

# Personalization and Agency of Digital Immigrants in China

by  
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**in**  
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## Abstract

This major research project explored how the design of traditional Internet browsers, which pose increasing interaction constraints to older adults with increasing age, could be stretched to create a more inclusively designed browser to meet their requirements. Specifically, design of the home page of an inclusive browser (given the name ‘iBrowser’) was carried out through a participatory process involving five older adults living in China as a first step towards future development of the full browser. Through two rounds of user-centred design, the effect of adding a personalization feature to the home page was examined. The ability to personalize the home page was found to provide a sense of agency to the older adult Chinese users, which they found welcoming. A new user interface design style (given the name ‘Literal Cards User Interface’) was developed, which could be useful to all users with compromised visual, dexterity and cognitive interaction abilities.

*Keywords:* HCI, web browser, home page, older Chinese adults, inclusive design, Literal Cards User Interface, personalization, agency.

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## Dedication

To Wensi Li

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# 1 Introduction

## 1.1 Background

China is the largest country in the world. As of 2015, China's population over 60 years of age exceeded 200 million, accounting for about 15% of the total population<sup>1</sup>. Projections from the United Nations Department of Economic and Social Affairs predict that the number of Chinese citizens over the age of 65 will soar to 219 million in 2030 and would grow to 25% of China's entire population by 2050<sup>2</sup>. The one-child policy<sup>3</sup> and attendant life style changes resulted in parents and children living far apart more often than not, with limited time spent by children with their parents. With retirement from work at the age of 55, older adults<sup>4</sup> in China lose the social contact they had with colleagues. Further, with aging, elders feel less inclined to go out and socialize. Such life style leads them to loneliness and negative emotional issues (Shi, 2012). Internet, as a communication platform and a source of information,

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<sup>1</sup>[http://www.business-standard.com/article/news-ians/china-s-elderly-exceeds-200-million-115113000361\\_1.html](http://www.business-standard.com/article/news-ians/china-s-elderly-exceeds-200-million-115113000361_1.html). Last accessed May 2, 2016.

<sup>2</sup> <http://news.nationalgeographic.com/2015/11/151113-datapoints-china-one-child-policy>. Last accessed May 2, 2016.

<sup>3</sup> The Communist Party introduced the one-child policy in 1979 in China to control rapidly rising population and food shortages. (<http://www.wired.co.uk/news/archive/2015-10/30/china-one-child-policy-in-numbers>). This policy has been lifted from January 1, 2016.

<sup>4</sup> Statistics Canada defines older adults as individuals of ages from 55 to 64 and seniors as individuals of age 65 and above. (<http://www.statcan.gc.ca/pub/85-002-x/2012001/article/11627-eng.htm>.)

affords them company at home, and helps mitigate social exclusion (Zajicek, 2004).

## **1.2 Problem**

According to the China Internet Network Information Centre (CNNIC), more than half of China's Internet users are between the ages of 10 and 30. These youngsters are digital natives<sup>5</sup> who found Internet to be a part of the world, as they first knew it (Prensky, 2001). They are native speakers of the digital lingo of the Internet. They not only consume but also produce content and shape the Internet through their actions. Many of them are designers of digital technologies. In the absence of explicit user requirements, they can only be expected to design for themselves (Barnicle, 2000), and not so much for others such as older adults or seniors, whose requirements could be different from their own.

Older adults and seniors account for less than 6% of the 650 million Internet users in China; and the rate of growth of older Internet

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<sup>5</sup> A term coined by Prensky (2001) to denote those born into an Internet-enabled world.

users is less than the ageing rate (CNNIC, 2012-2013). Internet was nonexistent when these individuals were growing up. As they enter the online world as digital immigrants<sup>6</sup>, they face other challenges such as unfamiliarity with the structure and norms as well as the related technical and social lingo that has developed with time. If they found some feature unsuitable, they do not have the capability, and therefore the agency, to personalize it to suit them. More often, personalization features that this population would require might not even be built into the design of the browser, web pages and other technologies that drive the Internet. Moreover, even individuals who have no apparent impairments in sensory or cognitive capacities would find those capacities deteriorating over age, leaving them lesser and lesser able to use the same browsers that they were able to use until then.

The top six Chinese web browsers by total reach as of August 2014 were IE, Chrome, Sougou, Cheetah, QQ Browser and 2345<sup>7</sup>. Due to commercial reasons, the web browsing tools industry has not focused

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<sup>6</sup> A term coined by Prensky (2001) to denote those who were born before the Internet happened and adopted its use out of fascination for it or for its utility.

<sup>7</sup> <http://www.chinainternetwatch.com/12582/top-6-desktop-browsers-in-china-in-2014>. Last accessed on May 2, 2016.

much on the elderly users in China, as can be seen from reviews of popular Chinese browsers<sup>8,9</sup>. Browsers, like many other digital tools, are designed for the typical user, who has perfect visual, dexterity and cognitive abilities. However, this typical user might not be representative of several other groups of users along the edges, such as older adults. Given the above scenario, there is a need to engage with older adults in China to understand the extent to which the current browsers that they use fall short of their requirements and expectations. New designs that encompass these requirements need to be created.

### **1.3 Design Challenge**

Inclusive design is about recognizing the diversity and uniqueness of users, identifying design that falls short of a group of users and stretching it through inclusive processes, in ways that not merely include them but also have a broader systemic impact (Treviranus, 2016). This project took on the challenge of designing a browser home page for older adults in China using a user-centred design approach. Design

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<sup>8</sup> <http://www.chinatechnews.com/2008/09/18/7557-qihoo-formally-launches-web-browser-product-in-china>. Last accessed on May 2, 2016.

