Winter 12-4-2009

The Effects of Language Difference on Operational Performance and Satisfaction with B2B E-Marketplace Interface

Pei-Chun Lin

Yi-Han Huang

THE EFFECTS OF LANGUAGE DIFFERENCE ON OPERATIONAL PERFORMANCE AND SATISFACTION WITH B2B E-MARKETPLACE INTERFACE

Pei-Chun Lin[1], and Yi-Han Huang[2]
Department of Transportation and Communication Management Science
National Cheng Kung University
[1]peichunl@mail.ncku.edu.tw; [2]kanji711206@hotmail.com

Abstract

This study integrated the user interface and information content of the business-to-business (B2B) electronic marketplace (e-marketplace) with language to analyze whether language differences affect the definition of good interface design and the information content that should be provided via an e-marketplace. An experimental design was adopted for collecting data from tasks, and then the Questionnaire for User Interface Satisfaction (QUIS) was used to ascertain how satisfied subjects were with regard to using the B2B e-marketplace interfaces. Study results showed that the language, the e-marketplace interface the subject used, and a combination of the two predict a person's operational performance and satisfaction with a B2B e-marketplace. This study's results provide a better understanding of whether B2B e-marketplace service providers should develop interfaces based on specific languages.

Keywords: Language Difference, Usability, e-Marketplace, User Interface

Introduction

An electronic market is an inter-organizational information system through which multiple buyers and sellers interact to accomplish one or more of the following market-making activities: (a) identifying potential trading partners, (b) selecting a specific partner; and (c) executing the transaction [6]. Electronic marketplaces (e-marketplaces) have a profound influence on the way in which organizations manage their supply chains. Supply chain management encompasses the coordination of order generation, order taking, and order fulfilment/distribution of products, services, or information [10]. Business-to-business (B2B) e-marketplaces that use Internet protocols as communication standards have gained widespread application in supply chain management [9]. The goal of supply chain management is to link the marketplace, the distribution network, the manufacturing process, and the procurement activity in such a way that customers are serviced at higher levels and a lower total cost [3]. B2B electronic commerce (e-commerce) can contribute to lower purchase costs, reduced inventory, and enhanced efficiency of logistics, as well as to increased sales and lower marketing costs [3].

By bringing together huge numbers of buyers and sellers and by automating transactions, Web markets expand the choices available to buyers, give sellers access to new customers, and reduce transaction costs for all parties involved [13]. During transaction processing, the value added, business opportunity, and management mechanism created by B2B e-marketplaces are unequalled by others transaction media [7]. From the purchasing company point of view, B2B e-commerce facilitates procurement innovations to result in reduced purchase price, reduced cycle time, and improved supplier sourcing [15]. Electronic business (e-business) enables organizations to reduce costs, increase demand, and create new business models. It has the potential to benefit all consumers through reduced prices and improved products and information flows [8].

B2B site goals are substantially more complex than those of the typical business-to-customer (B2C) site. This is the one excuse B2B sites have for their subpar usability. In reality, however, the more complex the scenario, the higher the need for supportive user interfaces. Thus, B2B sites subpart emphasize usability more, not less, because they must help users accomplish more advanced tasks and research more specialized products [19]. Although usability guidelines (eg., [18]) have been developed by observing users in the United Sates and, to a lesser extent, in Europe, the extent to which guidelines developed for one cultural and/or linguistic group will be able to predict usability for another becomes a concern [28]. The Web now is truly worldwide, and so designers from every country are becoming concerned with usability, in addition, concerned about usability, specifically a site's usability for international users [28]. This is particularly important for B2B e-marketplaces whose goals are to facilitate online trades between exporters and importers from around the world.

This study integrated the user interface and information content of the e-marketplace with languages to analyze whether language differences

affect the definition of good interface design and the information content that should be provided via an e-marketplace. This study asked subjects recruited in Taiwan to use four popular B2B e-marketplace sites: Alibaba.com (English), Alibaba.com (simplified Chinese), Made-in-China (English) and Made-in-China (simplified Chinese). The two languages and the two B2B e-marketplace sites were manipulated in a 2x2 factorial design to collect the operating time, number of screens, and accuracy of online transaction tasks. Subjects were then asked to complete a questionnaire that elicited information concerning their satisfaction with the sites. The main research questions addressed in this study were whether the differences between the languages have an impact on the definition of good interface design and whether manufacturers should develop interfaces based on languages. Section 2 contains a review of the literature related to B2B e-marketplace sites, the human-computer interface, and language differences. Section 3 contains an explanation of the study methods and experimental design, and Section 4 provides an in-depth description of the results derived from statistical analysis. The final section summarizes the findings and includes discussion of their implications and recommendations for further research.

