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# Advances in MASELTOV – Serious Games in a Mobile Ecology of Services for Social Inclusion and Empowerment of Recent Immigrants

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**Abstract.** Immigration imposes a range of challenges with the risk of social exclusion. As part of a comprehensive suite of services for immigrants, the MASELTOV game seeks to provide both practical tools and innovative learning services via mobile devices, providing a readily usable resource for recent immigrants. We introduce advanced results, such as the game-based learning aspect in the frame of recommender services, and present the rationale behind its interaction design. Benefits and implications of mobile platforms and emergent data capture techniques for game-based learning are discussed, as are methods for putting engaging gameplay at the forefront of the experience whilst relying on rich data capture and analysis to provide effective learning solutions.

**Keywords.** Mobile serious game, social inclusion, incidental learning framework, recommender system, human factors.

## 1 Introduction

Immigration imposes a range of challenges, including successful communication with members of the local society and understanding the culture of the host nation. Failure to overcome these challenges can lead to social exclusion from the information society (Halfman 1998) and difficulties of integration leading to fragmented

adfa, p. 1, 2011.

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communities and a range of social issues. With a comprehensive suite of services for immigrants, the European project MASELTOV<sup>1</sup> (Mobile Assistance for Social Inclusion and Empowerment of Immigrants with Persuasive Learning Technologies and Social Network Services) seeks to provide both practical tools and innovative learning services via mobile devices, providing a readily usable resource for recent immigrants. The services will support the development of communication skills, situated incidental learning of the target language and culture, and finally foster employability. The prototypical service implicitly has the potential to scale up to a very large number of end users, complementing popular online social networks for language learning.

Game-based components of education have been widely used in pedagogical approaches such as those of Vygotsky (1970) as a means for allowing learners to develop their understanding through abstraction; however, the emergence of digital technologies has played a key role in defining the notion of "serious" games, a term which broadly recognizes the use of digital technologies and parallels to digital gaming for entertainment purposes as having educational potential when aligned with a set of pedagogical goals. Context is of central relevance when seeking to deploy game-based learning (Muratet et al., 2012), as it can drive decisions regarding how much intrinsic motivation can be expected on the part of the learner, and in turn how much the game must foster the desire amongst learners to engage with the game as a recreational activity rather than a formal educational pursuit.



**Figure 1. Using the MASELTOV app (MAPP) for mixed reality gaming in the streets.**

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<sup>1</sup> <http://www.maseltov.eu>

In the particular case of cultural learning amongst immigrants, MASELTOV addresses the specific challenge of providing mobile services to immigrants via a suite of Android applications. By providing immediate support in addressing day-to-day challenges, whilst simultaneously allowing immigrants to learn key skills, these immediate supports become less required over time: they provide “scaffolding” to learning that can fade into the background when no longer required. The role of game-based learning in such a context must be carefully considered; the suite of MASELTOV services will provide on-demand educational content, and therefore caution must be taken to prevent game-based learning services simply presenting a more obtuse representation of this educational content. The MASELTOV game may also go beyond its target audience of immigrants, involving and raising awareness amongst the general population through the provision of an entertaining game. Finally, we provide more background into the target audience, and existing games targeted at raising cultural awareness or conveying cultural learning content.

In the case of game-based learning within MASELTOV, it is suggested that a game may provide a resource which allows users to identify through analogy areas in which cultural differences are most prominent, the form these differences might take, and strategies to address them. A game-based resource might also have appeal to audiences with little willingness to engage with more formal educational content, such as structured language lessons. This synergizes with the gamified, social approach to language learning presented by other services within MASELTOV such as those provided by social network based language learning communities, though also presents challenges in developing a game design suitable for this usage context and target audience. In Section 3, these challenges and the design approaches taken to address them are outlined. Sections 4 and 5 then present an early prototype design of the MASELTOV game, and discuss how it aims to synergize with the other MASELTOV services whilst providing a playful environment for cultural learning.