<sup>9</sup> <http://www.maxthon.com/?lang#product>. Last accessed on May 2, 2016.

requirements were generated through literature review, environmental scan and user survey with five older adults living in China. A browser home page was designed and provided to the participants for use and feedback. Based on the feedback, the home page was personalized to meet individual participant's requirements. Each participant used their individually personalized page and provided feedback, which was positive.

## **1.4 Outcome**

The home page of a new browser targeting older Chinese adults, named iBrowser (standing for Inclusive Browser), was designed using a novel 'Literal Cards User Interface' with the following features:

- Home page as a set of a dozen cards each leading to a website.
- Big words and high colour contrast (to support reducing vision).
- Large clicking area (to support reducing dexterity).
- Use of text instead of graphic icon (to reduce cognitive load).
- Less options to maintain focus (to reduce cognitive load).
- User option to change cards (to facilitate personalization).

Feedback from the participating users was found to be encouraging for undertaking further work on developing the browser.

## 1.5 Framework

Figure 1 depicts the user-centred research framework visually.

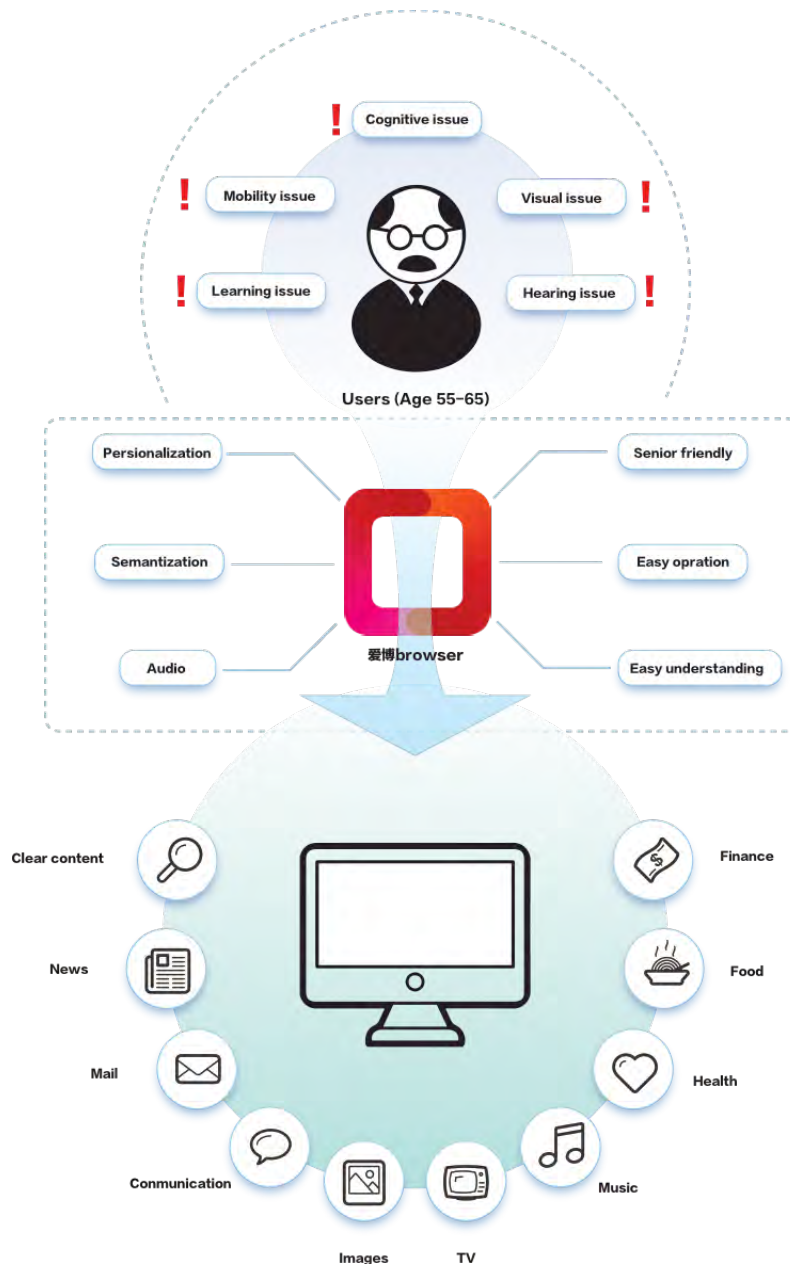


Figure 1: Framework

## **2 Literature review**

Chadwick-Dias, Bergel & Tullis (2007) had concluded, based on their research done almost a decade ago, that web browsing user experience research in China focused more on young users and neglected older age groups over the previous decade. This position continues today, as seen from a review of subsequent research reported in the following section.

### **2.1 Research on Interaction Design for Older Users**

There are several bodies of empirically grounded knowledge on interaction design for older people developed based on rigorous experimental work such as designing for dynamic diversity (Zajicek, 2000, 2004), research-derived ageing-centred web design guidelines (Kurniawan & Zaphiris, 2005), usability evaluation of ‘senior-friendly’ website (Hart, Chaparro & Halcomb, 2008), user interface design for older adults (Morris, 1994) and senior-friendly technologies: Interaction design for senior users (Duh, 2010).

