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Executive Summary

In this internal deliverable we present the results of the user evaluation of the Competence Matching Tool. A qualitative, case-based user study, making use of eye-tracking technology and a desirability toolkit. This study provides various insights in how users search for job vacancies and how interactive visualizations can support this search.

1 Evaluation of the Competence Matching Tool

1.1 Introduction

The Competence Matching Tool[1] (described in more detail in Deliverable 7.3) provides an interface to search for job offers, making use of a competence based search. This functionality is different from traditional job portals like *Monster* or *jobpilot* (see also Jansen et al, 2005). In contrast to these job portals, the Competence Matching Tool compares competences of a user with the required competences for a certain job. It extends the *normal* job search with the competence dimension and allows the users to see their abilities in the context.

The Competence Matching Tool gives the users the possibility to judge their current position and potentially required competences for the labor market. In a second step, the users can identify competence gaps in their competence profiles which they have to further develop to reach the required competence level of a target job profile.

Besides this innovative job search the Competence Matching Tool also provides an innovative way to view relevant jobs. It ranks relevant job offers according to the suitability to a certain user profile and visualises them on a two-dimensional graph. The vertical axis of the graph represents how close the match of a job with the competence profile of a user is and the horizontal axis represents the match with the search preferences of the user (job location, type of work, salary etc.) see Figure 1.1.

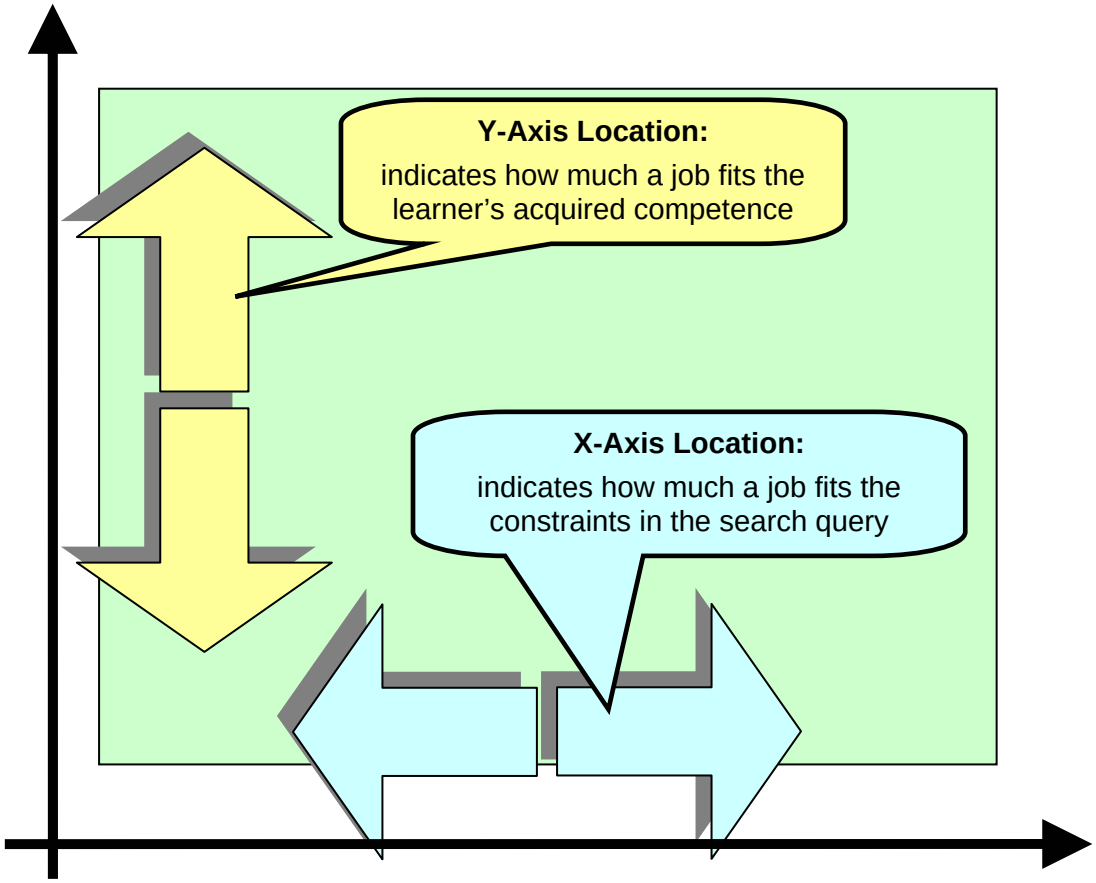

Figure 1.1. Placing jobs to visualize competence gaps and user preferences.

[1] Available at http://tencompetence.cvs.sourceforge.net/viewvc/tencompetence/wp7/CompetenceMatcher/

The chapter is structured as follows. In section 1.2 we present the usability evaluation of the Competence Matching Tool by introducing the evaluation approach, the procedure for the evaluation, and the used materials. In section 1.3 we present the results of the evaluation for the different evaluation measures (Eye-tracking results and Desirability results). Finally, we discuss the findings of the evaluation and provide suggestions for the future development and improvement of the Competence Matching Tool.

