TranSearch: A Multilingual Search User Interface Accommodating User Interaction and Preference

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Abstract

Multilingual Information Retrieval systems and
interfaces tackle the challenges multilingual searchers
face when searching for information in multiple
languages. In this paper, we present preliminary
findings from a qualitative study of design and
evaluation of a multilingual search User Interface,
TranSearch. Findings highlight that 1) during query
translation phase, intuitive user interaction, specifically,
automatic machine translation with user ability to edit
and keep track of queries is especially beneficial; 2) in
search phase, result displays facilitating comparison
across languages, customizable result panels
accommodating user preferences, and flexibility to
switch result languages play important roles. It is
identified that simplicity, visibility, and customization
are the characters mostly preferred. Based on user
preference explanation, implications for design are
discussed around these themes.

Author Keywords

Multilingual information retrieval; information
interaction; multilingual search user interfaces

ACM Classification Keywords

H.3.3. Information search and retrieval: Query formulation, Search process; H.5.2 User interfaces: Interaction styles, User-centered design.

Introduction

Searchers who speak multiple languages can search for information in more than one language. This often happens, for example, when searchers with second or foreign language knowledge of English search in English in the hopes of finding more or better content than in their native language. The need to retrieve information across multiple languages has been addressed before. Cross Language Information Retrieval (CLIR) systems allow entering queries in one language and retrieving relevant information in another [5][12][14]. CLIR systems are especially useful for users who do not speak the language of the documents well enough to construct queries. Multilingual Information Retrieval (MLIR) aims at users with a knowledge of two or more languages who can both construct queries and read resulting documents in multiple languages. Though different, both systems depend heavily on user interaction and input. Previous research examined user preferences in the presentation of results in multiple languages [17]. In this paper, we extend focus to the whole search process from query construction to examining search results through the design and evaluation of a new multilingual search user interface (UI), TranSearch. In addition, we also explain some of the reasons behind user preferences.

Subsequently, a qualitative study is carried out to evaluate TranSearch and aims to answer the following research questions:

- RQ1: What are the preferred MLIR search UI features and why?
- RQ2: What are the design implications for MLIR systems?

The paper is organized by firstly introducing previous work related to MLIR research status and system development practices. Then, the design of TranSearch and how it works are explained, followed by the description of the qualitative evaluation. Finally, we present the evaluation results and summarize the major findings and their design implications.

Related Work

Traditional CLIR and MLIR research studies an entire search process in two phases, query translation and the actual search, and usually focuses on improving machine translation accuracy and search result quality. Our research takes a different perspective by highlighting the importance of user interaction in the first phase, query translation, and user preference in the second phase, search result presentation.

Query translation
In MLIR, query translation is conducted by either user translation and entering, "direct querying", or fully machine automated query translation, "a delegate mode". Due to word-sense ambiguity, machine translation suffers from accuracy issue. Also, the results of automated query translation do not always outperform the users' direct querying in the target language [1][13]. Users make substantial use of automated translations for unfamiliar languages, whereas they tend to write their own translations for familiar languages [10]. Petrlli et al. [16] described and proposed a third approach, "a supervised mode", machine translation with user-editing ability.

Panel A: By "Pagination"

Single page view   Tabbed view

Panel B: By "Collection merger"

Blended   Non-blended

Panel C: By "Layout"
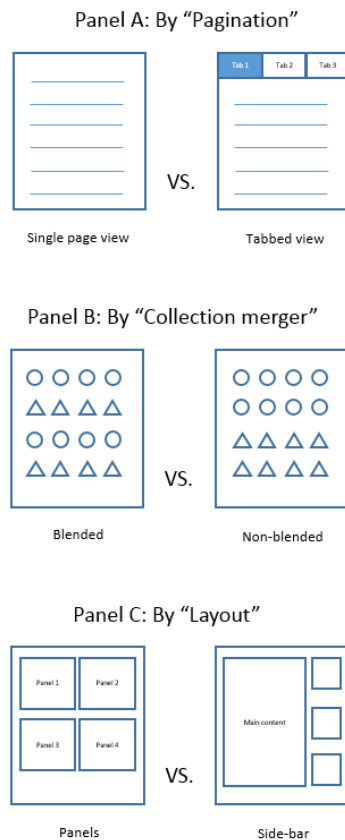
Panels   Side-bar

Figure 1: Search result user interface criteria and types.

These three approaches were utilized in the query translation phase by many systems, such as MULINEX [6], MTIR [2], and Clarity [15]. However, none of the approaches was ideal. Even the preferred "supervised" mode had its limits. For instance, it might add complexity and require more steps and user efforts. When users possessed inadequate knowledge of the sensitive meaning of translated queries in the target language, adding improper user interaction might be useless, or even worse, by confusing users [16]. A simplified, light-weighted, and intuitive solution of user interaction was called for.