Literature review

E-marketplace

Markets (electronic or otherwise) have three main functions: (a) matching buyers and sellers, (b) facilitating the exchange of information, goods, services, and payments associated with market transactions, and (c) providing an institutional infrastructure, such as a legal and regulatory framework, that enables the efficient functioning of the market. In a modern economy, the first two functions are provided by intermediaries, while the institutional infrastructure is typically the province of governments. Internet-based electronic marketplaces leverage information technology to perform the above functions with increased effectiveness and reduced transaction costs, resulting in more efficient, "frictionfree" markets [2]. An electronic market system can reduce customers' costs of obtaining information about the prices and product offerings of alternative suppliers as well as suppliers' costs of communicating information about their prices and product characteristics to additional customers [2].

Human-Computer Interface

To users, the human-computer interface is an input language; to computers, it is an output language; in terms of human-computer interaction (HCI), it is a communication protocol [4]. Interactive techniques and tools can support information exploration and knowledge construction only if users can use these instruments properly [1]. Shneiderman and Plaisant [24] suggested that an effective interface can make users feel positive and can promote usability and stimulate thinking. When interacting with a well-designed interface, users frequently do not notice the existence of the interface and thus can focus on jobs, searches, and pleasure in using the equipment. In contrast, interfaces with insufficient functions frustrate users, and some users will refuse to use them.

Nielsen [17] demonstrated that concise interfaces reduce users' response times. Teitelbaum and Granda [26] contended that one of the most critical interface guidelines involves positional constancy. Positional constancy prescribes that usability is enhanced if the physical screen location of a particular piece of information remains constant for all of the episodes that belong to the particular application. An interface that does not have an explicit exit function does not maintain exactly a view-state between two usage episodes. In addition, word length can cause problems with HCIs [22].

Chin et al. [4] suggested that the depth of the menu tree should be held constant while the breadth should vary with level. In general, explicit targets take less time to find and have fewer frames to traverse than scenario targets. Jacko and Salvendy [12] examined the relationship between task complexity and performance for menus of various breadths and depths. They found that response time and number of errors increased as menu depth increased. Users found deeper menus to be more complex.

Usability

ISO 9241 defines usability as the effectiveness, efficiency, and satisfaction with which specified users achieve specified goals in particular environments. Usability is concerned with "optimizing the interactions people have with interactive products" and is achieved by defining user experience goals. These goals aim to promote products that are effective, easy to learn, and enjoyable to use. Some aspects commonly tested in defining usability metrics for use in usability testing include learnability, speed of task execution, errors made, and likeability (attitude toward the software) [17] in defining usability metrics for use in usability testing. Users are becoming less willing to tolerate difficult or uncomfortable interfaces of computer products since experience with some current interfaces has shown them that a product can indeed be easy to learn and pleasant to use. Thus, an attempt to evaluate the usability of user interfaces would be seen as an intrinsic element [20].

Usability is a general concept that cannot be measured, but it is related to several usability parameters that can be measured. Measurable usability parameters fall into two broad categories: objective performance measures, which measure how capable the users are at using the system, and subjective user preference measures, which assess how much the users like the system [17][20]. User friendliness is a broad criterion for evaluating user-system interaction. More specific measures have been developed (e.g., [24]) including (a) time needed for the user to learn specific information representation functions, (b) speed of interaction, (c) rate of errors by the user, (d) retention over time, and (e) the user's satisfaction.

Language Difference

Software development for international users has always been a challenge. However, with the explosion of the Internet use, the need for user-friendly, global Web sites has become important for international business. Consequently, interest in the influence of culture on user interface design has grown within the HCI community [21]. To what extent will guidelines developed for one cultural and/or linguistic group be able to predict usability for another? There are several difficulties. The first problem is that translation of a computer interface into other languages is not always feasible or appropriate [14]. This is particularly true of translating English into Asian languages such as Chinese. Written Chinese uses a semantic-based logography in which the structure-meaning relationships of linguistic elements are much closer than in English. On the other hand, English is phonologically based, so its visual form can be used as a cue for pronunciation, but a word's meaning cannot be derived merely from its structure [28]. The difference in language systems between Chinese and English may produce differences in cognitive functioning [23][27]. Chinese is a logographic writing system in which the written symbols represent lexical morphemes. Whereas an alphabetic system uses a small number of abstract elements to represent the phonemic structure of the language, Chinese words are represented by a large number of different visual symbols. It is estimated that a child must learn at least 4,000 different characters by the time he or she reaches age 12. Consequently, it would appear possible that, whereas learning to read English depends on phonological skill, learning to read Chinese may depend more on the ability to make appropriate visual distinctions than on phonological skills [11].