1.2 Evaluation of the Competence Matching Tool

In order to get a first usability and satisfaction evaluation of the Competence Matching Tool we conducted a qualitative case study (Field and Hole, 2003) with five participants. Qualitative case studies with a limited amount of users have been shown to be effective for these types of evaluation (Nielsen, 2009).

The participants received a prepared user profile and had to find the most suitable jobs for their profile by using the Competence Matching Tool. The main questions for the evaluation were:

1. Do the users see the advantage of the competence based job search and can use it properly?
2. Are the users able to use the job graph view in an efficient manner?
3. Which changes and additions will improve the usability of the Competence Matching Tool?

1.2.1 Method

To test the Competence Matching Tool we applied a combination of two different usability evaluation methods, which address both the actual user behaviour (the eye-tracking method) and the user's attitude (a 'desirability' evaluation) (Nielsen, 2008).

1. For the eye-tracking method we used a *TOBI eye-tracker*[2] device. This eye-tracker enabled us to monitor user interactions in a quantitative way by recording the eye movements of the users during the runtime. In that way we could ask the participants during the interaction if, why, and where they struggle with the handling of the Competence Matching Tool. In addition, we were able to reflect together with the participants their interactions by looking at the eye-tracker recordings.
2. The second part of the evaluation was conducted on the basis of the *Desirability Toolkit* of the Microsoft Cooperation (Benedek & Miner 2002). We assessed the overall user acceptance and desirability of the system using *Product Reaction Cards*. The participants received 118 cards with descriptive words. The set contains 60% positive and 40% negative/neutral cards. The users were asked to pick the 5 most suitable cards from the 118 available to describe the Competence Matching Tool. Afterwards, we asked for an explanation why the users picked each of the 5 cards. During this information exchange the users offered many valuable information about their interaction with the Competence Matching Tool as well as their thoughts about the approach to use competences to identify most suitable job profiles. Therefore, the Desirability Toolkit offers qualitative information about the usability of the Competence Matching Tool in a standardised form.

1.2.2 Procedure

In total five users with an interest in educational technology and varying backgrounds (computer science, psychology, education) participated in the qualitative study; each of them used the Competence Matching Tool for the first time.

The users received a written and an oral introduction to their task. First they were asked to inspect their (predefined) user profiles in the Competence Matching Tool, to become aware of competences of their identity (Figure 1.2). Afterwards, we calibrated the eye-tracking device to the current user and

[2] http://www.tobii.com/

he/she started to search for the most suitable jobs. On average the participants used the tool for 40 minutes. Afterwards, we applied an online version of the Desirability Toolkit and asked the users to pick exactly five cards that best describe the Competence Matching Tool. This interview situation took in average 25 minutes.

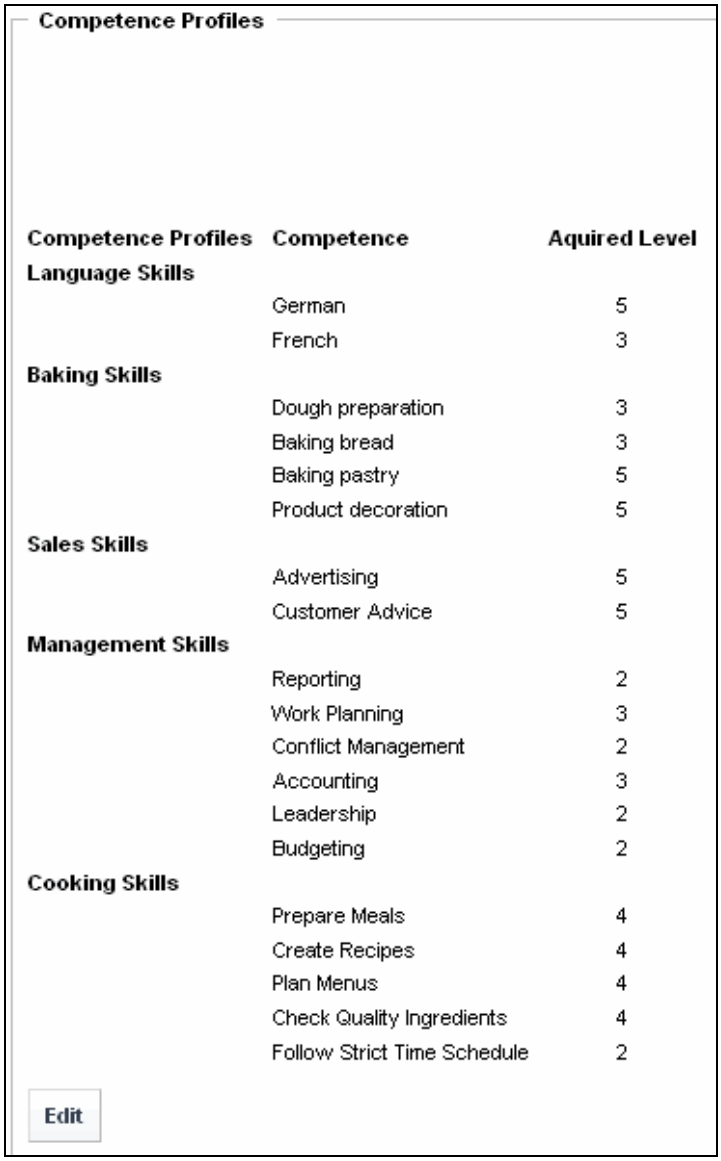

Figure 1.2. Summary of the user profile description in the Competence Matching Tool.