We introduce recent results, based on the initial game-based learning concept of the MASELTOV project presented in Dunwell et al. (2013). The benefits and implications of mobile platforms and emergent data capture techniques for game-based learning are discussed, as are methods for putting engaging gameplay at the forefront of the experience whilst relying on rich data capture and analysis to provide an effective learning solution. We specifically introduce a recommender system that proposes activities and content in the context of an ever progressing learning journey. Language lessons, communication in social fora as well as interaction with local citizens are activities recommended by the system, and, if successfully mastered, at the same time may foster progress in the serious game.

## **2 MASELTOV – a suite of playful services**

The European MASELTOV project recognizes the major risks for social exclusion of immigrants from the local information society and identifies the considerable potential of mobile services for promoting integration and cultural diversity: Everywhere/anytime (pervasive) assistance is crucial for more efficient and sustainable

support of immigrants. Language understanding, local community building, as well as awareness and knowledge for bridging of cultural differences will be fostered via the development of innovative social computing services that motivate and support informal learning for the appropriation of highly relevant daily skills.

A mobile service based assistant embeds these novel information and learning services such as ubiquitous language translation, navigation, administrative and emergency health services that address activities towards the social inclusion of immigrants in a pervasive and playful manner. MASELTOV is developing a mixed reality game in which the user applies her language skills in various situations, such as in dialogues during shopping, or for navigation in the urban environment (cf. Figure 1). The mobile service supports her in the situation as well as receives feedback from the user in order to measure or estimate performance.

The ecology of mobile services of MASELTOV includes:

**Peer reviewed language learning:** language exercises focusing around everyday tasks. The service is offering learning materials set at the Common European Framework of Reference for Languages (CEFR) A1 and A2 standard, but also some more elementary material to help very recent immigrants with their immediate needs. When an exercise is completed, it will be assessed by a peer learner. Further discussion will be possible via linked social forums. Progress will be recorded by a user profile system.

**Mobile navigation tool:** to help with directions, indicating local places of interest and services. The navigation tool will support pedestrian as well as public transport travel giving orientation information, distance to location and best route. Information about important services in the nearby environment will be shown (e.g. doctors, libraries, public transport stops). If selected by the learner, proximity to particular locations or types of buildings may trigger learning exercises or in-context language support.

**Profile system:** the user's details and learning progress will be recorded to enable personalized learning. The MASELTOV system will recommend particular types of content or learning exercises to support each learner's particular needs. Learners will be able to personalize their learning journey, indicating what is important to them.

**Geo-social radar:** A volunteer helper service allowing users to find nearby volunteers who can help them with a problem, for example acting as a translator at a doctor's appointment, or negotiating local bureaucracy.

**TextLens:** allows a learner to take a photo of a sign, and have this converted to text. This can then be coupled with a language translation tool such as Google Translate. Images and text can be uploaded for help when the meaning is ambiguous, and if the learner wishes to discuss their social, cultural or legal implications.

### 3 User Centred Design

When adopting user-centered design (UCD), the involvement of target users in the design and development process of a new service is crucial for its success (Vredenburg et al. 2001). Based on frequent user feedback addressing ideas, scenarios and prototypes the service concept is iterated and refined in order to match and satisfy users' needs. However, former research has shown that cultural differences (e.g. perceptual and cognitive processing) matter in interface design and affect the quality of user generated feedback within a UCD process (Callahan 2005). A precondition to any user involving activity is to know who the users of the service will be. MASELTOV and the serious game aim at supporting immigrants to approach socio-cultural conditions of the host country and successfully integrate themselves (and their relatives) into the foreign societal system.

Immigrants moving to countries within the European Union come from all over the world and form a very heterogeneous group (Eurostat 2013). Due to great variety of user characteristics depending on maternal language, cultural background, motivation, education, profession, religion and duration of stay, immigrants' needs (such as individual, social as well as security related) differ widely. Hence, approaching all immigrants in Europe at once seems to be unreasonable, especially when supporting social integration. Keeping the cultural diversity in mind, we explicitly target three large immigrant groups within the European Union (Eurostat 2013): Arabic-speaking immigrants from North Africa, Turkish-speaking Turks and Spanish-speaking Latin Americans. These groups are meant to have a perceptibly different cultural background than Western cultures, especially in the cultural dimensions of power-distance and collectivism/ individualism (Hofstede 2001) which should be addressed within the serious game.