Zajicek (2001) recognized the variance over time in age-associated interaction constraints in older users due to failing memory and vision,

and came up with an innovative interface design approach named Design for Dynamic Diversity (DDD) that recognizes and addresses design issues resulting from changing user requirements related to changing abilities. Memory is required to build strategies at the interface in order to complete tasks and good sight is crucial for using small buttons and multitasking windows.

Gregor, Newell & Zajicek (2002) declared the making of accessible interfaces for older people to be a unique but many-faceted challenge. They advanced a novel form of design called User Sensitive Inclusive Design based on their empirical finding that older people have significantly different and dynamically changing needs where memory, vision and confidence provide the parameters for discussion, and illustrate the importance of User Sensitive Inclusive Design in establishing a framework for the operation of Design for Dynamic Diversity.

Through their study involving heuristic and usability evaluations, Hart, Chaparro & Halcomb (2008) have demonstrated the importance of



using both guidelines and usability testing when designing websites for older adults.

Kurniawan, King & Evans (2006) in their study about personalization of web pages by older people, state that personalizing could be used to alleviate functional impairments in older people. Based on user comments, they recommend that the best personalization technique instrument for older persons would be one that most faithfully preserves the original layout while requiring the least effort.

Older adults form a user group that is significantly different from the mainstream user groups as a result of age-associated changes including fluid memory loss, and low levels of confidence (Zajicek, 2001, 2004).

In his study on search performance by older adults, Aula (2005) discovered that although their performance in the search tasks was adequate, understanding the structure of the Web and terminology used caused problems. This shows that older adults might be less fluent in Internet terminology than younger web users.

## 2.2 Ageing and Interface Design

Aging is the inevitable process of becoming older, which brings about a reduction in the visual and auditory average resolution, the reaction of average strength and speed, the sense of flexibility and complex thinking skills and at least one part of memory function (CRCA, Web, n.d.). Important changes that occur with age, as published by the Chinese Research Centre on Ageing (CRCA) are listed below under the categories of vision, hearing, dexterity, memory, learning, thinking and attention, along with implications for interface design.

**Vision:** In visual perception, the perceptual ability of static details and dynamic stimuli decline sharply with age. By the age of 90, the sense of perception might be roughly 80% declined. Interface design for the aged, therefore, should be as simple as possible, avoiding the use of compact navigation bar, small icons and animation.

Perceiving movement on the screen could take them longer. Further, due to reduced ability to regulate the eye lens, objects on close-up become blurred. In addition, the perception of visual depth information also becomes slow, making it difficult to determine the

specific location of any object, resulting in reduced eye-hand coordination, especially in operations involving pointing and clicking with the mouse. Interface design must, therefore, build in some degree of fault tolerance, and minimize the need for fine operation. Element spacing should be reasonable, and not crowded.

Color perception gradually declines in older adults. Due to the lens becoming brown, there could be errors in colour recognition, especially on the blue spectrum. Interface design should strengthen the contrast between interface elements and details, making them easier to be identified, avoiding the use of similar hues of color.

**Hearing:** With the onset of age, hearing ability declines. The recession of high pitch is more obvious than the bass, making it easier to detect low frequency sounds from 500 to 100 Hz. Therefore, when using audio prompts in interface design, a low frequency male voice might be the better choice.

Moreover, in a noisy environment, it is difficult for older adults to separate out complex sound forms to identify useful voice information. Therefore, when conveying voice information on an interface, clarity of

the sound must be maintained by reducing noise, allowing sound playback and making it adjustable.

**Dexterity:** The ability to coordinate and control movement significantly decreases with age. Studies have indicated that a 60-year old person takes at least 20% more time to react than what they would have taken when 20 years old. In addition, their muscles gradually become weaker, making it more difficult to perform tasks involving dexterity. Therefore, complex operation of gestures such as screen scrolling must be avoided in interface design, keeping it simple and easy to use.

**Memory:** As age increases, memory weakens. This mainly manifests as reduced short-term memory in elders. Information can be saved in people's short-term memory for about 20-30 seconds. American psychologists, Shiffrin & Atkinson (1968) indicate that if some stimulus information cannot be processed repeatedly, or get transferred to a cognitive operation task in short-term memory, such stimulus will decline and disappear; otherwise it will be stored in long-term memory. Therefore, in the case of complex or unfriendly interface design, the elderly might find it difficult to learn and shift from short-term memory

to long-term memory, causing them to forget. The decline of long-term memory of the elderly is not obvious, but recalling from short-term memory takes them a long time. And, compared with the most recent memory, they are more likely to recall very early memory. Therefore, in the design of the interaction, as far as possible early memory information is to be used. Task complexity and the number of tasks should be limited, and the relevant tasks should not produce conflict with each other.

**Learning:** Learning new things is more difficult for the elderly, mainly because they have to understand the contents of the study while retaining it in the short-term memory and then deposit into the long-term-memory. In addition to the impact of memory characteristics, the design of the learning content is also important. Vivid and interesting content can accelerate their mastery of the learning content. Beyond the age of 75, the speed of information processing of the elderly, such as thinking, decision-making, reading, calculation, etc. decrease gradually. Therefore, in the design of user interface for the elderly, designer should provide an environment that is easy to learn and operate, and allow them more time to get information or to complete a task. After proper

learning, they would be able to have a good grasp of the operation of the method and process.