1.2.3 Materials

As mentioned in the introduction, the Competence Matching Tool provides two innovative procedures to search for most suitable jobs: the competence based search to find suitable jobs (Figure 1.3) and the ranking and visualisation of the most suitable jobs on a two-dimensional graph, where the vertical axis represents how close the match of an advertisement is with the user's competence profile and the horizontal axis represents the match with the preferences of the users (Figure 1.4). We focused the usability evaluation on these two aspects and report the results in the following sections.

Figure 1.3. The Job search form of the Competence Matching Tool.

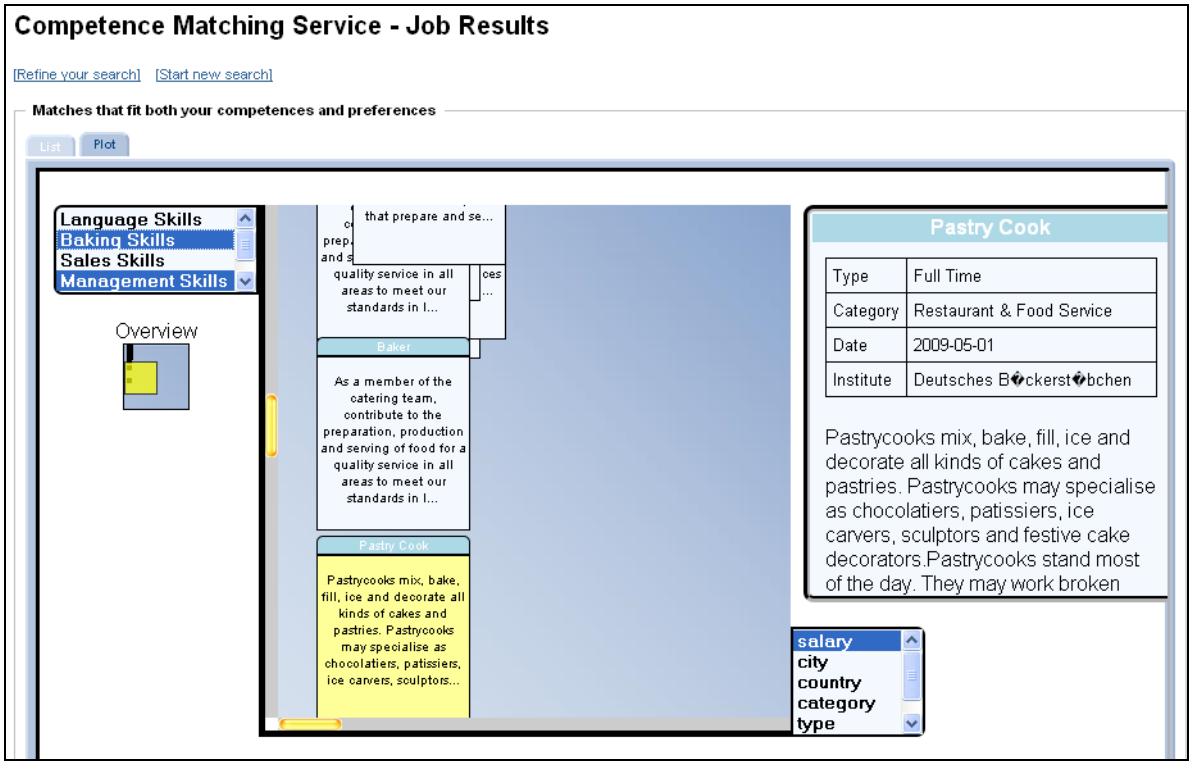

Figure 1.4. The relational graph view of available jobs in the Competence Matching Tool.

1.3 Results

1.3.1 Eye-tracking results

The eye-tracking analysis was very fruitful regarding suggestions for the improvement of the Competence Matching Tool. Here we report on the two most important aspects of this eye-tracking analysis. We discuss a *heatmap* and a *gazeplot* representation of the competence profile of the user, the job search form, the list view of the suitable jobs, and the relational graph view.

The heatmap shows an overlay of all heatmaps of the 5 users that participated in the eye-tracking evaluation. Color in a heatmap represents the level of focused interest or invested time of users. Here the green color represents a lower interest / invested time while the red color represents a high level of interest / invested time.

The gazeplot represents the movement of the eyes from one point of interest in the Competence Matching Tool to another one. It shows the connections between these points of interest and the spend time in seconds. Equally to the heatmap representation the gazeplot is also an overlay of the eye-movements of all participants in the evaluation. Each of them is represented with a different color.

