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Helping older people: is there an app for that?

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Abstract

From social networks to health and fitness, everyday a lot of mobile devices applications (apps) are being developed. The variety and availability is such that people start to think that indeed "there's an app for everything". Many of these apps address either problems or characteristics that affect older people and that are related with the ageing process (e.g. memory and visual aids apps). They can effectively help people and are under constant evolution.

However, the lack of knowledge about these available technological aids can undermine its dissemination and consequently the help that people really receive, especially those who need it the most: older people. As such, a methodological search for available aid apps was made both in Google Play and in iTunes: 536 were selected, their classification analysed and the kind of help that they provide identified. It was noted that either in Google Play or in iTunes the apps' categories are similar. Furthermore, it is not easily perceived what the type of help that each app can provide is and how is it provided.

Hence, based on the results from the aforementioned methodological search, this paper proposes a new scalable tree-based classification methodology for aid apps, which is considered more suited to perceive what the available aid apps for mobile devices are. The existing apps were then characterized based on the proposed classification, to determine what the main aid that they provide is.

Keywords: Apps, Classification; Aid; Mobile devices; Older people.

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1. Introduction

Population ageing is progressing rapidly in the world, especially in developed countries. This tendency is creating an attractive market for most information and communications technology (ICT) products and applications, as well as for smartphones and other personal technological devices. Since Apple launched its trademark catchphrase "There's an app for that", people started to imagine that there's an app for everything. This catchphrase is even defined in the Urban Dictionary[1] as a possible answer to other peoples' problems.

Everyday, a great deal of apps is being developed for a variety of purposes. Many address either problems or characteristics that affect older people and may include functionalities known to be commonly related to the ageing process, such as: memory, visual and haptic aids; features to minimize error and safety features[2]. Some apps are specially designed to facilitate the use of smartphones by older people. As such, they may be focused on their interface, namely by simplifying its general appearance, reducing the number of features and steps for basic tasks and increasing pictures' size and the text font. Knowing that technology is constantly evolving and helping to solve new problems, the potential of the aforementioned technologies for helping older people is far superior to the help that is indeed received.

The usual barriers to the use of ICT products and applications by older people are related to the devices' accessibility and support, to age, marital status, education and health[3]. Particularly when regarding aid apps, another possible reason is the lack of knowledge about the available aids and their usefulness. There is also an excess of information and permanent changes of available solutions. If it is not expected that a common smartphone user searches for novelties in apps stores everyday, when it comes to an older person this simply won't happen. Perceiving usefulness is a strong motivation for the use of ICT[3].

A methodological search made in Google Play and iTunes for apps considered to be of help to people is presented: 536 were selected, their classification analysed and the kind of help that they provide identified. Based on its results, this paper proposes a new scalable tree-based classification methodology for aid apps, which is considered more suited to perceive what the available aid apps for mobile devices are. Then, the existing apps are characterized based on the proposed classification, to determine what the main aid that they provide is.

With the proposed classification methodology, the authors intend to contribute to better organize apps and to clarify how smartphones might effectively help older people.

The rest of the paper is structured as follows: in Section 2, some related work regarding apps classification schemas is presented. Then, in Section 3, the methodology used for selecting existing apps that might be of help to older people is detailed. Google Play and iTunes apps classification and organization schemas are compared in Section 4. Finally and just before the conclusions that derived from this study, presented in Section 6, a new scalable tree-based apps classification methodology, focused on problems or characteristics that affect older people and that are related with the ageing process, are presented and discussed in Section 5.

2. Related work

The classification of applications for mobile devices is made by those who develop them in the submission process to an app store. This may mislead users, especially in app stores with permissive publication policies. Additionally, each store relies on its own classification scheme, targeted to its functionality. For instance, the Amazon app store focuses on readers, hence its classification scheme is more directed to that target-audience than to common users. As such, it only hosts apps for the Kindle eBook reader[4].

West et al.[5] in 2012 conducted a study with the objective to overview the developers' written descriptions of health and fitness apps and to appraise each app's potential for influencing behaviour change. They analysed the descriptions of 3336 paid apps from the health and fitness categories, available on iTunes during February 2011. Then they were categorized using the Precede-Proceed Model (PPM)[6], which identifies the functions or goals of health-related mobile apps into three categories: predisposing, enabling, and reinforcing.