Working with immigrant users requires the consideration of some special challenges for the process of UCD: (i) in general the impact of the cultural orientation of the immigrants toward the home and the host country on the design process is unclear, (ii) designers might not be familiar with relevant particularities within the cultural orientation of the home country (e.g. basic values, attitudes), (iii) recruitment processes for the successful acquisition of participating volunteers from a vulnerable user group according to pre-defined criteria are complex and laborious (Aykin et al. 2006), and (iv) mistrust towards involved experts from design and research might lead to a lack of frankness on the part of the immigrants (Hynes 2003). These issues and challenges emphasize the importance of user involvement as otherwise no accurate predictions can be made whether immigrants of the defined target group would be able and willing to use the developed services. To reduce the mentioned issues we created a framework for the requirements analysis of the UCD process (Bobeth et al. 2013) and collaborated with three nongovernmental organizations (NGOs) in Graz (Austria), London (UK) and Madrid (Spain) who provide support services for immigrants and organized the recruitment of the participants for user involving activities in MASELTOV.

### **3.1 Procedure for requirements analysis**

To gain deeper insights into barriers and problems in everyday life of immigrants, we conducted semi-structured interviews with 20 participants (10 Arab, 3 Ecuadorian and 7 Turkish immigrants). Based on the interview data and previously elaborated concepts the MASELTOV service scenarios were formulated. Aiming to earn valuable feedback and to create additional input, we discussed the service scenarios within focus groups with overall 37 immigrants at the NGOs. In contrast to the interviews, we invited more accommodated immigrants who had lived in the host country for more than three years. The goal of the focus groups was to discuss the service concepts and further ideas by benefiting from participants' experience and retro perspective reflection. Participating immigrants appreciated the idea of having a serious game to become aware of cultural differences in the host countries. They found playful explanations motivating and believed that the acquired knowledge could help them to feel more comfortable in everyday life.

### **3.2 Usability Studies for feedback on design**

Based on the results of the requirements analysis user interfaces for the MASELTOV services including the serious game were designed following an iterative process. At first, elementary user interface concepts were elaborated and discussed with usability experts. The updated mock-ups were evaluated by immigrants within a usability evaluation study, whose purpose was to identify usability issues of the current user interfaces and to gather suggestions for improvement. By performing a set of tasks and interacting with the gaming application on one and the same mobile device the participants were encouraged to talk to each other about the system's behavior (Wildmann 1996). The results of the evaluation showed that the idea of the game was in general assessed very positively as the participants welcomed the playful approach to learn about cultural differences. User feedback and elaborated design suggestions served as input for the next design iteration when the concepts were refined and finalized.

## **4 Incidental Learning and Progress Indicators**

### **4.1 Incidental learning**

Incidental learning has been defined as "unintentional or unplanned learning that results from other activities", and it is an emerging paradigm in mobile language learning (Song & Fox, 2008). Incidental learning occurs during everyday activities, and while it may be triggered by events or incidents and solve an immediate problem (Silva, 2007), it can also happen in more reflective moments, such as while engaging in leisure activities like game playing, or in the course of observation, conversation or social interaction (Le Clus, 2011). Incidental learning is often triggered by context, and is therefore a particularly suitable mode of learning for mediation via mobile devices such as smart phones that are ubiquitous in daily lives and enhanced by sensors that can make sense of the environment and trigger recommendations. For example, in a typical MASELTOV scenario, an inbuilt GPS sensor may register that the user is in the locality of a train station, and may offer to provide a language learning

lesson based around travelling. Knowledge gained from incidental learning has been argued to develop self-confidence and increase self-knowledge in learning (Ogata & Yano, 2004) and is hence particularly suitable for recent immigrants who may not have had previous positive experiences with formal education.

Flexibility in educational provision and delivery is crucial to support these learners, who may also struggle to attend regular classroom based learning due to constraints of work and family lives. Mobile ICT based learning may therefore provide a very suitable form of education for immigrants (Kluzer et al. 2011, pp.9-10). Mobile phones are known and trusted by many people, and ‘domesticated’ into their everyday practices. This integration with everyday life is beneficial for language learning. Second language acquisition is perceived by adult migrants as well as host governments, “as a crucial factor for socio-economic and cultural integration”, with language acquisition and social integration closely intertwined (Van Avermaet & Gysen, 2009). For example, knowledge of specific terminology is required to sit a driving licence exam, which then opens up opportunities for employment (Farinati et al., 2012).