**Thinking:** The response of older people becomes more sluggish over the years. They need more time to form a new concept through thinking, and they are more conservative. In general, they make little response to new knowledge and rarely try new ways to solve a problem. They are more likely to rely on the accumulated past knowledge, and would base decisions on their experience.

**Attention:** Decreased attention causes low concentration, rendering decision making more difficult. Therefore, the interface design should be reasonable in planning the layout of the interface, guide attention and shorten the process of processing information for the elderly.

### **2.3 Design Criteria from Literature**

From the above review of literature, some design considerations emerge with respect to designing for older Chinese adults. Salient points that could be included in the design criteria for the browser home page for older adults as part of this research have been listed hereunder:

- Design should dynamically accommodate the changing user requirements related to changing abilities (Zajicek, 2001).
- Memory, vision and confidence provide parameters for design. Fluid memory loss, and low levels of confidence mark older users (Gregor, Newell & Zajicek, 2002).
- It is important to use both guidelines and usability testing (Hart, Chaparro & Halcomb, 2008).
- The best personalization technique for older users would be one that most faithfully preserves the original layout while requiring the least effort (Kurniawan, King & Evans, 2006).
- Older adults might be less fluent in Internet terminology than younger web users (Aula, 2005).
- Based on important changes that occur with age in vision, hearing, dexterity, memory, learning and attention as published by the Chinese Research Centre on Ageing (CRCA, Web, n.d.), the following interface design criteria emerge:
  - Interface design should be as simple as possible, avoiding the use of compact navigation bar, small icons and animation. (vision)
  - Interface design must build in some degree of fault tolerance, and minimize the need for fine operation. Element spacing should be reasonable, and not crowded. (vision)
  - Interface design should strengthen the contrast between interface elements and details, making them easier to be identified; similar hues of color must be avoided. (vision)

- When using audio prompts in interface design, a low frequency male voice might be the better choice. (hearing)
- When conveying voice information on an interface, clarity of the sound must be maintained by reducing noise, allowing sound playback and making it adjustable. (hearing)
- Complex operation of gestures such as screen scrolling must be avoided in interface design, keeping it simple and easy to use. (dexterity)
- Early memory information is to be used in interaction design. Task complexity and the number of tasks should be limited, and related tasks should not produce conflict with each other. (memory)
- An environment that is easy to learn and operate must be provided. More time must be allowed for users to get information or to complete a task. (learning)
- Interface design should be reasonable in planning the layout of the interface, guide attention and shorten the process of processing information for the elderly. (attention)



### 3 Environmental scan

This section presents a review of tools developed in China and all over the world that make the Internet available and accessible to people with disabilities and those that are ageing.

#### 3.1 Accessible Browsers

This section reviews browsers built specifically to cater to users with disabilities. Sadly, most of these browsers are out of date, not available or not downloadable.

**BrookesTalk:** <http://www.brookes.ac.uk/speech/>

This browser, developed by Oxford Brookes University, focuses on facilitating intelligent web searching. It offers speech output and screen-magnification. A demonstration piece is available.

**EIAD:** <http://gippsnet.com.au/eiad/browser.htm>

A browser from Sarsfield Solutions, which provides enhancements specifically for people with special needs and learning difficulties. It is compatible with touch-screen interface, and has a simplified language interface. Demonstration is available.

**EMACSPEAK:** <http://emacspeak.sourceforge.net/>

This is a speech-enabled environment for EMACS, running under UNIX or LINUX, including full web browsing capabilities through W3. It features speech output and a simple keyboard interface. A free download is available.

**HomePage Reader:** <http://www.ibm.com/ca-en/>

This speech-based browser from IBM, using Internet Explorer as its engine, was designed for blind or visually impaired users. Speech output and standard graphical user interface. Full function trial is available, in multiple languages.

**Marco Polo:** <http://www.webpresence.com/sonicon/marcopolo>

This is a plug-in for Netscape Navigator from Sonicon with speech and auditory icons. It has speech output, audio icons and simple keyboard interface. Demonstration is available.

**MultiWeb:** <http://mis.deakin.edu.au/mis/multiweb/>

This is a disability-specific browser developed at Deakin University. It includes speech output, screen magnification and scanning for switch devices.

**pwWebSpeak:** <http://www.issound.com/pwWebspeak.htm>

This has speech output, synchronised speech, screen magnification and a simple keyboard interface. Note from the isSound Web site: "isSound has made the decision to discontinue selling, enhancing and supporting the pwWebSpeak non-visual browser effective, 1 Jan 2001." Demonstration is available.

**Sensus Internet Browser:**

<http://www.sensus.dk/sensus/notfoundpage1.aspx?notfoundurl=%2fsib10uk.htm>

This is a low-vision Internet browser from Sensus in Denmark. It has speech output, Braille support and special screen fonts. No demonstration available.

**Simply Web 2000:** <http://www.econointl.com/sw/>

This has a talking interface and uses the Internet Explorer engine. It has speech output, simple keyboard interface. Free download is available.

### **3.2 Browsers with adaptive technology**

These browsers are all designed for general use, but are of interest because they may give enhanced accessibility in combination with particular adaptive systems, and some have enhanced screen magnification or navigation options.

**AMAYA:** <http://www.w3.org/Amaya/>

This is W3C's test-bed browser, implementing emerging web technologies. There are versions for Windows 95/98/ME, Windows NT and UNIX.

**ARACHNE:** <http://arachne.browser.org/>

This is a graphical browser for MS-DOS.

**Internet Explorer, accessibility features:**

<https://www.microsoft.com/enable/products/ie.htm>

Microsoft has included many features in Internet Explorer to enhance accessibility.