1.3.1.1 Competence profile of a user

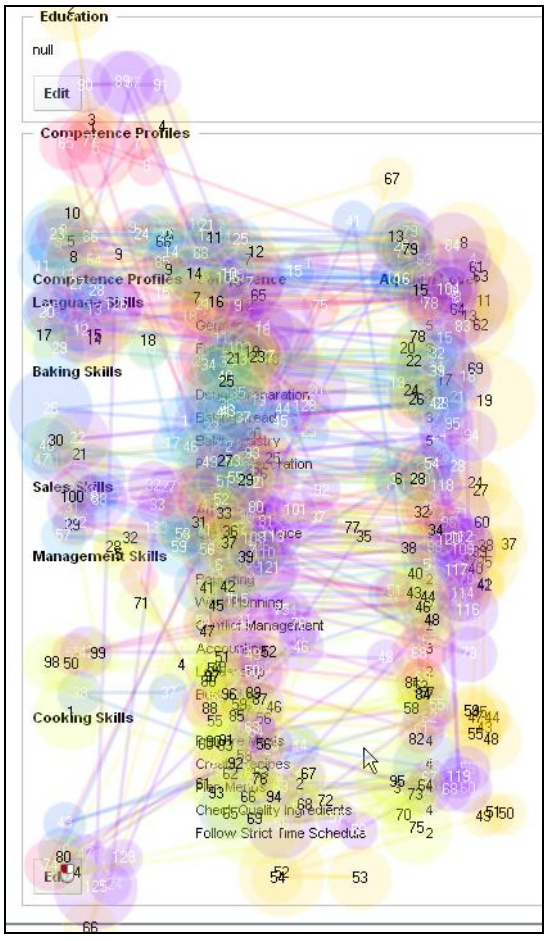

Figure 1.5. Gazeplot of the Competence profile of a user.

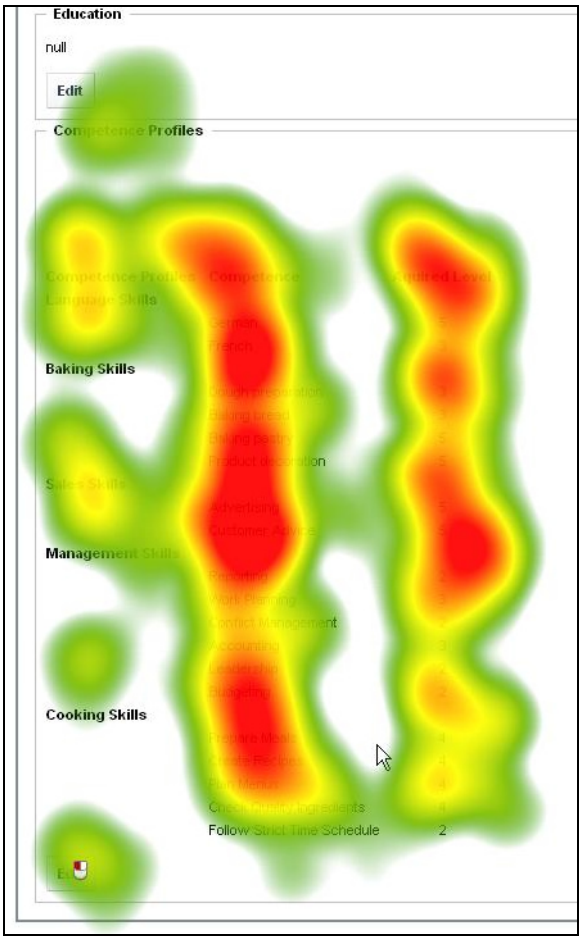

Figure 1.6. Heatmap of the Competence profile of a user.

Figure 1.5 and 1.6 show that the participants carefully looked at the upper information of the competence profile of the user, but they spend less time to read the lower information of the competence profile, especially the competence values on the lower right corner. This was already

obvious during the evaluation phase, so we asked the participants why they spent less time on this area. All of them reported that they had difficulties to relate a certain competence to the related competence level. The main reason for low attention was that it was hard to read and took a lot of effort, so they tended to skip that section. Another explanation for this phenomenon is given by Nielsen (2006): users tend to concentrate mainly on the top-left area 'above the fold'.

1.3.1.2 Search form

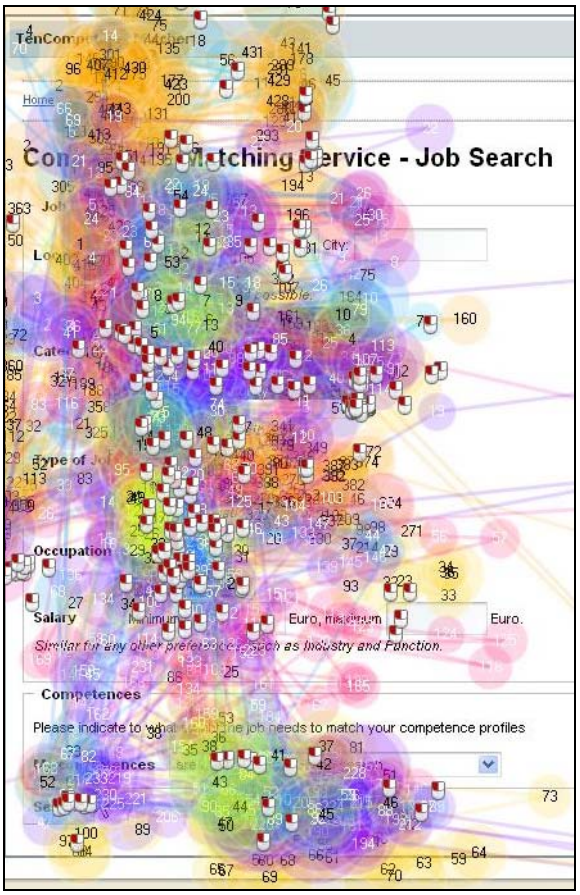

Figure 1.7. Gazeplot of the job search form.