However, a challenge with incidental learning is that, since it occurs in everyday life during other activities, it may occur in “fragments” or small learning episodes that are weakly structured and disconnected from each other. It is therefore necessary to understand how such fragmented learning episodes can be reconceived by users as elements of a more coherent, longer term learning journey towards social inclusion. We argue that timely and appropriate feedback and progress indicators may encourage this shift towards a more reflective learning process.

#### **4.2 Feedback and progress indicators**

We propose that feedback and progress indicators (FPIs) may play an instrumental role in helping learners reflect upon the individual learning episodes and conceive them as constituting elements of a longer learning journey (Gaved et al., 2013). Furthermore, educational research suggests that timely and appropriate feedback and indicators of progress can motivate learners (Nix and Wyllie, 2009). We define ‘feedback’ as responses to a learner’s performance against criteria of quality and as a means of directing and encouraging the learner; and ‘progress indicators’ as responses indicating the current position of a learner within a larger activity or. Well-presented feedback can help learners to take responsibility for their own learning. In addition, learners’ activity using a computer mediated set of learning tools (such as the MASELTOV serious game and other apps) can be captured and held within the system to act as feedback to the software and educational developers, who can act on patterns of use to iteratively improve their services, for example recognizing that learners struggle with particular tasks, either because the user interface requires further design or because the content itself is at an inappropriate level.

FPIs provided to the learners can be instantiated in a range of ways and can be cognitive (such as knowledge achieved, assessment results), affective (praise, emotional reflection) and social (peer ratings of quality of participation, support). FPIs are recognized as an important aspect of learning, and have been well described for both formal and informal learning. We have identified previously (Gaved et al., 2013) that



there is a scarcity of FPIs present in incidental learning, notably with respect to goal setting, planning, structured feedback from peers, and reflection on improving performance for specific activities. Encouraging these specific types of feedback and progress indicators may enable the transition from isolated, sporadic learning on a problem by problem basis towards a more reflective learning process and enable the recent immigrant to consider their broader social inclusion goals. However, feedback has to be managed sensitively since the effects of feedback on performance are highly variable: “under some conditions, feedback may improve performance, and under other conditions, feedback may reduce performance (Kluger and DeNisi, 1996)” (in Garris, 2002). Gibbs’ model of reflection (see Figure 2) indicates cognitive, affective and social aspects of the process, and we can see that these could form the basis for feedback prompts to the MASELTOV user to encourage them to both look back on what they have done, as well as forward to plan what they might do next.

Summaries of a MASELTOV learner’s progress and feedback to and from the learner will be stored and displayed in a personal space to enable the learner to reflect and monitor their own progress. Many services offer a “progress dashboard” which shows users a report of their progress across a number of tasks, often as a summary of all their activities. The information in this dashboard is presented as a list, or as a graphical representation; it may be presented in an initial ‘home page’ for the software or alternatively held on a personal profile page. Such dashboards enable learners to ‘own’ their user profile and use it as a tool for self-reflection and modifying future goal planning. This approach is being considered for implementation in MASELTOV.

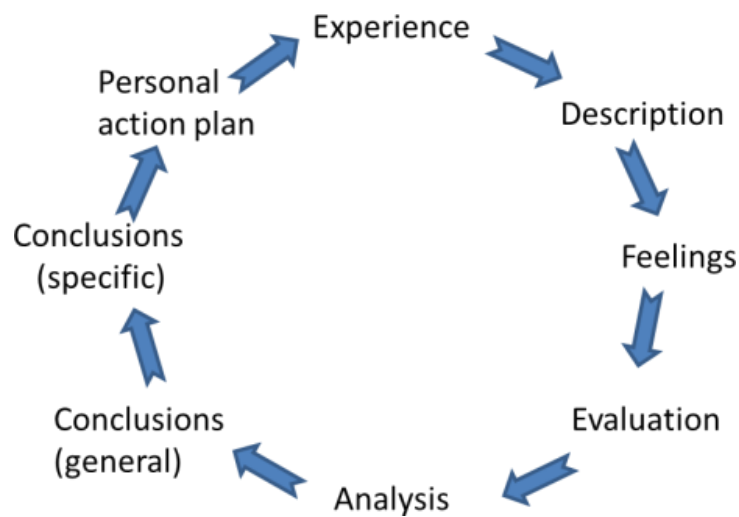


Figure 2. Gibbs’ model of reflection (1988).