The second problem with generalizing standards derived from one culture to another comes from differences in socio-cultural norms and cognitive styles. Many aspects of psychological functioning, from aesthetics to interpersonal dynamics to motivations, will vary from culture to culture. Therefore, behavioral rules derived from one culture may not transfer to another [28]. People from different cultures are different in their perceptions, cognition, thinking styles, and values. Thus, it is important to thoroughly understand different cultural traits in designing computer interfaces for international users, rather than simply translating language [21]. The American way of thinking tends to be analytic, abstract, and imaginative beyond the realm of the immediately apprehended; in contrast, the Chinese way of thinking tends to be synthetic, concrete, and remain within the periphery of the visible world. The Chinese prefer to categorize on the basis of interdependence and relationship, whereas Americans prefer to analyze the components of stimuli and to infer common features [5]. One of the major differences between analytical and relational styles of thinking involves how subjectivity is treated. The analytical style separates subjective experience from the inductive process that leads to an objective reality. The relational style of thinking rests heavily on experience and does not separate the experiencing person from objective facts, figures, or concepts [25]. The use of the thematic cognitive mode by the Chinese is probably associated with field dependence. The Chinese people tend to display a cognitive style of seeing things or phenomena in wholes rather than in parts, while Americans tend to do the reverse. When first using a software system, Chinese users may tend to need a concrete representation of the system to help them develop accurate mental models and perform the interaction tasks properly and efficiently [21].

Moreover, not only English is very different from Chinese. Simplified Chinese and traditional Chinese characters are one of two standard sets of Chinese characters of the contemporary Chinese written language. They are based mostly on popular cursive forms embodying graphic or phonetic simplifications of the traditional forms that were used in printed text for over a thousand years. Simplified character forms were created by decreasing the number of strokes and simplifying the forms of a sizable proportion of traditional Chinese characters. Some characters were simplified by applying regular rules; for example, by replacing all occurrences of a certain component with a simpler variant. Some characters were simplified irregularly, however, and some simplified characters are very dissimilar to and unpredictable from traditional characters. Although many characters were left untouched by simplification, and are thus identical between the

traditional and simplified Chinese orthographies. It is still difficult for people to convert such Simplified Chinese characters to Traditional Chinese characters without misunderstanding. In June 2009, Taiwan leader Ma Ying-Jeou proposed an approach to improve understanding between the Taiwanese people and the people across the Straits—"write the traditional Chinese characters and know the simplified version." He pointed out that the traditional characters, widely in use in Taiwan, Hong Kong, and many other Chinese communities around the world, are representative of the Chinese culture, but the use of the simplified version is standard on the Chinese mainland. Therefore, this study incorporated the B2B e-marketplace with the two most popular languages, English and simplified Chinese in response to the following hypotheses:

H1a: Various interface designs affect e-marketplace operational performance.

H1b: Various interface designs affect e-marketplace operational satisfaction.

Research method

This study adopted an experimental design to investigate whether the interface design of e-marketplaces leads to differences in user performance, and then employed the Questionnaire for User Interface Satisfaction (QUIS) (see Appendix) to ascertain how satisfied novice users were with regard to using the different e-marketplace interfaces. This section provides an explanation of how the data were collected for testing the hypotheses presented in the literature review section.

Experimental design

This study conducted a laboratory experiment to ensure an undisturbed environment in which subjects could focus on the operational performance of e-marketplace sites. The test sessions were conducted in an isolated room at the National Cheng Kung University in Taiwan. Subjects were randomly selected to participate in the study and randomly assigned to one of the four groups to use one of two B2B sites, selected because they have the highest number of visitors with the highest visitors according to Alexa.com for English and simplified Chinese interfaces respectively, namely: Alibaba.com (English), Alibaba.com (simplified Chinese), Made-in-China (English) and Made-in-China (simplified Chinese). Subjects took approximately 30 to 60 minutes to complete the experiment, with each subject following specified steps:

1. Orientation session: Each participant attended an orientation session. The objectives of the investigation and instructions for browsing the e-marketplace interface were presented.
2. Task performance: To randomly assign subjects to one of the four e-marketplace interfaces, subjects were asked to select a piece of paper from a shuffled pile of papers. Each paper had the name of one of the four e-marketplace interfaces on it. After selecting a piece of paper from the pile, each subject participated in a 10-minute acclimatization session before executing the actual test tasks. This session provided subjects with a general introduction to e-marketplace interfaces. Subjects were asked to complete three consecutive tasks and the operating time/number of screens and accuracy of the result for each task were recorded by LogSquare [16].
3. Post-task questionnaire: Participants were asked to rate the items presented in the QUIS shown (see Appendix) [4][24], in order to express their perceived level of satisfaction with the e-marketplace interface. Each response was measured using a five-point Likert scale.