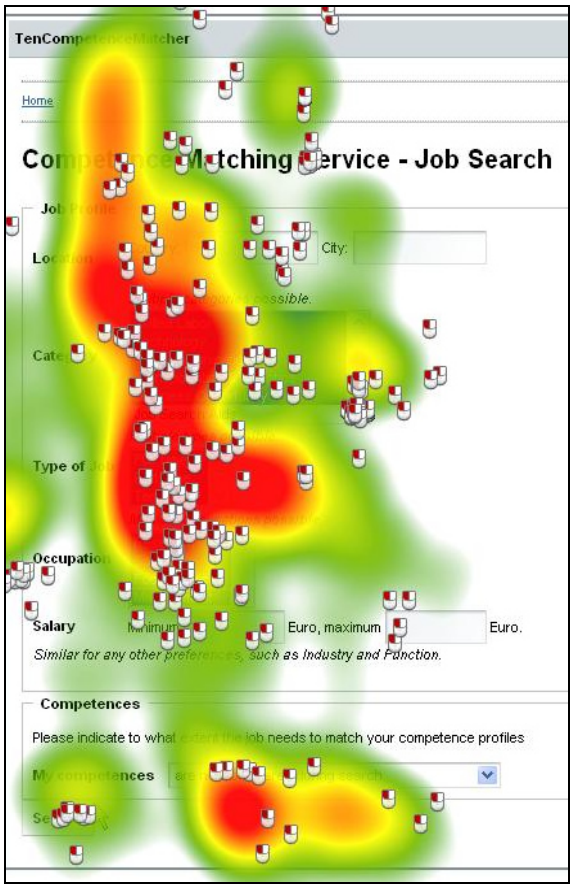

Figure 1,8. Heatmap of the job search form.

Figure 1.7 and 1.8 show that the participants actively selected different search options within the job search form. Via the eye-tracking approach no problems were identified: the user's attention was at the areas where it should be for the form.

However, the desirability evaluation later on made clear that the participants had problems to decide what they should select in the *Competence combo-box* as almost all mentioned options were meaningless to them. Further, it was hard to understand for the participants that the competences of the user profile have an effect on the search results while they are not shown in the search form.

1.3.1.3 Job list view

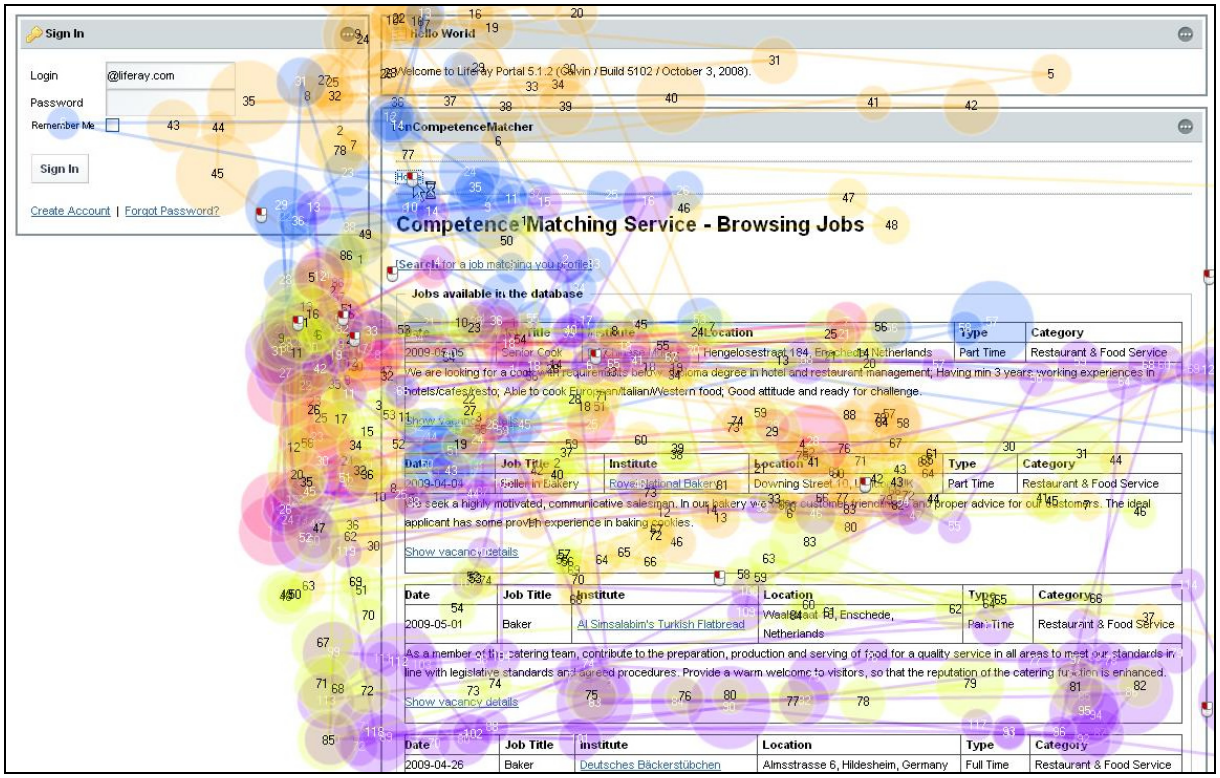

Figure 1.9. Gazeplot of the job list view.