## 5 A Serious Game for Cultural Learning

The first generation of serious games focused more on high priority learning environments such as first response training, levee patrolling and medical simulation (Knight et al., 2010). But more recently, games have been regarded not only as a basis for learning through simulation, but also as a tool for the development of a wider range of skills such as communication, through more diverse and abstract forms of play (Zielke et al., 2009; de Freitas & Routledge, 2013). The main reason that games can be so effective in cognitive-based areas of training arises from the way in which games allow for negotiated meanings to be developed within individuals; as part of group activities, shared realities can be negotiated and derived. This characteristic is mainly affected through game design mechanics that allow for individual tasks and practices to be blended with social elements and services. One way in which games can offer this capability is to have the learner assume the role of an avatar, embodying them within the environment and thus allowing for subjective relations to be associated with the behaviors of their own and other avatars. This individual connection between gameplay and the player or learner then consequently placed at the heart of the relationships set up in such a game, making it an effective tool for both replicating real, and projecting imagined environments. Both support higher cognitive learning and can be a valuable tool in how games as learning tools can be deployed to support formal and informal learning and training.

Serious games have demonstrated capabilities for supporting a diverse range of pedagogical models. The cultural learning space is a complex and intricate environment, which must take into account many different aspects such as language learning skills, interpersonal skills, team skills and problem-solving. Within the MASELTOV project, the design seeks to encompass both the notions of 'playful' cultural learning, whereby learning is supported in an engaging and intrinsically motivating form, and the concept of using a 'freemium' model which provides premium content to players on the basis of positive actions and learning activities, using players' time and activities as a currency rather than a financial model. In previous work, we have reviewed the use of games in cultural heritage for example (Anderson et al., 2010), a key finding being that the method of game design and development needs to find a balance between fun and learning, utilize immediate feedback, and requires research and development based upon four dimensions: the learner, their context, the representation of the game, and the learning theories and approaches deployed. Otherwise, it may be either too close to an entertainment game, or too close to existing formal educational materials, limiting efficacy.

To this end, development seeks to focus first on establishing an engaging and 'fun' gameplay model, attracting a player base. In the context of MASELTOV, the game will be deployed on a mobile (Android) platform. We seek to exploit these benefits by focusing first on the entertainment aspects, working with an existing cultural model to ensure pedagogical aspects (Hofstede, 2005). Research will then seek to work with both the attracted audience of 'real' players of the game, as well as with an invited audience of immigrants in form of usability and user experiences studies supported by

non-government organizations who provide support to immigrants on a daily basis. Working with this target group to evolve the game and ensure pedagogical requirements are met aims to address the careful balance between engagement and education, allowing the various methods of conveying learning content and encouraging behavioral changes to be evaluated, refined, and validated. This will be achieved through both direct metrics obtained from the game engine, for example time spent with certain content elements and the extent to which external resources within the MASELTOV platform are used, as well as through qualitative feedback and surveys.

An image taken from the prototype game is shown in Figure 3. Whilst the environment seeks to immerse the player in a pseudo-realistic context, a game-based narrative and 'dimension flip' mechanic, coupled with playable platform levels, it wraps cultural learning through dialogues with an immersive storyline and platform gameplay which seeks to engage the player and to generate a perceived value for character upgrades and game progression. The game then intends to use this perceived value to explore how the currency for these upgrades might be earned through positive actions using other MASELTOV services: for example rewarding use of the social network, posting on the forums, using information sources, or engaging with mixed-reality challenges using the context awareness services or text lens. The dimension flip also plays a central role in the game, allowing the player to observe two distinct, fictional cultures at opposite poles informed by Hofstede's model of cultural differences, and via scaffolding provided by other learning services within MASELTOV, to learn incidentally how, where, and why differences in cultures can cause issues.