In 2014, Wang A. et al.[7] proposed a classification scheme for analysing apps used to prevent and manage disease in late life. Their purpose was to facilitate the selection of mobile applications by older adults so that they can choose the most appropriate apps for them. They selected 199 apps from the "Health & Fitness" category of iTunes, analysed

the developers' description and constructed a classification scheme for the classification of mobile applications according to three dimensions:
1. the PPM categorization of West et al.[5] expanded with;
2. whether the apps are for disease management and/or prevention;
3. whether they are related to physical and/or mental health.

The authors point out as limitations that they adopted a generalized classification scheme rather than a finer-grained one and therefore it provides older adults little specific information regarding particular health conditions in which they might be interested. Furthermore, they chose to consider those apps that would have potential relevance for older adults and not people of all ages.

In a scenario in which a person wants to search and find an app suitable for its own needs, it would be more useful to have a unique classification scheme, according to which all apps are classified. This scheme should be independent of the store where a given app is marketed and user-defined.

3. Aid apps selection methodology

To identify existing mobile applications that might be of help to older people, the authors began by determining a set of problems or characteristics that can affect them and that are related with the ageing process. Then, a systematic search was conducted in two of the most popular apps stores, to identify the apps that comply with the defined criteria.

3.1. Search keywords determination

To identify existing mobile applications that might be of help to older people, a systematic search was conducted using two of the most popular mobile operating systems (OS) apps stores: Google Play (Android, Google) and iTunes (iOS, Apple). According to the International Data Corporation[8], in the end of the second quarter of 2015, Android had 82.8% of the worldwide smartphone OS market share and iOS had 13.9%. The remainder OS only represent 3.3%.

To begin the process that led to the aforementioned systematic search, the main human capabilities that can change with the ageing process were determined and are presented in Table 1 a). Thereafter, a set of 76 related keywords - mainly substantives such as "arm", "nose", "memory", "taste" and "cholesterol"- was chosen. The full keyword list is presented in Table 1 b).

3.2. Apps selection

The process continues by entering each of the related keywords - Table 1 b) - on both the preceding apps stores' search engines. Mobile applications were selected in two stages:
1. **Pre-selection** - A first set of apps was selected based solely on each mobile application name, title or image. Any one of these characteristics should suggest that it was an aid to an older person. Those apps that seemed similar or duplicated were ignored after the tenth occurrence. The list of results was analysed until either the results were no longer related with this paper's purpose or after reaching the 100th mobile application.
2. **List validation** - Each app that resulted from the pre-selection stage was then analysed and reselected if, by reading its description, it was confirmed that it might of help to older people. Otherwise, it was rejected. For the final list of apps, both their store Link and Category were registered.

After finishing the systematic search, a total of 536 apps were considered to be of some kind of help to an older person. As a remark, the mobile applications were selected based only on the description available on the app stores. None of them was tested. The authors are aware of some risks, negative issues and worrying deficiencies in existing apps, but these matters are not in this paper's scope.

Table 1. Main capabilities' changes during people aging and Result keywords

a) Main capabilities' changes during people aging

Capabilities changes	Consequences
Sensory impairments	Vision impairment: blurred vision; central image distortion; blurred vision; sensitive to brightness; loss of visual field; poor night vision.
	Hearing impairment: Problems listening to the phone; difficulty following conversations; perception that others murmur
	Taste and smell impairment: Loss of appetite, weight loss, malnutrition (weakened immunity)
	Touch impairment: Increased thermal pain threshold
Motor impairment	Overall decrease of energy and vigour; joint degeneration; postural instability;
Cognitive impairments	Loss of memory, concentration and organization
Body changes	Urinary problems; cardiac and respiratory problems; weakened immunity; loss of blood flow
Appearance change	Appearance of wrinkles and blemishes; Loss of skin elasticity; Hair colour loss; Loss of muscle mass

b) Result keywords

ankles, back, blood pressure, breath, capability, care, cognitive, cholesterol, deaf, dementia, difficulty, disability, distraction, ear, elder, esteem, evaluation, eyes, eyesight, fat, feel, finger, flavour, foot, great, hand, head, health, hear, hearing, heart rhythm, heavy, helper, humour, illusion, injury, kitchen, knees, leg, listen, look, looking, me, memory, mental, motor, mouth, neck, nose, ocular, odour, old people, physical, physiotherapy, psychological, psychologist, relax, savourless, senior, shoulder, sight, skinny, smell, stress, surd, tact, taste, test, tester, therapy, thin, touch, trauma, view and vision.