Task description

This experiment adopted three tasks. The basic task was for subjects to become familiar with the e-marketplace interfaces via basic browsing operations, and the advanced tasks were based on online transaction processes. A detailed description of the three tasks is presented below:

Task 1. Please search for the User Guide, How to sell, and How to buy in this B2B e-marketplace.

Task 2. Suppose your company wants to order printers. Please key in the keyword printer and locate some printer sellers and add one seller to My Contact. Suppose your company also wants to order laptops. Please key in the keyword laptop and locate some laptop sellers and add one seller to My Contact. Please click My Contact and make sure both sellers were added.

Task 3. Suppose you want to join as a premium member. Please find out the specific term and services provided for premium members in this B2B e-marketplace.

Results

The 60 subjects recruited for testing B2B e-marketplace usage all had online shopping experience, but had never previously browsed a B2B e-marketplace. All participated in the experiment voluntarily. Table 1 presents the subjects' profile. Among the 60 participants, both genders were well represented. Most subjects

(91.7%) considered that their searching online information frequency was high. However, about 72% of the subjects evaluated their computer ability as low. Furthermore, although all subjects had online shopping experience, only 3.6% shop online more than three times per month. Table 2 presents the mean and standard deviation of the number of screens operated for carrying out all tasks, the operational time taken to accomplish all tasks using the four B2B e-marketplaces, and the frequency of subjects asking for help while conducting the experiment.

Table 1. Users' profile

		Sample size	Frequency distribution
Gender	Male	23	38.3%
	Female	37	61.7%
Searching online information	Low	5	8.3%
	High	55	91.7%
Computer self-evaluation	Low	43	71.7%
	High	17	28.3%
Shopping frequency per month	0-1	46	80.7%
	2-3	9	15.8%
	4-5	1	1.8%
	More than 5	1	1.8%

Table 2. Group statistics for e-marketplaces

	e-marketplace	Sample size	Mean	STD
Total operational time for tasks in seconds	Alibaba (E)	15	826.8	188.9
	Alibaba (C)	15	777.3	195.8
	Made-in-China (E)	15	554.1	163.8
	Made-in-China (C)	15	477.5	105.6
Total number of screens for tasks	Alibaba (E)	15	25.5	5.8
	Alibaba (C)	15	27.7	6.2
	Made-in-China (E)	15	16.9	3.3
	Made-in-China (C)	15	16.1	3.5
Frequency of asking for help	Alibaba (E)	15	1.5	1.2
	Alibaba (C)	15	1.2	0.8
	Made-in-China (E)	15	0.7	0.7
	Made-in-China (C)	15	0.3	0.5

Test for objective performance

Table 3 shows that the mean number of operation screens and operational time needed to complete all tasks differed among Alibaba (English), Alibaba (simplified Chinese), Made-in-China (English), and Made-in-China (simplified Chinese) users. Scheffé's multiple comparison t-test was applied to ascertain the effect of the e-marketplace on operational performance. Table 4 shows that, on average, users of Alibaba (English) needed more operational time, more screens, and more help to complete tasks than users of Made-in-China (English); on average, users of Alibaba (simplified Chinese) needed more operational time, more screens, and asked for more help to complete tasks than users of Made-in-China (simplified Chinese). Therefore, hypothesis H1a, Various interface designs affect e-marketplace operational performance, was supported.