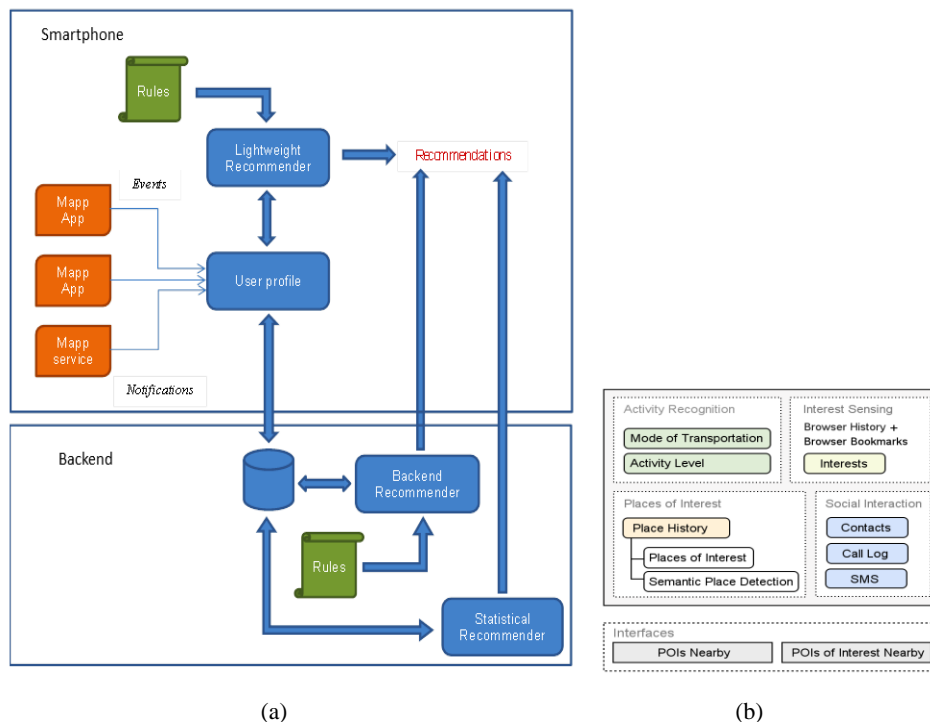
**Figure 3. Image from the MASELTOV game, currently in development for Android.**

In particular, the MASELTOV project seeks to explore the benefits of integration within the comprehensive suite of its mobile services. By integrating educational content with service provision, the platform seeks to support both tools for immediate assistance, and deeper learning over time to lessen reliance on these tools, and promote integration. There are several roles a game could play which capitalize on the

strengths of game-based learning: a game might reach a wider audience than purely pedagogical or service-based content; it may offer a means to provide feedback and rewards to learners and hence stimulate certain actions; and it may allow for a different perspective on cultural learning than that provided by more conventional forms of education such as text-based content. Effective integration, therefore, demands the ability to capitalize on these advantages, whilst similarly leveraging the strengths of the other services to provide a comprehensive and integrated mobile solution.

## 6 User Profile and Recommender System

The User Profile is a central component of the MASELTOV game platform that maintains information about personal data and user preferences, as well as collected knowledge on user usage behavior, progress and user context recognitions (Dimakis et al., 2010) that enable the personalization of used services, for example triggering of personalized recommendations on MASELTOV functionalities, targeted services and assistance. The feedback and progress indicators that are maintained with the User Profile will facilitate the overall learning journey, allowing the monitoring of the user satisfaction for the offered services and the offering of advanced personalized targeted services.