**Net-Tamer:** <http://www.nettamer.net/>

This package runs under MS-DOS and includes both text-based and graphical browsing capabilities.

**Netscape Navigator:** <http://www.aol.ca/?r=netscape.aol.com>

Navigator enables enlargement of fonts.

**Opera:** <http://www.operasoftware.com/index.html>

This compact browser for Windows 95/98/ME offers enhanced keyboard navigation and screen magnification.

### 3.3 Summary

Through this extensive review, it became clear that browser accessibility extensions primarily provide features such as colour enhancement, high contrast, image alt texts and caret browsing to improve user experience. Some accessibility features built into the browser were, page zoom and screen read. However, these are hard to

use and not very stable. The interface is complex, with a number of function icons, possibly not very easy to use even for young users. Moreover, most of the browser products listed cannot be downloaded or installed. Many of them have stopped updates; possibly they are hard to sustain.

Overall, the lesson learned from the review of accessible browsers and plug-ins is that, while each attempts to cater to one or more specific sensory impairment, none of them is designed to support a gradual and simultaneous reduction in several sensory as well as cognitive capacities as is the case with aging. The design of a new browser for older adults is, therefore, a useful pursuit.

## 4 Methodology

This project is an inclusive design exercise conducted with the voluntary participation of a group of older Chinese adult web users living in China. They represented an edge case user group whose requirements were studied to facilitate the design of a browser home page that meets those requirements. In order to stretch the limits of current browsers, the online browsing practices of these users were examined through an online survey to understand how they find required information and perform tasks using traditional Chinese browsers. An accessible browser home page was designed and provided to them for use for one week and their feedback was obtained. Based on the feedback, the home page was revised and given back to them to use for one more week. Their feedback was obtained once again. The outcome was written up as a research report. Before commencement of this research, an ethical research protocol describing the above research process was written up and submitted to the Research Ethics Board of OCAD University, who reviewed and approved the same.

**Recruitment.** Five participants of age between 55 and 65 years were recruited from China by posting a notice as given in Figure 2 on Baidu postbar<sup>10</sup>, which is the largest communication platform provided by the Chinese search engine Baidu. The recruitment notice was posted online at <http://tieba.baidu.com/p/4374690926>.



**招募** 爱博浏览器  
ibrowser Invitation  
让中国中老年人享受上网得乐趣  
Making web browsing easier and more enjoyable for older adults in China

**你居住在中国二线城市吗？  
你的年龄在55-65之间吗？  
你退休了吗？**

如果答案是：**是的！**那么您  
被荣幸的邀请来参与中国中老年人  
浏览体验调查。

我是谁：我叫Zen，来自加拿大，多伦多。我是OCAD艺术大学，包容性设计专业的研究生。我的研究课题是如何让中国中老年人网上浏览体验更舒适。  
如果您希望参加这次调查，请通过微信联系我：**linyu6518**

希望您抽出30分钟时间，我将会给您发送一份电子问卷。之后您将会被要求设置浏览器的首页。通过新首页的使用，我会收集您的反馈信息完善首页的设计。之后我会撰写研究报告。  
如果您有任何问题请及时在微信上联系我，谢谢。  
作为回报，您将有机会获得加拿大产的健美生保健维生素一瓶。  
期待您的参加：)



Figure 2: Invitation letter.

<sup>10</sup> tieba.baidu.com.



English translation of the above posting is given in Figure 3.

**Making web browsing easier and more enjoyable  
for older adults in China**

**Invitation to participate in research study**

Are you a resident of a second tier city in China?  
Is your age as on January 1, 2016 between 55 and 65  
years?  
Have you retired from your work?

If your answer to all these questions is YES, then you are invited to participate in my research study. I am Yu Lin, a final year student in the Master of Design program in Inclusive Design in OCAD University, Toronto, Canada. I am studying the online practices of older adults in order to design a browser tool that will make browsing easier and more enjoyable for them.

If you wish to participate, please contact me by WeChat at linyu6518.

As part of the study, I will send you an electronic survey by WeChat. It will take you 30 minutes or less to complete it. After you return the completed survey, you will be asked to try out a home page. With your feedback, I will make changes to your home page and ask you to review it again. By learning from the inputs of participants like you, I will be writing a report about the results of my research.

If you have any questions, please contact me.

*Figure 3: English translation of Chinese recruitment poster*

All communication with the participants was carried out via WeChat<sup>11</sup>, the largest mobile text and voice messaging system used by more than half a billion people in China.

**Gathering user requirements through survey.** Based on the literature review on Internet browsing by older Chinese adults and an environmental scan on browser accessibility, a survey as given in Appendix A was designed to gather data on the web browsing practices of the five participants. The survey was prepared and distributed using the Chinese site Tencent survey<sup>12</sup>. The link to the online survey is:

<http://wj.qq.com/survey.html?id=291019&hash=7bdf>.

**Usability studies.** Based on user requirements gathered from all the above data, a home page was designed at <http://linyu6518.wix.com/ibrowser>. The link to this home page was sent to each of the five participants and they were advised to use it for one week. A tutorial as in Appendix B was prepared to guide the participants in setting the designed page as their home page. After one

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<sup>11</sup> <http://www.wechat.com/en/>.

<sup>12</sup> <http://wj.qq.com>.

week, online interviews were done through WeChat to collect feedback from users.