Figure 1.10. Heatmap of the job list view.

Figure 1.9 and 1.10 show that most of the participants only looked at the top-3 ranked jobs in the list view and spent significantly less time on viewing the lower jobs presented. The gazeplot in Figure 1.9

shows how the different participants read through the job offers and that they had a different job description in focus. No major problems were found on this screen.

1.3.1.4 Job results view

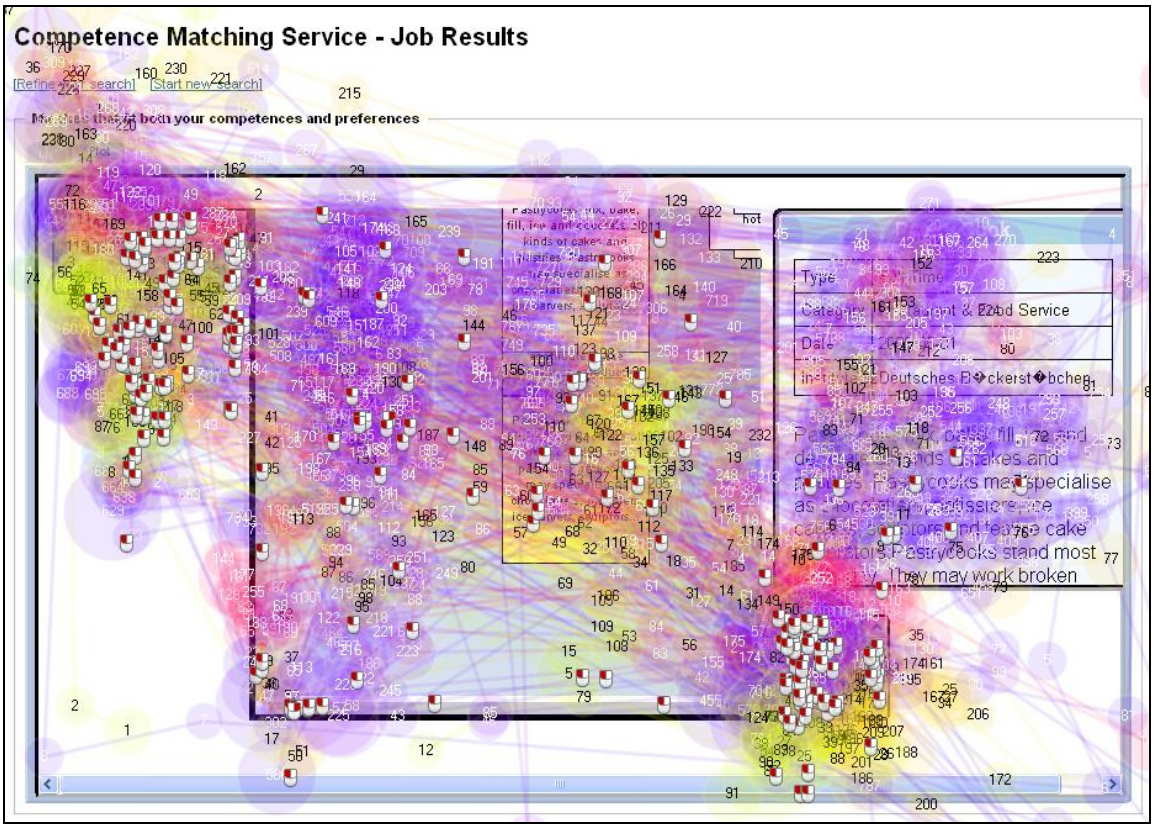

Figure 1.11. Gazeplot of the relational graph view.