**Figure 4. (a) Architecture of the User Profile and the Recommender System. (b) Modes of geo-contextual awareness applied in MASELTOV.**

Recommendations can feed into serious game components, such as, recommending to play a specific component of the mobile serious game, e.g., buying a ticket at the virtual bus stop. The objective of the recommender system is to issue useful personalized recommendations to its user based on the events and notifications it receives from other MASELTOV app (MAPP) applications. The information that is carried through the events and notifications allow the recommender system to formulate the required level of context awareness, and, in combination with a set of rules that specify the preconditions under which actions should be taken, allow it to issue targeted recommendations. The functioning of the recommender system depends on (a) events received from MAPP applications, which are application dependent and reflect the current user activity and context, (b) notifications received from MAPP platform services, like the current user location, (c) the information contained in the user profile, like user preferences and progress indicators, and (d) a set of defined rules, which may also be specialized to specific user groups.

The architecture that is presented in Figure 4a shows the two platforms, namely the smartphone and the backend, and the components that run on each of the two. The user profile makes use of a backend database to store user preferences data and information that is communicated to it, like events coming from MAPP applications and notifications coming from MAPP services. The stored information can also be used by more advanced recommender systems, either rule based ones or based on statistical processing of data. The architecture shows a lightweight rule based recommender system that runs on the smartphone and a fully-fledged rule based recommender system that runs on the backend server.

The recommender makes use of a set of rules, which specify actions (recommendations in this case) to be taken when certain conditions are satisfied. A general form of a rule is *Predicate*  $\rightarrow$  *Action* [*expiration specification*]. The interpretation of this rule is that when the predicate is satisfied the rule fires and the action is taken. A typical recommendation for language learning, for example, would take status features from a geo-contextual event ('at the bus station') to trigger an appropriate recommendation action 'propose language lesson on vocabulary/expressions used at a bus station'.

## **7 Context Awareness and human factors**

### **7.1 Geo-contextual context sensing and classification**

MASELTOV embeds an easily scalable context recognition framework (Dimakis et al., 2010) that receives contributions from various context feature generating services; it evaluates the user behavior and from this maps to appropriately motivating actions in the form of recommendations. In MASELTOV, user behavior is evaluated in terms of progress indicators in the frame of the various services. An important progress indicator for language learning is the capability in leading a dialogue for a specific purpose, and the capability to memorize vocabulary and apply it at the spot of interest. Activities such as effectively finding the point of interest in the urban environment (job centre, doctor, shop, tourist sight), successful interaction in the geo-social radar, or the visiting of a local event, are further indicators for progress. The context

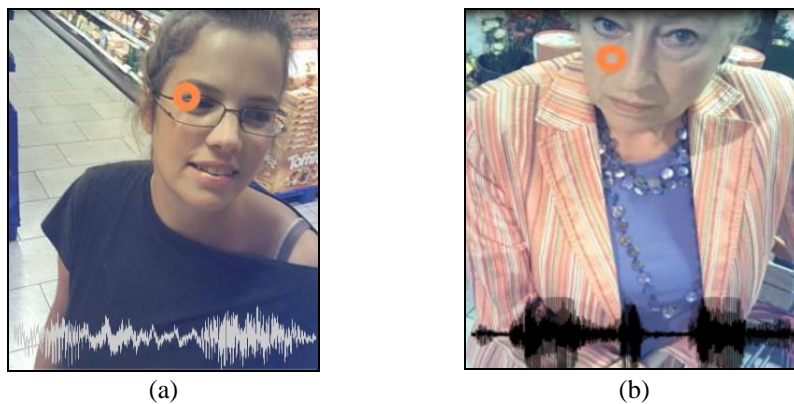
module is implemented as background module on the smartphone and analyses continuously data from build-in sensors, user interactions and entries as well as location based data from online resources to finally generate hypotheses on a user's current situation, their overall daily behaviour and to identify their interests and preferences. Any context information is consequently sent to the local user-profile and will be used to trigger context sensitive recommendations.