Based on their feedback, one personalized version of the homepage was prepared for each of the participants and each link was sent to the corresponding participant. A second interview was held via WeChat after one week to gather user feedback. The browser home page designs are presented and discussed in Section 6.

Data from the user survey were analysed using descriptive statistics and results from the analysis are presented in the following section.

## 5 Ideation

### 5.1 User requirements from Survey

Data gathered through the Tencent survey were analysed to arrive at results as presented and discussed below.

**Findings from the survey.** Three of the five participants had spent between 3 to 5 years on the Internet. One participant reported less than three years, while the last one had spent more than 5 years online.

Table 1: Internet usage by participants

选项	小计	百分比
1年以下 Less than 1 year	0	0%
1-3 年 years	1	20%
3-5 年 years	3	60%
5 年以上 More than 5 years	1	20%



Figure 4: Internet usage by participants

With regard to browsers used, two of the participants used Safari and one each used 360, QQ and Sogou browsers.

Table 2: Browsers used often

选项	小计	百分比
IE 浏览器	0	0%
360 浏览器	1	20%
遨游浏览器 Aoyo Browser	0	0%
Chrome 浏览器	0	0%
QQ 浏览器	1	20%
火狐 Firefox	0	0%
搜狗浏览器 Sogou browser	1	20%
其他	2	40%

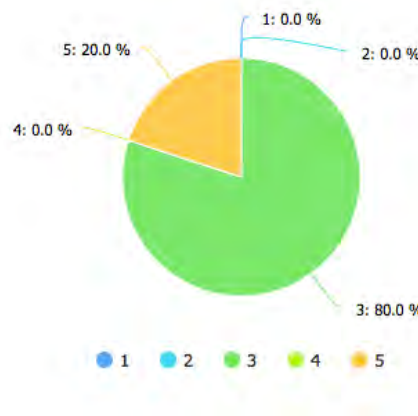
One participant said they used **360** browser, and that it was “just so-so.” Another participant, who used **QQ** browser, said that it was very slow. One participant, who used **Sogou** browser, reported that it was “pretty good.” Two participants said they used **Safari**, under the last option (others); they had never tried any other browser, so could not compare their experience with anything else.

*Table 3: Familiarity with browser features*

选项	小计	百分比
非常了解 <b>Very familiar</b>	0	0%
了解一点 <b>Familiar a little</b>	3	60%
一点也不 <b>Know nothing</b>	2	40%
其他	0	0%

When it came to familiarity with features of the browser, none of the participants said they were very familiar with all features. Two of them said they knew nothing, while three said they were a little familiar. This is in alignment with the general understanding gathered from literature review and environmental scan, that older adults in China are not too savvy when it comes to use of technology for web browsing. Four of the

five said that the browser is most important to them; one said it was of average importance.



*Figure 5: Importance of browser*

When asked to rate the browser they were currently using most, four out of 5 said it was average and one said it was very good (Figure 5).

One of the participants felt that his browser was pretty handy and the features were quite good. Two felt that the text in their browsers was too small, and they would prefer a feature for the browser to be able to zoom the text to read the screen easily. Two of them felt that there is something lacking, but they were not able to suggest any new feature. This only shows that they were not very tech savvy.

The variety of online activities participants engaged in is shown in Table 4.

Table 4: Activities done often with browser

选项	小计	百分比
看新闻 News	4	80%
看视频或电影 Video or Movie	1	20%
音乐或广播 Music or Radio	1	20%
玩游戏 Game	0	0%
发邮件 Email	1	20%
交朋友 Making friends	2	40%
购物 Shopping	0	0%
其他	1	20%

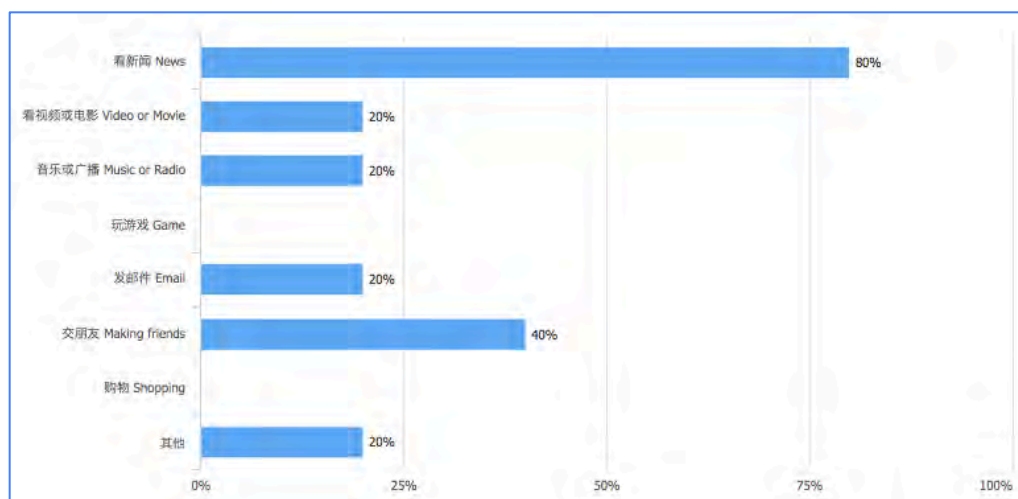


Figure 6: Activities done with browser



Table 5: Reasons with unhappiness with web browsing

选项	小计	百分比
界面复杂 <b>Complex interface</b>	3	60%
运行太慢 <b>Too slow</b>	3	60%
推荐内容不满意 <b>Unsatisfactory content that the browser recommended</b>	3	60%
不安全 <b>Unsafe</b>	1	20%
其他	1	20%