Table 3. One-way ANOVA for operational performance by e-marketplace

e-marketplace operation		Sum of Squares	df	Mean Square	F	Sig.
Operational time for tasks	Between Groups	1291610	3	430536	15.37	0.000*
	Within Groups	1568567	56	28010		
	Total	2860177	59			
Total number of screens for tasks	Between Groups	1551	3	517	20.11	0.000*
	Within Groups	1439	56	25.7		
	Total	2990	59			
Frequency of asking for help	Between Groups	11.33	3	3.778	5.237	0.003*
	Within Groups	40.4	56	0.721		
	Total	51.73	59			

*p-value<0.05

Table 4. Scheffé's multiple comparison t-test for the effect of e-marketplace on operational performance

Total operational time for tasks			
e-marketplace (I)	e-marketplace (J)	Mean Difference (I-J)	Sig.
Alibaba (E)	Alibaba (C)	49.60	.882
	Made-in-China (E)	272.80*	.001
	Made-in-China (C)	349.33*	.000
Alibaba (C)	Alibaba (E)	-49.60	.882
	Made-in-China (E)	223.20*	.007
	Made-in-China (C)	299.73*	.000
Made-in-China (E)	Alibaba (E)	-272.80*	.001
	Alibaba (C)	-223.20*	.007
	Made-in-China (C)	76.53	.668
Made-in-China (C)	Alibaba (E)	-349.33*	.000
	Alibaba (C)	-299.73*	.000
	Made-in-China (E)	-76.53	.668
Total number of screens for tasks			
e-marketplace (I)	e-marketplace (J)	Mean Difference (I-J)	Sig.
Alibaba (E)	Alibaba (C)	-2.20	.70
	Made-in-China (E)	8.53*	.00
	Made-in-China (C)	9.33*	.00
Alibaba (C)	Alibaba (E)	2.20	.70
	Made-in-China (E)	10.73*	.00
	Made-in-China (C)	11.53*	.00
Made-in-China (E)	Alibaba (E)	-8.53*	.00
	Alibaba (C)	-10.73*	.00
	Made-in-China (C)	.80	.97
Made-in-China (C)	Alibaba (E)	-9.33*	.00
	Alibaba (C)	-11.53*	.00
	Made-in-China (E)	-.80	.97
Frequency of asking for help			
e-marketplace (I)	e-marketplace (J)	Mean	Sig.

		Difference (I-J)	
Alibaba (E)	Alibaba (C)	.26	.86
	Made-in-China (E)	.73	.14
	Made-in-China (C)	1.13*	.01
Alibaba (C)	Alibaba (E)	-.26	.86
	Made-in-China (E)	.46	.52
	Made-in-China (C)	.86	.06
Made-in-China (E)	Alibaba (E)	-.73	.14
	Alibaba (C)	-.46	.52
	Made-in-China (C)	.40	.65
Made-in-China (C)	Alibaba (E)	-1.13*	.01
	Alibaba (C)	-.86	.06
	Made-in-China (E)	-.40	.64

*The mean difference is significant at the 0.05 level.

Tables 5 and 6 show that the mean operational time and the mean frequency of asking for help needed to complete all tasks differed between users rating low and high on computer self-evaluation. The independent samples test was applied to ascertain the effect of e-marketplace on operational performance. On average, users with low computer self-evaluation needed more operational time and asked for more help to complete tasks than users with high computer self-evaluation.

Table 5. Group statistics for computer self-evaluation

	Computer self-evaluation	Sample size	Mean	STD
Total operational time for tasks in	Low	43	707.55	229
	High	17	535.94	134
Total number of screens for	Low	43	22.44	7.23
	High	17	19.29	6.47
Frequency of asking for help	Low	43	1.09	1.04
	High	17	.529	.514

Table 6. The independent samples test for the effect of computer self-evaluation on e-marketplace operation

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	Sig. (2-tailed)
Total operational time for tasks in seconds	Equal variances assumed	5.388	0.024	0.005*
	Equal variances not assumed			0.001*
Total number of screens for tasks	Equal variances assumed	1.034	0.313	0.124
	Equal variances not assumed			0.111
Frequency of asking for help	Equal variances assumed	3.242	0.077	0.034*
	Equal variances not assumed			0.007*

Test for subjective performance

This study then measured the internal consistency reliability of QUIS, which surveyed how subjects perceive satisfaction with using the e-marketplace interface. Cronbach's α in this study was as follows: overall reactions to the B2B e-marketplace interface 0.90, on the B2B e-marketplace screen 0.5, terminology and system information 0.7, learning 0.83, and system capabilities 0.59. It was found that Cronbach's α values were all well above the recommended acceptable criterion.

Table 7 shows that user reactions to the five categories in the QUIS differed among users of Alibaba (English), Alibaba (simplified Chinese), Made-in-China (English), and Made-in-China (simplified Chinese).

