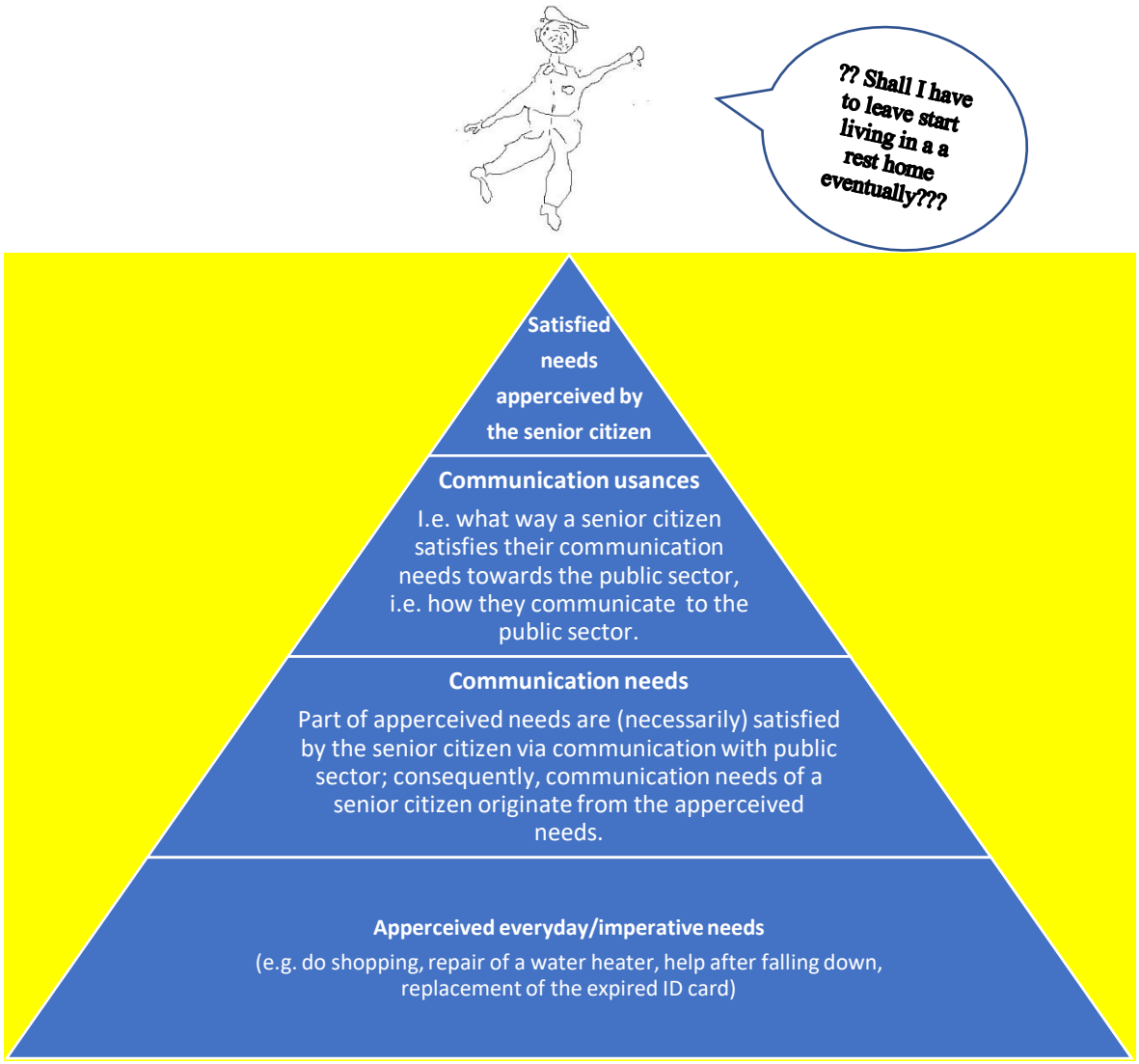