Search result presentation
Search result presentation can also be challenging for MLIR systems. Figure 1 illustrates various options when differentiating result presentation UI types:

- By pagination: Single page view (e.g. [3]) and tabbed view with each tab displaying results from a different language (e.g. [8])
- By collection merger: "blended" and "non-blended" views presenting results in separate lists of languages or mixed together (e.g. [4])
- By layout: Panels and side-bars, each of which displaying a list of results in a language (e.g. [18])

Steichen and Freund [17] presented a comparison of five different search interface designs for CLIR or MLIR. Results indicated that single-page displays with clear language separation were most preferred. Thus, in our paper we selected the single-page design with panels clearly separating the two languages. We also examined the user preferences for panel placement in the single-page design.

Design of TranSearch

TranSearch is a MLIR interface that allows the user to search in two languages at the same time, in this case English and Chinese. The system integrates intuitive user interaction during query translation phase and accommodates user preferences of search result displays. Figure 2 is the main interface with the top "uni-box" that accepts an initial query and the two "sub-boxes". One of the "sub-boxes" contains the original query and the other holds the machine-translated query in the target language.
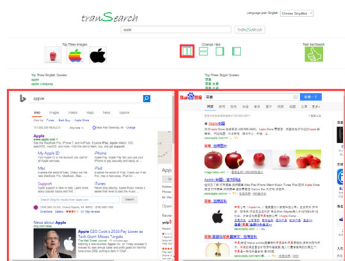

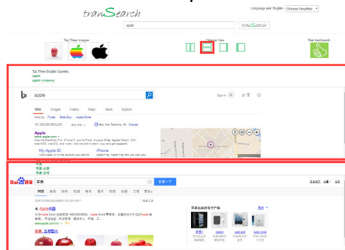**Figure 2**: Query input, translation and editing boxes

Query translation
The system utilizes the Microsoft Bing Translation API to translate queries in the English-Chinese language pair. Specifically, TranSearch provides the following affordance during query translation phase:
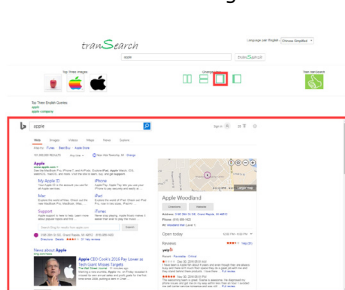
Panel A: Left-right

Panel B: Top-bottom

Panel C: Single

Figure 3: Search result layouts.

- Uni-box accepts and recognizes the language of initial query
- Sub-boxes hold the original query and provide machine translation of the query
- Users can adjust the automatically translated queries
- Uni-box and sub-boxes keep track of query history

Result presentation
To give users control over the search result display, the layout of the panels can be modified (see Figure 3). The two panels displaying results in one of the two languages can be modified with two options: the number of panels shown (one or two) and the layout of the panels (horizontal vs. vertical split). The following are taken into consideration for the design:

- Provide a default view that is preferred by most users in Steichen and Freund's study [17]: single page, non-blended, and double-panels
- Offer the flexibility to customize the layout in terms of panel numbers and panel layout
- Provide functionality and accuracy of contemporary search engines in multiple languages
- Panels work independently and utilize two search engines, Bing (for English) and Baidu (for Chinese)

Using Baidu for Chinese search was preferred by some users in Chu et al. study [7]. But a search engine focusing on a specific language may not exist for all languages, TranSearch in future should offer users the ability to select preferred search engines.

Evaluation Methods
Qualitative research methods were utilized during the evaluation, specifically, observation of the search task

process, semi-structured interviews, and structured questionnaires with open-ended questions. Ten individuals were recruited to participate in system evaluation (see Table 1 for demographics). Due to the fact that our system was built on English-Chinese language pair, all participants were chosen from native Chinese speakers. Two qualifying criteria were utilized for participant screening, participants' English proficiency at a conversational level and previous English search experience with online search systems. The criteria guaranteed our system was evaluated in a meaningful way. Participants who were included in the study reported searching in English three to ten times per day (6.9 on average).

The evaluation session took approximately one hour and a half. Participants were first asked to perform three search tasks with TranSearch (See Table 2). The three typical search tasks given to the participants were a location based restaurant recommendation task, a medical terminology lookup, and an English grammar examination. When they were performing the tasks, we purposely did not explain how TranSearch interface was working to see how intuitive the interface was.

Subsequently, interviews were conducted to complement search task logs and answers. Follow-up questions were asked to make sense of TranSearch use, preferences for features and displays, and user experience. These provided insights in understanding user behaviors and evaluating TranSearch. The last part of the interviews concerned general English search behaviors and recommendations for MLIR systems. At last questionnaires gathered demographics and triangulated the data collected from the interviews.

Ave. Age	27.5
SD Age	2.3
Male	4
Female	6

Table 1: Demographics

T1. One of your friends will spend his/her holiday in New York City, USA with his/her spouse and children ages six and eight. He/she asks you to make suggestions on a Chinese restaurant and an American restaurant. Please list reasons you recommend.
T2. What is "Glucosamine" and how does it work?
T3. The usage of the most common prepositions of location: in, on, at.