The system consists of the following main components, shown in Figure 4b: activity recognition, interest sensing, places of interest, social interaction and an interface for querying nearby points of interest (POIs) and nearby places of interest. *Activity recognition*: The mode of transportation module returns the type of movement of a person. Modes that can be detected are on foot, on bicycle, in a vehicle, still, tilting and unknown, including confidence values for the detected mode. The activity level represents the intensity of the physical activity of a person, measured by the number of times a certain threshold of the accelerometer magnitude has been exceeded within a specific time window. *Places of Interest*: Interests are determined by analyzing the frequency of occurrences of specific terms within the browser bookmarks and browser search history on the mobile phone. The recognition of social interaction is realized by detecting the amount and duration of communications on the phone. Statistics about the call behavior, SMS messages and contacts are collected. *Interfaces*: An interface method for querying nearby POIs is provided by the context module. Places with a longer staying time are compared to the POI database and added to a place history. *Interest sensing*: If a place is regularly visited it will be assumed that the place is of interest to the person. Frequently visited places are added to the place history with the number of visits updated. With the help of the semantic place detection module, categories of places can be detected, such as, being "at home" and "at work". An interface for querying places of interest nearby is provided. Categories of nearby places are compared to the interests collected in the user profile and can be filtered accordingly.

## 7.2 Mobile human factors sensing and classification

In addition, in MASELTOV we consider long-term communication assessments with multimodal mobile context awareness on the basis of affect and attention sensitive services in order to classify the language learning behavior of the recent immigrant. The recommender system then instantiates – according to the individual human factors profile and the measured performance – personalized motivating games, in order to change the behavior of the user. For example, to reinforce the training on interaction with local citizens, the rewarding of dialogue supporting activities will be increased, such as, by doubling virtual credits in return for dialogue specific language learning and measured communication in shopping scenarios. The success of an applied dialogue in terms of the emotion and frustration of the user is sensed with the smartphone in situ, using recent computational audio-based affective computing. Advanced human factors studies with wearable interfaces are further applied to extract the decisive parameters of affective and attention oriented content in audio. Next, wearable eye-tracking glasses data are interpreted with semantic 3D mapping of atten-

tion (Paletta et al., 2013), bio-signal sensing, and classification to automatically extract from a huge data analysis the decisive parameters for behavior analysis (Schuller et al., 2013), such as the evaluation of dialogues. An important aspect in short dialogues is attention as manifested by eye-contact between subjects. In a first study we provided quantitative evidence that visual attention is evident in the acoustic properties of a speaker's voice (Figure 5), and extracting a significant relation between the acoustic features and the distance between the point of view and the eye region of the dialogue partner. Mobile service components detecting eye contact, the speaker's capability in controlling the host language, and the user's satisfaction will become available to evaluate the progress of applying language knowledge in-situ.



**Figure 5. Progress indicator underlying the mobile game based language learning. Dialogues are evaluated using voice analysis and its relation to eye contact.**

## 8 Conclusion and Outlook

The approach taken to game-based learning development in MASELTOV intends to capitalize on both the strengths of the mobile platform, in terms of the ability to capture data on users and adapt the game accordingly. In this paper, we have suggested that such an approach could benefit from focusing first on entertainment and engagement aspects, and then work with the resultant user base to implement and assess pedagogical goals. Validating this approach will be a central goal of future work, as will comparing the efficacy of the resultant solution to approaches which place pedagogical design at the forefront. Such an approach can be particularly challenging to communicate to stakeholders with expectations of a game which "appears" immediately educational at the earliest stage, such as a simulation-driven approach. However, for the reasons outlined in Section 3 it is difficult to define how a ubiquitous simulation-driven solution might be achieved. The more abstract approach proposed by this paper reflects on the context of mobile gaming for cultural learning alongside, and blended with, a wide range of other educational and practical tools for immigrants. Achieving this integration effectively requires reflection on the limitations of game-based learning as well as its strengths: in contexts where information is needed urgently, a game is likely to prove a cumbersome means of transferring this infor-

mation. However, in contexts in which mobile games are commonly played, for example during travel, a chance to reflect upon cultural differences in a gamified form, with immediate access to educational resources if requested, may prove an effective combination.

Defining the means by which efficacy can be established and measured is another central topic of research. The nature of learning, which includes a temporal component as well as multiple levels of comprehension, can only be assessed to a limited degree by existing instruments such as surveys. In this project, it has also been posited that game-based learning deployed on a mobile platform represents an ideal opportunity to move the evaluation process away from smaller-scale trials, and towards a larger community of active players. Provided ethical requirements can be met, interesting future potential exists in understanding the rich volume of data these communities might generate in their online interactions, both in-game and in the wider context of the MASELTOV services and social network.

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