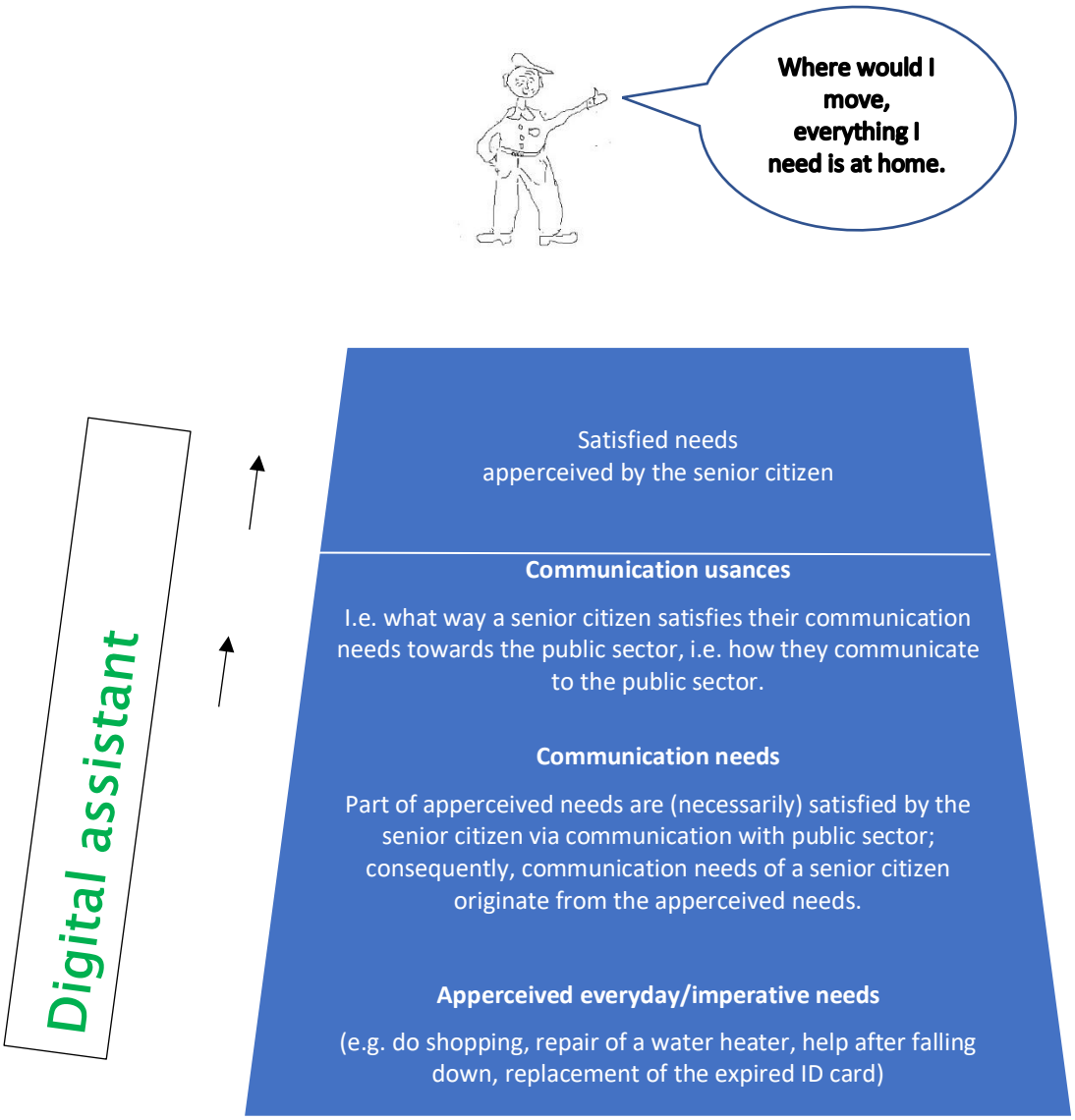