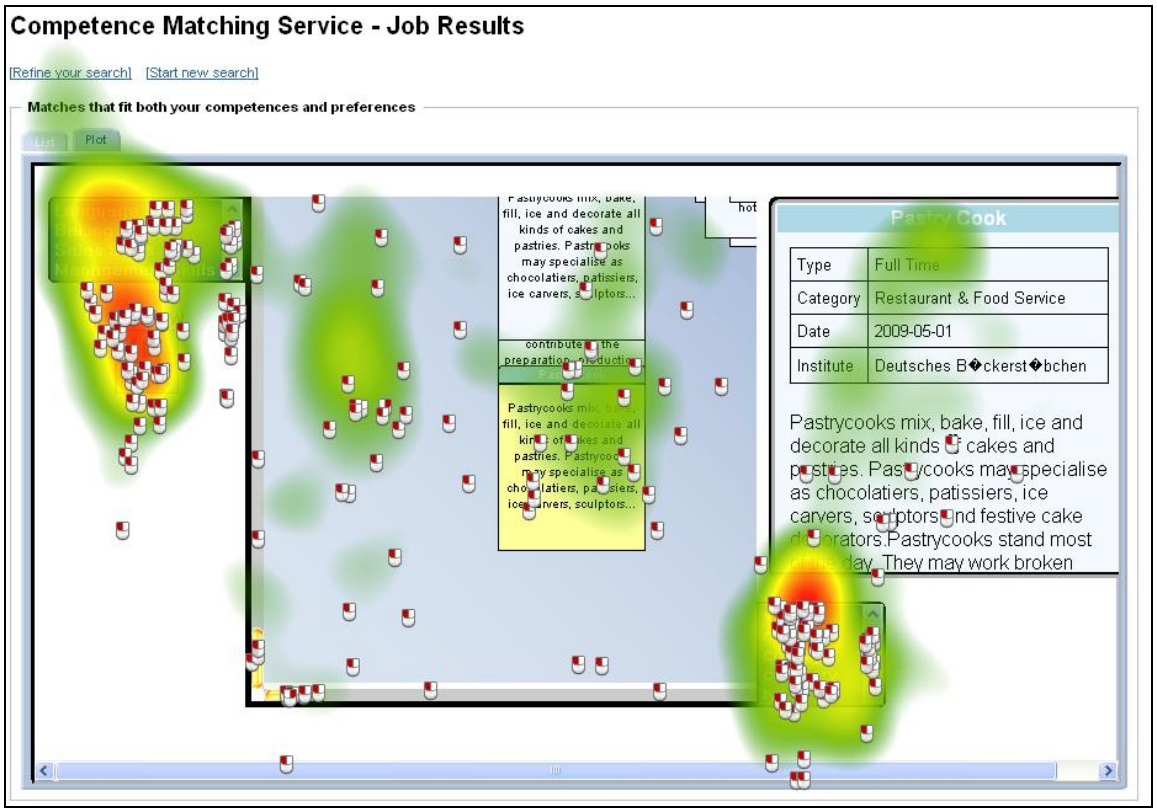

Figure 1.12. Heatmap of the relational graph view.

Figure 1.11 and 1.12 show that there are two hotspots in the graph interface. These hotspots are on the one hand on the overview window and on the other hand on the categories shown from the search.

The interpretation of these results can be that the users explored the influence of these two “navigation tools” on the graph view. On the other hand it can be expected that this exploration phase should stop after some time. But the eye-tracking analysis reveals that there is a constant attention to these aspects of the interface, which could also mean that they are distracting from the more important graph view. Surprisingly, the participants almost never used the scroll bars of the graph to navigate through the offered jobs.

The gazeplot in Figure 3.10 confirms these findings and shows also the order of attention. Often users followed the sequence “Overview window – graph – categories” while most attention was spent on the overview window and the categories in order to discover the most suitable jobs. Further, the gazeplot in Figure 3.11 also shows that the participants watched at the jobs in the graph view and the detailed job description but that had no effect on the heatmap. This is reasonable, as the jobs were located differently and moved on the graph depending on the combination of preferences by the participants.

1.3.2 Desirability results

We categories the results of the Desirability Toolkit into three main objectives: *User Interface*, *Technology*, and *Innovation*. Figure 1.13 shows the online Version of the Desirability toolkit that was used for the evaluation of the Competence Matching Tool. In Table 1.1 we present the selected cards and the comments of the participants.

Figure 1.13: The online version of the Desirability Toolkit created by the CELSTEC institute. 118 reaction cards are shown to the participants and they should select at 6 out of them.

Table 1.1: Reaction cards and interview comments.

Feedback	Reaction cards	Description
User Interface	**Competence based search** • 2 x Difficult • 3 x Confusing • Hard to Use	**Competence based search** • I don't understand how my competences in the search form are involved in the results. The selection statements where just meaningless to me. • I find it very difficult to find the most suitable job based on my competence. That made the job search much more complex. Normally, I just look for something suitable and then I call the employer. • The results of my search and the competence related search aspects were unclear to me. • Most of the time the job descriptions are overlapping each other. I would expect that they show really different locations based on my preferences, which would make it clearer. • I did not understand how I can influence the search criteria. The jobs where moving from one corner to another but I did not know where the most suitable jobs are located. • I find the technical solution very old-fashioned, even when the search is based on competences. It is not

		supportive or transparent what is happening behind the system.
	Job graph view • Annoying • Unpredictable • Inconsistent	**Job graph view** • The interface was not very appealing and inconsistent. • There are no labels at the graph; a user does not know which position represents the most suitable job. • I still can not predict how the graph view reacts based on the search criteria. I just don't get how this tool supports my job search. It really needs some more indicators and support features to make it easier and more intuitive.
Technology	• 2 x Dated • 2 x Gets in the way • 2 x Too Technical	• 90% of the application is a simple search engine. • I always received an error message when I tried to view the plot. That also shows that the tool is really in the prototype status and has to improve a lot. • The error messages were annoying. • The categories do not sound anything to a user. The descriptions have to be much more clearer. • Why do I see this error message all the time?
Innovation	• Personal • Innovative • Unconventional • Simplistic • Easy to use • Stable • Predictable • Integrated	• Search based on my personal competences makes it more personal. • The idea of visualizing jobs and distances to an individual profile is an innovative idea even when the technical solution is still a bit difficult. • The idea to visualise jobs on a graph to show their relation to an individual profile is an innovative idea even when the technical solution is still a bit prototypical. • It's just a search engine. • Besides some error messages it is easy to use. • I always got the same results. • Not much surprises here. • It seems to be integrated in other systems.