The Scheffé method was applied to compare mean differences between perceived satisfaction with these items for the four B2B e-marketplace interfaces to ascertain the effect of e-marketplace interface design on operational satisfaction. Table 8 shows that, on average, users perceived the items in "Overall reactions to the B2B e-marketplace" as more satisfactory when using the Made-in-China (English) or Made-in-China (Simplified Chinese) interface than the Alibaba (English) or Alibaba (Simplified Chinese) interface. On average, users perceived the items in "On the B2B e-marketplace screen" as more satisfactory when using the Made-in-China (English) or Made-in-China (Simplified Chinese) interface than the Alibaba (English) or Alibaba (Simplified Chinese) interface. On average, users perceived the items in "Terminology and system information" as more satisfactory when using the Made-in-China (English) or Made-in-China (Simplified Chinese) interface than the Alibaba (Simplified Chinese) interface. On average, users perceived the items in "Learning" as more satisfactory when using the Alibaba (English) interface than the Alibaba (Simplified Chinese) interface; and users perceived the items in "Learning" as more satisfactory when using the Made-in-China (English) interface than the Alibaba (Simplified Chinese) interface; users perceived the items in "Learning" as more satisfactory when using the Made-in-China (Simplified Chinese) interface than the Alibaba (English) or Alibaba (Simplified Chinese) interface. On average, users perceived the items in "System capabilities" as more satisfactory when using the Made-in-China (Simplified Chinese) interface than

the Alibaba (Simplified Chinese) interface. Therefore, hypothesis H1b, Various interface designs affect e-marketplace operational satisfaction, was supported.

Table 7. The one-way ANOVA for operational satisfaction by e-marketplace

e-marketplace satisfaction		Sum of Squares	df	Mean Square	F	Sig.
Overall reactions to the B2B e-marketplace	Between Groups	593.933	3	197.978	9.336	0.000*
	Within Groups	1187.467	56	21.205		
	Total	1781.400	59			
On the B2B e-Marketplace screen	Between Groups	284.333	3	94.778	6.908	0.000*
	Within Groups	768.267	56	13.719		
	Total	1052.600	59			
Terminology and system information	Between Groups	255.250	3	85.083	9.156	0.000*
	Within Groups	520.400	56	9.293		
	Total	775.650	59			
Learning	Between Groups	501.783	3	167.261	15.897	0.000*
	Within Groups	589.200	56	10.521		
	Total	1090.983	59			
System capabilities	Between Groups	107.067	3	35.689	4.659	0.006*
	Within Groups	428.933	56	7.660		
	Total	536.000	59			

*p-value<0.05

Table 8. Scheffé's multiple comparison t-test for the effect of e-marketplace on operational satisfaction

Overall reactions to the B2B e-marketplace			
e-marketplace (I)	e-marketplace (J)	Mean Difference (I-J)	Sig.
Alibaba (E)	Alibaba (C)	1.2000	.916
	Made-in-China (E)	-5.1333*	.034
	Made-in-China (C)	-6.0667*	.008
Alibaba (C)	Alibaba (E)	-1.2000	.916
	Made-in-China (E)	-6.3333*	.005
	Made-in-China (C)	-7.2667*	.001
Made-in-China (E)	Alibaba (E)	5.1333*	.034
	Alibaba (C)	6.3333*	.005
	Made-in-China (C)	-.9333	.958
Made-in-China (C)	Alibaba (E)	6.0667*	.008
	Alibaba (C)	7.2667*	.001
	Made-in-China (E)	.9333	.958
On the B2B e-Marketplace screen			
e-marketplace (I)	e-marketplace (J)	Mean Difference (I-J)	Sig.
Alibaba (E)	Alibaba (C)	-.5333	.984
	Made-in-China (E)	-4.4667*	.018
	Made-in-China (C)	-4.7333*	.011
Alibaba (C)	Alibaba (E)	.5333	.984
	Made-in-China (E)	-3.9333*	.047
	Made-in-China (C)	-4.2000*	.030
Made-in-China (E)	Alibaba (E)	4.4667*	.018
	Alibaba (C)	3.9333*	.047
	Made-in-China (C)	-.2667	.998
Made-in-China (C)	Alibaba (E)	4.7333*	.011
	Alibaba (C)	4.2000*	.030
	Made-in-China (E)	.2667	.998
Terminology and system information			
e-marketplace (I)	e-marketplace (J)	Mean Difference (I-J)	Sig.
Alibaba (E)	Alibaba (C)	1.6000	.563
	Made-in-China (E)	-3.2000	.051
	Made-in-China (C)	-3.1333	.058
Alibaba (C)	Alibaba (E)	-1.6000	.563
	Made-in-China (E)	-4.8000*	.001
	Made-in-China (C)	-4.7333*	.001
Made-in-China (E)	Alibaba (E)	3.2000	.051
	Alibaba (C)	4.8000*	.001
	Made-in-China (C)	.0667	1.000
Made-in-China (C)	Alibaba (E)	3.1333	.058
	Alibaba (C)	4.7333*	.001
	Made-in-China (E)	-.0667	1.000
Learning			
e-marketplace (I)	e-marketplace (J)	Mean Difference (I-J)	Sig.
Alibaba (E)	Alibaba (C)	3.6667*	.030
	Made-in-China (E)	-2.6667	.180
	Made-in-China (C)	-3.8667*	.020
Alibaba (C)	Alibaba (E)	-3.6667*	.030
	Made-in-China (E)	-6.3333*	.000
	Made-in-China (C)	-7.5333*	.000
Made-in-China (E)	Alibaba (E)	2.6667	.180
	Alibaba (C)	6.3333*	.000
	Made-in-China (C)	-1.2000	.795
Made-in-China (C)	Alibaba (E)	3.8667*	.020
	Alibaba (C)	7.5333*	.000
	Made-in-China (E)	1.2000	.795
System capabilities			
e-marketplace (I)	e-marketplace (J)	Mean Difference (I-J)	Sig.
Alibaba (E)	Alibaba (C)	1.6000	.480
	Made-in-China (E)	-.8667	.864
	Made-in-China (C)	-2.0667	.254
Alibaba (C)	Alibaba (E)	-1.6000	.480
	Made-in-China (E)	-2.4667	.127
	Made-in-China (C)	-3.6667*	.008
Made-in-China (E)	Alibaba (E)	.8667	.864
	Alibaba (C)	2.4667	.127
	Made-in-China (C)	-1.2000	.704
Made-in-China (C)	Alibaba (E)	2.0667	.254
	Alibaba (C)	3.6667*	.008
	Made-in-China (E)	1.2000	.704