Table 6: Features for good browsers

选项	小计	百分比
简单易用 <b>Efficiency; simple and easy to use.</b>	3	60%
全能型,集成多种应用于一身 <b>All-round; integrate diverse apps into one browser.</b>	2	40%
个性化 <b>Affords personalization.</b>	0	0%
其他	0	0%

Three of the five participants wanted the browser to be efficient; simple and easy to use. One of them said, “For my age, I like easy to use features.” Second also said, “More convenient for my age.” Another said, “For me, the easier, the better.” Two said they did not want to deal many apps; rather, they preferred different apps to be integrated into one browser that would be an all-round, efficient tool. Both felt that the functional aspects of the browser are more important.

Surprisingly, none of them selected the option that browsers should afford personalization. On the contrary, in a subsequent step in the research, each and every one of them spelt out some feature of the home page that they needed to get personalized. This just means, possibly, that they did not understand the technical term ‘personalization’, or that they did not know they needed it until they knew it could be done, but in reality, they did prefer their browser featured to be personalized to their preferences.

## **5.2 Design Criteria from User Data**

Guided by the findings from the survey as discussed in the previous section, the following design criteria were noted for consideration in the home page design:

- Avoid technical jargon (participants were not very tech savvy).
- Create a novel design (some were not very satisfied with their current browsers; but all were willing to try out new designs).
- Try innovative ideas (they felt that “there is something lacking”, but they were “unable to suggest any new feature”).
- Use large text (they found the text on their browser too small; so, larger text would be easier for them to read).

- Keep the design simple (they found their browser's interface to be too complex).
- Link their favourite websites to the home page (they were not happy with the content recommended by the browser).
- Keep the design minimalistic and functional (they wanted the browser to be simple, easy and efficient to use).
- Provide an integrated interface (they wanted a single interface for doing all their online activities).

The above criteria, together with some criteria derived in Section 2 and Section 3 based on literature review and environmental scan, were used in the design of the iBrowser home page, as described in the following section.

## 6 Implementation

The home page created initially can be viewed at <http://linyu6518.wix.com/ibrowser>. Figure 6 shows a screenshot of the home page. This page is in Mandarin Chinese. This page was sent to all participants along with a tutorial (as in Appendix A) explaining how they could set it up as the home page on their browser.

The same page is rendered again at <http://linyu6518.wix.com/ibrowser#!en/wzt52> along with English translation, as shown in Figure 7.



Figure 7: Initial accessible home page for all participants

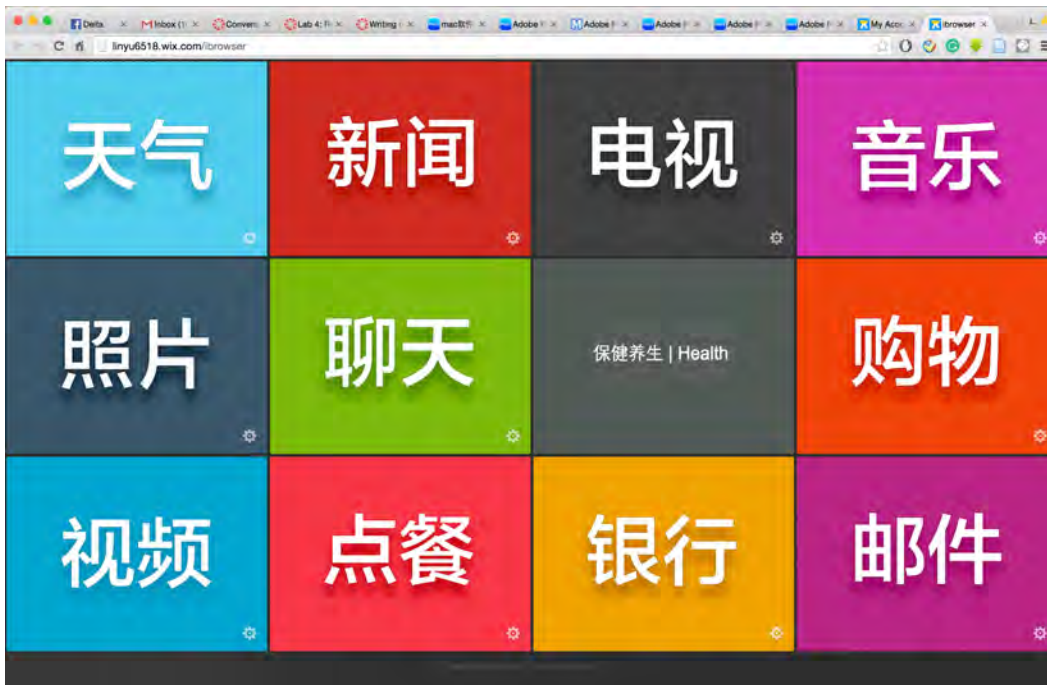


Figure 8: Initial accessible home page

A satisfaction survey was carried out via WeChat at the end of one week after the participants had set up the home page on their browsers. Results of the survey are presented and discussed below.

## 6.1 Satisfaction Survey

Q1: How many hours do you spend on the Internet per day?

- P001: 3 hours. On music, stock information and health.
- P002: 2 hours. On daily news and military news.
- P003: 4 hours. On painting information and news.
- P004: 5 hours. On stock and personal blog
- P005: 1 hour. On photography and news.