4. Analysis of Google Play and iTunes categories: the user's perspective

Google Play and iTunes have their apps organized by categories that once compared have multiple similarities. The 536 apps that resulted from the systematic search presented in section 3 are distributed in both stores, according to their respective categories schema. To understand how, the authors opted for:
- categories that shared the same name were grouped;
- similar categories that did not shared the same name were grouped in a new category whose name comprises the designations of both stores (e.g. categories such as "Utilities" from iTunes and "Tools" from Google Play were grouped in a new category named "Tools & Utilities");
- completely different categories have remained.

Figure 1 presents the graphic with the 536 selected apps, organized by grouped categories, as previously explained. These categories are organized by descending order, based on the number of apps that each one contains. Also, apps that were available on both platforms are represented under the label "Both".

Through the analysis of the graphic depicted in Figure 1, the most numerous category is "Health & Fitness" with 250 apps: 158 belonging to Google Play, 83 from iTunes and 10 available in both stores. The following category is "Medical", with 102 apps. Together, these two categories - directly related to the notions of "help" - have 352 apps, which is more than half of the 536 selected apps. Considering both the aim and the keywords of the methodology used to select the aid apps, this was to be expected.

The remaining apps are distributed in diverse categories. The most numerous are: "educational" with 33, "games" has 29, 27 in "communication" and "lifestyle" with (23). Together, they have 112 apps, which is the total number of apps of the remainder categories listed: "Tools & Utilities", "Books & Reference", "Entertainment", "Productivity", "Social", "Photo & Video & Multimedia", "Food & Drink", "Travel & Local", "Music & Audio", "Sports" and "Business".

These latter categories are not easily associated with the concept of "help" and it is not perceptible how their apps can be of help to older people.
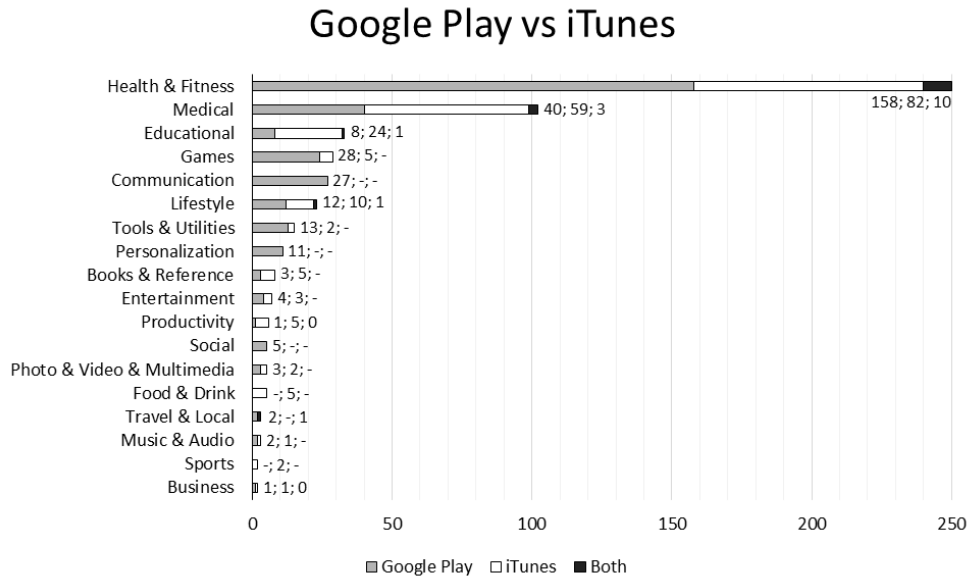

Fig. 1. Selected Apps organized by grouped categories.

5. Help Apps

To characterize the help that the selected apps can provide they were re-organized in: help-type, which is a noun that characterizes the type of help; and help-how, which is a set up to three words that typify the provided help. Table 2 presents a list of "help-type" categories with at least four attributed apps.

Table 2. Considering the previously selected apps, this table reorganizes them and presents a list of "help-type" categories, with at least four attributed apps.

Diagnostic	**64**	Magnifier	6	Physical activity	5	Speed	10
Visual	21	Drugs recognition	5	Step counter	5	Strengthen	10
Hearing	14	Pictogram-to-speech	5	Auto-localization	4	Calculation	9
Memory	4	Body mass index estimation	4	**Protection**	**16**	Injury rehabilitation	8
History	**49**	Communicate	4	Drugs reminder	8	Injury prevention	7
Blood pressure	20	Reassurement	4	Eyes - Blue light	6	Posture correction	7
Weight	6	**Informative**	**69**	**Simulation**	**6**	Visual stimulation	7
Calories consumption	5	Good health	12	Slimmer appearance	6	Cognitive abilities	5
Organize activities of daily living	4	SOS Informative	10	**Trainer**	**221**	Recognition	5
Improve	**152**	Dementia	7	Memory	34	**Tutorial**	**49**
Relaxation	38	Cholesterol control	5	Relaxation	25	Injury rehabilitation	8
Speech-to-text	18	Physical care	4	Focus	15	Sign language	8
Text-to-speech	18	Wheel chair support	4	Logic	15	Improve Self-esteem	7
Amplify	15	**Interface**	**3**	Fitness	14	Massages	4
SOS Request	8	**Measurement**	**33**	Improve breathing	12		
Risk estimation	7	Heart beats	10	Physiotherapy	10		