Figure 2 Relation between "apperceived everyday/imperative needs", "communication needs" and "communication usances" of a senior citizen living separately after a digital assistant implementation



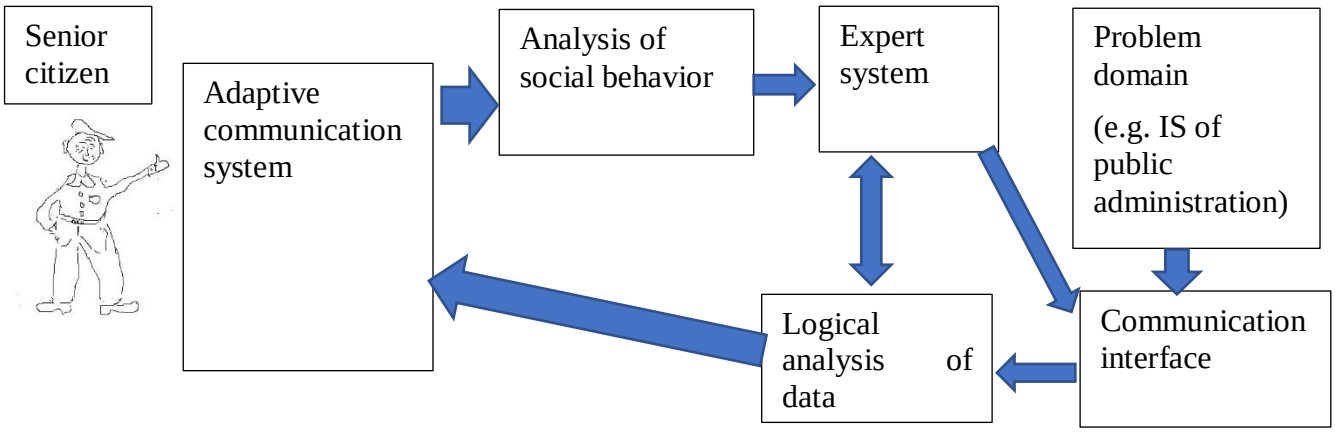
The support for the persistence of independently living senior citizens in their natural environments, that is aimed by this study through the proposal of a digital assistant communication interface, is a legitimate aim not only with regard of the fact that significant portion of senior citizens prefer their separate living to being cared in an institution, but also with regard of relatively low capacities of institutions providing permanent care in comparison to a potential demand.

So as to achieve that public sector services could meet their purpose, it is essential that relevant offerings were communicated towards relevant target groups of citizens. Therefore, the "communication needs of public sector" emerge primarily as a result of the necessity to inform citizens about the public sector offerings so that they can receive "orders" from citizens for providing services. Thus, the "communication usances of the public sector " will include the following factors: tools of communication, procedures of communication, direct and indirect participation of citizens in forming tools and procedures of communication, evaluation of the efficiency of utilized tools and procedures of communication both from the point of view of their impact on the target group and regarding their ability to satisfy the apperceived needs of the target group, thus senior citizens living separately in this case.

IV. Structure of digital assistant

Functions of the digital assistant are obvious from Fig. 3. A senior citizen communicates with the interface that is adaptive according to the senior citizen specific current needs. The social intelligence function is ensured both by the analysis of a senior citizen's social behavior, and problem-oriented expert system that transforms the senior citizen's requests and his/her social behavior into requests for the communication interface of the specific information system. The response is then logically analyzed and forwarded to the senior citizen.

Figure 3 Functions of the digital assistant



V. Conclusions

Digital assistants will bring more natural conversations, answer more complex questions, offer more elaborate recommendations and forecasts to senior citizens. When the artificial intelligence is combined with the emerging 5G technology, the recommendations and forecasts will come quicker, and digital assistants will be likely to include more advanced features like High-definition videoconferencing. It is likely that many senior citizens can have their digital assistant in the place of their residence and thus their everyday communication and information needs are met.

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