*The mean difference is significant at the 0.05 level.

Conclusions

This study has demonstrated the presence of differences in the definition of good interface design among B2B e-marketplaces. An experimental design was adopted for data collection to test whether interaction exists between the operational performance of B2B e-marketplace interfaces and language and whether either main effect predicts a person's B2B e-marketplace

operational performance. Two results were recorded: (a) different interface designs affect B2B e-marketplace operational performance and (b) different interface designs affect B2B e-marketplace operational satisfaction.

The primary limitation of this study is that respondents used traditional Chinese interfaces and a sample of young people familiar with interacting with computer interfaces. Thus, the ability to generalize the results to other populations with different languages or of different ages may be limited. Future studies should recruit subjects familiar with languages other than traditional Chinese.

Acknowledgement. This research was supported in part by the Global Logistics Research Center at National Cheng Kung University in Taiwan under the ”Promoting Academic Excellence of Universities” program.

Appendix 1

QUIS

Overall reactions to the B2B e-Marketplace
terrible 1 2 3 4 5 wonderful
Difficult 1 2 3 4 5 easy
frustrating 1 2 3 4 5 satisfying
inadequate power 1 2 3 4 5 adequate power
dull 1 2 3 4 5 stimulating
rigid 1 2 3 4 5 flexible
On the B2B e-Marketplace screen
characters
hard to read 1 2 3 4 5 easy to read
highlighting simplifies task
not at all 1 2 3 4 5 very much
organization of information
confusing 1 2 3 4 5 very clear
sequence of screens
confusing 1 2 3 4 5 very clear
Terminology and system information
use of terms throughout B2B e-Marketplace interface
inconsistent 1 2 3 4 5 consistent
terminology is related to the task you are doing
never 1 2 3 4 5 always
position of messages on screen
inconsistent 1 2 3 4 5 consistent
messages on screen which prompt user for input
confusing 1 2 3 4 5 clear
keep you informed about what it is doing
never 1 2 3 4 5 always
Learning
learning to operate the B2B e-Marketplace interface
difficult 1 2 3 4 5 easy
exploring new features by trial and error
difficult 1 2 3 4 5 easy
remembering names and use of commands
difficult 1 2 3 4 5 easy
task can be performed in a straightforward manner
never 1 2 3 4 5 always
supplemental reference materials
confusing 1 2 3 4 5 clear
System capabilities
system speed
too slow 1 2 3 4 5 fast enough
system reliability
unreliable 1 2 3 4 5 reliable
correcting your mistakes
difficult 1 2 3 4 5 easy
experienced and inexperienced users’ needs are taken into consideration
never 1 2 3 4 5 always

References

[1] Andrienko, N., G. Andrienko, et al. (2002). "Testing the usability of interactive maps in CommonGIS." Cartography and Geographic Information Science 29(4): 325-343.