1.3.2.1 User Interface

Regarding the category *User Interface* we received 3 times the reaction card ‘Confusing’, 2 times ‘Difficult’, and once ‘Hard to use’. The participants criticized during the interview that they did not understand how the competences of their profile were involved in the job search. The selection of jobs was unclear to them and there was no explanation or help text available. Additionally, the participants found the graph view ‘Hard to use’, ‘Inconsistent’, and even ‘Annoying’. They got frustrated because the graph view builds upon the competences in the user profile and the search results and was therefore even less reasonable for them.

In a similar fashion as in the user profile and the job search form, the users missed information about the graph view and how to use it properly. They did not understand when a job was suitable, because the graph offered no indicators for that. They also missed help information for using the graph view and for manipulating the results.

1.3.2.2 Technology

Regarding the category *Technology,* the participants selected two times the reaction card ‘Dated’, 2 times ‘Gets in the way’, and two times ‘Too Technical’. Parts of these comments are related to a technical problem on one of the evaluation sessions. There was sometimes an error message on the screen mentioning that no job profiles could be placed in the graph view.

In addition, the participants criticized that most of the text descriptions in the Competence Matching Tool were too technical and meaningless for them.

1.3.2.3 Innovation

Regarding the category *Innovation*, the participants selected a broad range of reaction cards. None of the cards were selected twice. Surprisingly, they selected some oppositional cards compared to the cards they selected earlier. Also in their comments they valued the competence based search as an interesting, innovative, and personal way of searching what stands in contrast to their earlier expressions. The general concept seems to be a reasonable and interesting approach for the participants. One of the participants literally said:

"The idea to visualise jobs on a graph to show their relation to an individual profile is an innovative idea even when the technical solution is still a bit prototypical."

1.4 Discussion

In this section we provide answers to the initial evaluation questions to point out critical aspects and potential improvements.

Question 1: *Do the users see the advantage of the competence based job search and use it properly?*

We can say that overall, the participants found the competences based search approach interesting and innovative. Most of them believed that this can help to offer more personalised search results. Regarding the second part of the question (*Can the participants use the competence based search properly?)* we have to admit that the participants were confused and not able to use the tool in the most efficient manner. They missed supportive information how to affect the results of the Competence Matching Tool. That can be solved by improving the user interface and adding additional help information.

Question 2: *Are the users able to use the job graph view in an efficient manner?*

The graph view got many criticisms by the participants and most of them found the graph view very difficult to use. One reason for that might be that people always stick to traditional information models like 'lists' or 'table overviews'. They need more time to get used to new information models and especially to discover their advantages. However, the participants mentioned some comprehensible improvements like adding a legend to the graph, emphasizing the most suitable job offers, and adding descriptions to the axis of the graph. By implementing these practical hints and by adding supportive help texts, the graph view might be more useful for the end-users.

Question 3: *Which general changes and additions will improve the usability of the Competence Matching Tool?*

Based on the conducted evaluation we can suggest a list with practical improvements to increase the usability and desirability of the Competence Matching Tool. On a general issue is the connection between the competence profile of the user and the job search form. In case of competence-based job search, the search form and the user profile should be locally combined in one page. This especially applies, when the job search form should also work as a gap analysis between the current user profile and the desired job descriptions. More specific recommendations are listed below.

User profile

- The competences and their related competences level should be highlighted with different a background colors to improve the readability.

Job search form

- The wordiness of the job search form should be less technical and therefore renamed to the needs of the end-users. For instance, the participants had problems to decide what they should select in the Competence combo-box because almost all options were meaningless to them.

Job graph view

- The presented jobs in the job graph should not overlap each other rather than being aligned otherwise they hardly can be read.
- The graph view needs further descriptions on the axis and some indicators to mark the most suitable jobs.
- The graph view should support at least the most popular web browsers like Firefox, Safari and Internet Explorer to avoid confusing error messages.

1.5 Conclusions

From the evaluation of the Competence Matching Tool it has become clear that the users recognized and appreciated the innovative features of the approach. However, there are still some areas for improvement before it becomes part of the standard distribution of the TenCompetence infrastructure.

Apart from the suggestions for improvement of the user interface, an interesting observation is that whereas users recognize the benefits of graphical interfaces, they still prefer list-based results, which are easier to interpret: the higher a result is in the list, the more relevant the result is. This ease of interpretation may yield for simple keyword-based searches, but it is definitely not the case for tasks in which many, orthogonal facets are important – facets that at the start may not be apparent to the user. As discussed in Deliverable 7.3, a job search depends on many different factors: suitability of a job in terms of function description, experience level and industry; education and background required for the job; more mundane factors such as location and salary play a significant role as well. This wide range of factors is taken into account by the matching algorithms, but the screen real estate and the users' difficulties in dealing with multi-dimensional visualizations hinders the effective presentation of these various dimensions simultaneously. For this reason, graph-based views can be used as an effective interface, but classical list-based views should be the default option.

Another observation is that users do not have a clear mental model of the concept of competences, which is an obvious obstacle for competence-based search and exploration of job vacancies. This emphasizes the need for standardized competence models, which provide users a framework to relate to and for understanding the relation between the competence matching and the ranking of search results. In order to reach this point, standardization efforts such as the Dutch Colo project[3] together with new technologies that show how to put these competence models into effective use play a significant role.

[3] http://www.colo.nl/

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