Through the analysis of the previously selected apps, ten categories were identified and are represented in Table 2 in bold and with a gray background. All of them have at least one "help-how" subcategory with more than three apps selected, except for the "Interface" category. Other categories can be added when the need arises. The next subsections will provide a definition for each of the aforementioned ten "help-type" categories, with examples of identified "help-how" and the respective selected apps.

5.1. Diagnosis

This category considers applications that based on a user survey and data acquisition from sensors (both internal and external), seek to provide an indicative diagnosis. Most the times, developers advise users to confirm the indicative diagnosis with medical experts. From the selected apps, 64 fit this purpose. Twenty different "help-how" categories were identified. From these, three were more relevant having 39 in 64 apps. A few examples of apps belonging to these categories are:

- "Diagnosis/Visual": "Eye Care Plus" app[10] allows for a visual acuity test, namely Snellen chart, LoGMAR table, table-Sivtsev Golovin, Landolt C and E rotary table.
- "Diagnosis/Hearing": "Hearing test" is a hearing test to check the level of speech understanding[11].

5.2. History

The History category has applications that use the smartphone to record the history of events. A total of 49 apps that fit this purpose were identified, along with 13 different "help-how" categories. From these, 4 were deemed more relevant, with 35 apps. Some examples are:

- "History/Blood pressure", "History/Weight": "Bood Pressure diary" helps to keep record of blood pressure, pulse and weight readings, taken by doctors or at home. Data records include site and position, systolic and diastolic, heart rate (pulse), weight (kg / lb) and comments, which are presented either as statistical or in graphics[12].
- "History/Organize activities of daily living": "CarePlan inmente", can help to create a structured and organized life for people with dementia, while supervising daily activities[13].

5.3. Improve

Applications that somehow improve users' skills were considered in the Improve category, having been identified 152 apps and 24 different "help-how" categories. With 132 apps, 12 of the latter were considered more relevant. A few apps examples are presented next:

- "Improve/Amplify": The "Hear" app helps people with hearing deficit to more accurately control both the direction as the area from which they receive sound[14].
- "Improve/Relaxation": "Sleep Helper" plays gentle music, creating a special atmosphere to help overcome the disadvantages factors of sleep insomnia and to improve sleep quality[15].
- "Improve/Text-to-speech": "AAC Speech" is an app that provides a generic communication tool for anyone with speech disabilities. It forms grammatically correct sentences when a series of pictograms are clicked and then speaks them aloud (text-to-speech)[16].

5.4. Informative

This category has applications that inform users about subjects that they need help with. From the previously selected apps, 69 were placed here and 22 different "help-how" categories were identified. With a combined total of 42 apps, 6 "help-how" categories were considered more relevant. A few example apps from some of these more relevant categories are:

- "Informative/Good health": "Nutrition Facts" is a quick guide that allows to search 8000 foods for accurate nutrition and facts, including fat, cholesterol, protein, carbs, calories, omega 3 and others[17].

- "Informative/SOS Informative": "In Case of Emergency" is a guide to help senior citizens and their families to prepare to a medical emergency[18].
- "Informative/Dementia": "BPSD Guide" app is a guide for medical personnel and caretakers caring for persons living with dementia and that have behavioral and psychological symptoms[19].

5.5. Interface

Apps that use the smartphone interface to interact or to control other devices, or that allow to remotely control a smartphone, were considered to this category. A total of 3 apps were identified, along with 2 different "help-how" categories.

- "Interface/Wheel chair": "Tecla" works as an input method which enables external access to android and to most of its functions[20].
- "Interface/Hearing aid": "TruLink Hearing" app connects the user hearing aids to its smartphone to easily stream the phone's sound directly to its ears[21].