Table 2: Search tasks

Topics	Mentions
Academics	24
News/sports	21
Shopping	16
Health/Medicine	13
Culture	11

Table 3: Top five topics TranSearch is useful

All interviews were audio-recorded, along with investigator note taking. The detailed investigator notes were first coded to identify preliminary concepts of interest. Next, the interviews transcripts were coded through an inductive and iterative process. In the initial open coding phase, concepts describing affordances and constraints of TranSearch, design suggestions, desired system features, and user preferences were identified. Following this step, axial coding took place to group concepts, identify themes, and create relationships. The method of constant comparison was used as new transcripts were added and the more recently emerging concepts and categories were compared to those previously identified [9][11]. The analysis process was carried out in iterations. The codes were finally classified into the identified themes, by which results and discussion were organized.

Results and Discussion

In general, the participants had a positive experience with the system. All participants completed the tasks with no difficulties. They also confirmed the usefulness of the features built in the system and offered explanations as to why these were useful.

TranSearch query construction (RQ1)
In the phase of query translation and reformulation, participants indicated that automatic query recognition and translation helped to save time and the procedure of human translation or the usage of a dictionary was no longer needed. *"TranSearch saves my time translating keywords* (Interview P665; similar comments in interview P698, P695, P602, P648, P693).

TranSearch user interaction in query translation and reformulation was intuitively perceived and used.

Participants easily found and modified the query text. Uni-box and sub-boxes contributed to the usefulness. *"It shows all the keywords (in both the uni-Box and the sub-Boxes) …very clear... helpful when I want to change keywords or go back"* (Interview P602).

TranSearch results displays (RQ1)
In terms of result presentation, most participants confirmed that TranSearch was useful in offering additional information in another language and results from two search engines. *"It is like hitting two birds with one stone... in two languages and with two search engines, both Baidu and Google (the participant meant Bing)"* (Interview P602). Another important functionality was the result display panels that offered comparison of results in different languages, as well as flexibility to manage the layout of the panels.

Our results, in most cases, verified the previous findings [17] that single-page displays with clear language separation were mostly preferred. Users preferred such an interface because of its simplicity and visibility. *"The two panels are clear and so simple...I can compare results all together...on the same screen"* (Interview P665).

Participants also mentioned that search topics had an impact on TranSearch usefulness. It was indicated that TranSearch was beneficial especially for topics such as Academics, news, and sports (see Table 3 for the top five topics mentioned), because for these topics participants usually needed to check and compare results in both languages. Our results confirmed that user preferences hinged on tasks and contexts. While for some tasks searching in both languages was important, for others bilingual users would just use one

language [7]. Systems and UIs were required to provide flexibility to accommodate the various preferences. For certain tasks that users searched and focused on only one language, displaying an additional panel might not be necessary. *"Sometime I need only one panel (two panels are not desired)...It needs to be able to show whole screen, I mean to maximize and switch between language panels"* (Interview P689).

Depending on devices and contexts, users' preferences might change. Some participants preferred left-right panels on a desktop, but tended to choose top-bottom panels on devices with smaller screens. In panels of top-bottom layout, there would be fewer results, but each result was entirely displayed. *"TranSearch paneled screen is small (when panels are horizontal), sometimes it is not able to display the whole results, I need to drag the scroll bar (from left to right) to see all (because the text was not wrapped)"* (Interview P600).

Implications: Characteristics and functionalities (RQ2)
Our study identifies a series of characteristics and functionalities that are crucial to the success of CLIR and MLIR systems and interfaces:

1) Visibility and Simplicity
Online searchers are used to market-leading search engines such as Google, Bing, and Baidu. Considering and accommodating their UI design is important. Offering intuitiveness and simplicity is a key to the success of MLIR system UI. *"I like that it (TranSearch UI) is so simple and I know what I need to do without anyone showing me how"* (Interview P695).

2) Query translation

Machine query translation is beneficial and needs to be clearly displayed. Perceived affordance to modify it, as well as keep track of query translation and reformulation history, is necessary.

3) Result display
Due to the doubled cognitive load, MLIR system UIs face urgent needs to display and compare results across languages. What is more, flexibility and customizability, which accommodate various user preferences, are important. For instance, providing the ability to rearrange language panels and change their layout across devices is beneficial.

Conclusion
In this paper, we propose TranSearch, a MLIR system UI, which provides intuitive user interaction in query translation and reformulation, as well as accommodating user preferences in search result presentation. Various features of TranSearch are evaluated in an exploratory qualitative study focusing on query translation phase and result display phase.

The results indicate that simplicity, visibility, and customizability are the most valued system characteristics. It is also implied that user preferences may vary with different search tasks and contexts. Interfaces need to be flexible to accommodate preferences and adjustable if they do vary. In future research, the study will be expanded by improving user interaction to provide better query management, such as formulation, translation, and reformulation. From result presentation side, effort will be focused on result relevance and correlation across languages. The sample size and diversity of user tests will be increased in a more thorough evaluation.

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