[2] Bakos, Y. (1998). "Emerging role of electronic marketplaces on the Internet." Communications of the ACM 41(8): 35-42.

[3] Baron, J. P. and M. J. Shaw (2000). "Web-based e-catalog systems in B2B procurement." Communications of the ACM 43(5): 93-100.

[4] Chin, J. P., V. A. Diehl, et al. (1988).

Development of an instrument measuring user satisfaction of the human-computer interface, ACM New York, NY, USA.
[5] Chiu, L. H. (1972). "A cross-cultural comparison of cognitive styles in Chinese and American children." International Journal of Psychology 7(4): 235-242.
[6] Choudhury, V., K. S. Hartzel, et al. (1998). "Uses and consequences of electronic markets: an empirical investigation in the aircraft parts industry." MIS Quarterly 22(4): 471-507.
[7] Cunningham, M. J. (2000). B2B: How to build a profitable e-commerce strategy, Basic Books.
[8] Dunt, E. S. and I. R. Harper (2002). "E-commerce and the Australian economy." The Economic Record 78(242): 327-342.
[9] Eng, T. Y. (2004). "The role of e-marketplaces in supply chain management." Industrial Marketing Management 33(2): 97-105.
[10] Gehrke, D. and E. Turban (1999). Determinants of successful website design: relative importance and recommendations for effectiveness. Proceedings of the Thirty-second Annual Hawaii International Conference on System Sciences, Citeseer.
[11] Huang, H. S. and J. R. Hanley (1995). "Phonological awareness and visual skills in learning to read Chinese and English." Cognition 54(1): 73-98.
[12] Jacko, J. A. and G. Salvendy (1996). "Hierarchical menu design: Breadth, depth, and task complexity." Perceptual and Motor Skills 82(3): 1187-1201.
[13] Kaplan, S. and M. Sawhney (2000). "E-hubs: the new B2B marketplaces." Harvard Business Review 78(3): 97-106.
[14] Kukulska-Hulme, A. (2000). "Communication with users: insights from second language acquisition." Interacting with Computers 12(6): 587-599.
[15] Mahadevan, B. (2000). "Business models for Internet-based e-commerce: An anatomy." California management review 42(4): 55-69.
[16] Mangold (2009). LogSquare. Sydney, Australia, Mangold International GmbH.
[17] Nielsen, J. (1993). Usability engineering. San Francisco, Morgan Kaufmann.
[18] Nielsen, J. (2002). "Top Ten Guidelines for Homepage Usability." Accessed at: http://www.useit.com/alertbox/20020512.html, 2009.
[19] Nielsen, J. (2006). "B2B Usability." Accessed at: http://www.useit.com/alertbox/b2b.html, 2009.
[20] Park, K. S. and C. H. Lim (1999). "A structured methodology for comparative evaluation of user interface designs using usability criteria and measures." International Journal of Industrial Ergonomics 23(5-6): 379-389.
[21] Rau, P. L. P., Y. Y. Choong, et al. (2004). "A cross cultural study on knowledge representation and structure in human computer interfaces." International journal of industrial ergonomics 34(2): 117-129.
[22] Riegelsberger, J. and Y. Nakhimovsky (2008). Seeing the bigger picture: a multi-method field trial of google maps for mobile. Paper presented at the Conference on Human Factors in Computing Systems. Florence, Italy.
[23] Roberson, D., I. Davies, et al. (2000). "Color categories are not universal: Replications and new evidence from a stone-age culture." Journal of Experimental Psychology General 129(3): 369-398.
[24] Shneiderman, B. and C. Plaisant (2004). Designing the user interface: strategies for effective human-computer-interaction, Addison Wesley.
[25] Stewart, E. C. and M. J. Bennett (1991). American cultural patterns: A cross-cultural perspective, Intercultural Press, Inc.
[26] Teitelbaum, R. C. and R. E. Granda (1983). The effects of positional constancy on searching menus for information. The SIGCHI conference on Human Factors in Computing Systems, Association for Computing Machinery, Inc, One Astor Plaza, 1515 Broadway, New York, NY, 10036-5701, USA.
[27] Whorf, B. L. (2001). "The relation of habitual thought and behavior to language." Linguistic anthropology: A reader: 363-381.
[28] Yau, J. K. Y. and W. G. Hayward (2005). It's a small world after all: Western Usability guidelines predict behavior of Chinese web users of on-line bookstores.