5.6. Measurement

Applications based on sensors (internal or external) that measure and estimate magnitudes of the user's activities were considered in the "Measurement" category, having been identified 33 apps and 10 different "help-how" categories. With 24 apps, 4 of the latter were considered more relevant. A few example apps from some of these more relevant categories are:

- "Measurement/Heart beats": "Cardiio" measures the user's heart rate and relates it with its health. It also has effective workouts to get in shape and tracks the progresses made[22]. This app can also be classified in the "Tutorials" and "Trainer" help-type categories.
- "Measurement/Step counter": "Pacer" counts a user's steps to provide help in getting an active life[23]. This app can also be placed in the "Tutorial" and "Trainer" help-type categories.

5.7. Protection

This category has applications to protect the user by creating actions and/or preventive alarms. A total of 16 apps that fit this purpose were identified, along with 4 different "help-how" categories. With a combined total of 14 apps, 2 "help-how" categories were considered more relevant. A few examples of apps belonging to these categories are:

- "Protection/Drugs reminder": The "Med Helper Pill Reminder" app keeps track of user prescriptions, manages medications intake and stock, as well as doctor's appointments[24].
- "Protection/Eyes - Blue light": "Eyes Protector Bluelight" warns about prolonged exposure to smartphones' blue light[25].

5.8. Simulation

Applications that allow to foresee the impact of certain products or actions were considered in the "Simulation" category, having been identified 6 apps and 1 "help-how" category - "Slimmer appearance" - with 6 apps. Some examples are:

- "Simulation/Slimmer appearance": "Slim & Skinny" can generate a perfect figure[26].

5.9. Trainer

In the Trainer category, tutorial applications that teach techniques and that propose a training plan to achieve certain goals were considered. Typically, these apps also monitor the training progress by means of sensors (internal or external) and/or by the manual introduction of feedback information. With 221 apps and 35 different "help-how"

categories identified, 16 of the latter (summing up 193 apps) were considered more relevant. A few example apps from some of these more relevant categories are:

- "Trainer/Memory" and "Trainer/Focus": "Brain-Train" is an app that selects exercises promoting creative thinking, analytical vision, improved concentration, memory, and processing speed[27].
- "Trainer/Relaxation": "Calm - Meditate, Sleep, Relax" teaches how to meditate, help sleep and to relax[28]. It also fits in the "Tutorials" and the "Improve" help-type.

5.10. Tutorials

This category has informative applications that in addition to inform, also teach users on how to apply techniques to achieve a particular purpose. A total of 49 apps were identified, along with 19 different "help-how" categories. Four categories were deemed more relevant, with 27 apps, such as:

- "Tutorials/Injury rehabilitation": "Strappt" is an app to assist on applying strapping techniques for injury rehabilitation and prevention[29].
- "Tutorials/Sign language": "Sign Language" helps to learn how to fingerspell words, numbers, sign basic sentences, idioms, deaf culture[30].
- "Tutorials/Improve Self-steem": "Free Hypnosis Self Esteem" helps to boost confidence through video "hypnosis session"[31].

Summing up, from a general analysis of Table 2, four app groups stand out:
1) The "Trainer" and "Improve" categories with 221 and 152 apps, respectively, represent 56% of the previously selected aid apps. They provide a wide range of different ways of help and are, presently, the most available aids.
2) Aids from the "Informative" (69 apps) and from the "Diagnostic" (64 apps) categories represent 20% of the considered apps.
3) Also representing 20% of the selected apps are the "Tutorial", "History" and "Measurement" categories, with 49, 49 and 33 apps, respectively.
4) Finally, "Protection", "Simulation" and "Interface" categories represent only 4% of the total number of selected apps, which is not relevant.

This analysis was obtained based on the previously selected applications considered to be of help to people, within the defined selection criteria and to the systematic search date. It is to be expected that the available aid apps change with time. This is why the use of a classification schema like the one proposed in this paper is important, because it will allow people to realize what is available.

6. Conclusions

A systematic search was conducted in two of the most popular apps stores - Google Play and iTunes - to identify apps that the authors considered to be of help to older people. The search result was the identification of 536 apps. In the aforementioned stores, apps are organized according with each store's categories schema, which are similar when compared and do not allow to easily perceive what is the type of help that each app can provide and how is it provided.

This paper proposes a new scalable tree-based classification methodology for aid apps based on two types of categories – "help-type" and "help-how" - which is considered more suited to perceive what the available aid apps are. The identified apps were then characterized based on the proposed classification and categories were selected, to determine what the main aid that they provide is.

As future work, a model that allows the identification of apps based on the ageing-related changes in the human body is in its final development stage.

Acknowledgements

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