Q2: Do you feel satisfied with the tutorial about setting the home page?

- P001: Very satisfied.
- P002: Very satisfied.
- P003: Very satisfied.
- P004: Somewhat satisfied. Clear but too much.
- P005: Very satisfied.

Q3: Overall, do you feel satisfied with the performance of the home page?

- P001: Somewhat satisfied, looks good, easy to use but I don't use online banking.

- P002: Very satisfied, very good news resources, I can find everything.
- P003: Unsatisfied, not too much information about Chinese painting, and I don't know how to find them.
- P004: Somewhat satisfied, but I need to add stock quotes.
- P005: Very satisfied, simple, all functions that I need has already been put on it. Cool.

Q4: How satisfied are you with the look and feel of the home page?

- P001: Very satisfied, the words are very clear.
- P002: Very satisfied, easy to click.
- P003: Very satisfied, I like the big words.
- P004: Very satisfied, colourful, and easy to read.
- P005: Very satisfied, simple and direct.

Q5: Based on your experience, would you recommend this to a friend?

- P001: Sure.
- P002: Yes.
- P003: Why not?
- P004: I am happy to do this
- P005: I would, if some one needs it.

Q6: How would you describe this home page in one or more words?

- P001: Beautiful.
- P002: Simple and efficient

- P003: Clear
- P004: So so.
- P005: Need to be better.

Q7: What do you find most frustrating about the home page?

- P001: Getting use to it.
- P002: I feel good with it.
- P003: I am okay.
- P004: Cannot find what I want. Stock, for example.
- P005: No frustration.

Q8: Overall, how easy to use do you find?

- P001: Very easy
- P002: Easier than before.
- P003: Yes, easier than before but the resource is lesser than before.
- P004: Still need to learn, but you can get use to it.
- P005: Very easy. All I need to do is click on the coloured square.

Q9: What features could you not live without?

- P001: Music
- P002: I can't live without the computer.
- P003: News
- P004: Stock information for sure.



- P005: I think it is as simple as possible; you could not simplify it any more.

Q10: What do you like best about this home page?

- P001: Big words.
- P002: Big words and coloured screen.
- P003: Big and clear words.
- P004: Big text.
- P005: Easy to use.

Q11: What do you like least about this home page?

- P001: Cannot add function.
- P002: Love it.
- P003: Cannot change the square.
- P004: Less resource about stock.
- P005: Opening is a little bit slow.

Q12: How can we improve you personal home page? What item(s) do you want to remove and what do you want to add?

- P001: For me, I would like to have more music resources which can let me download, because I am a singer in our community. I need to keep my songs storage fresh. And I would like to have some health online course website. I hope I can help my friends around me by adding to my health knowledge. Item that I want to

remove is Banking. I do not believe in the security of online banking.

- P002: This home page is able to satisfy me. If you can add more military news, that would be better. Besides, I do not listen to music, do shopping, order food or do banking online.
- P003: It would be great if you can add links about Chinese painting; as many as you can. And I like Weibo, but I don't find it on your home page.
- P004: I want as much information as I can about stock. Other buttons are fine.
- P005: I need more art news, especially the photography.

Some highlights from the feedback on first home page are:

“Very satisfied” “Very good resources” “Very simple” “Cool”  
“Each word is very clear.” “Easy to click” “Big words easy to read”  
“Colourful” “Simple and direct.” “Beautiful” “Like the big words  
and colour UI”

“Could be better” “Easier than before but lesser resources” “Cannot  
add functions” “Cannot edit the square” “Not much information  
about Chinese paintings” “I need to access stock quotes.” “I don’t  
want Banking.”

Based on each participant's response to Q12 regarding their preferences for personalization of their home page, five separate personalized home pages were developed as presented in Figures 8 to Figure 13.



*Figure 9: Home page personalized for Participant 1*



Figure 10: Home page personalized for Participant 2



Figure 11: Home page personalized for Participant 3



Figure 12: Home page personalized for Participant 4



Figure 13: Home page personalized for Participant 5

Participants used these pages for one week, after which one more satisfaction survey was done via We Chat. Summary of the feedback on the second home page is given below:

How do you find this one?

“Very satisfied” “Clear” “Simple and efficient” “Easier than before” “Now I can find everything I want.” “All functions that I need have been put on it.” “Very easy. All I need to do is to click on the coloured square.”

Would you recommend this to a friend?

“Sure.” “Yes.” “Why not?” “I am happy to do this.” “I would if some need it.”

## 7 Representation of User States and Contexts

The participating older Chinese adults are digital immigrants, in the sense that they were born before the advent of the Internet and migrated into the Internet culture, unlike young Chinese web users who are digital natives, born into a world of which the Internet is already a part. They possess adequate level of digital literacy to operate on the Internet by virtue of the way they were recruited online, while not being too familiar with the online lingo. Although not stated explicitly, their need for personalization was seen to be high. They possessed lesser than typical vision and dexterity on account of aging. Their cognitive capacity is doubly reduced, firstly due to their state of aging and secondly due to the context of complex and crowded interface design.

By plotting the six dimensions referred to in the above summary—digital familiarity, fluency in Internet lingo, browser personalization, vision, dexterity and cognition—in the form of a user states and contexts diagram as in Figure 14, an assessment of the outcome of this inclusive design exercise is attempted. This user states

and context diagram illustrates the inclusive design of browser home page achieved through this project.

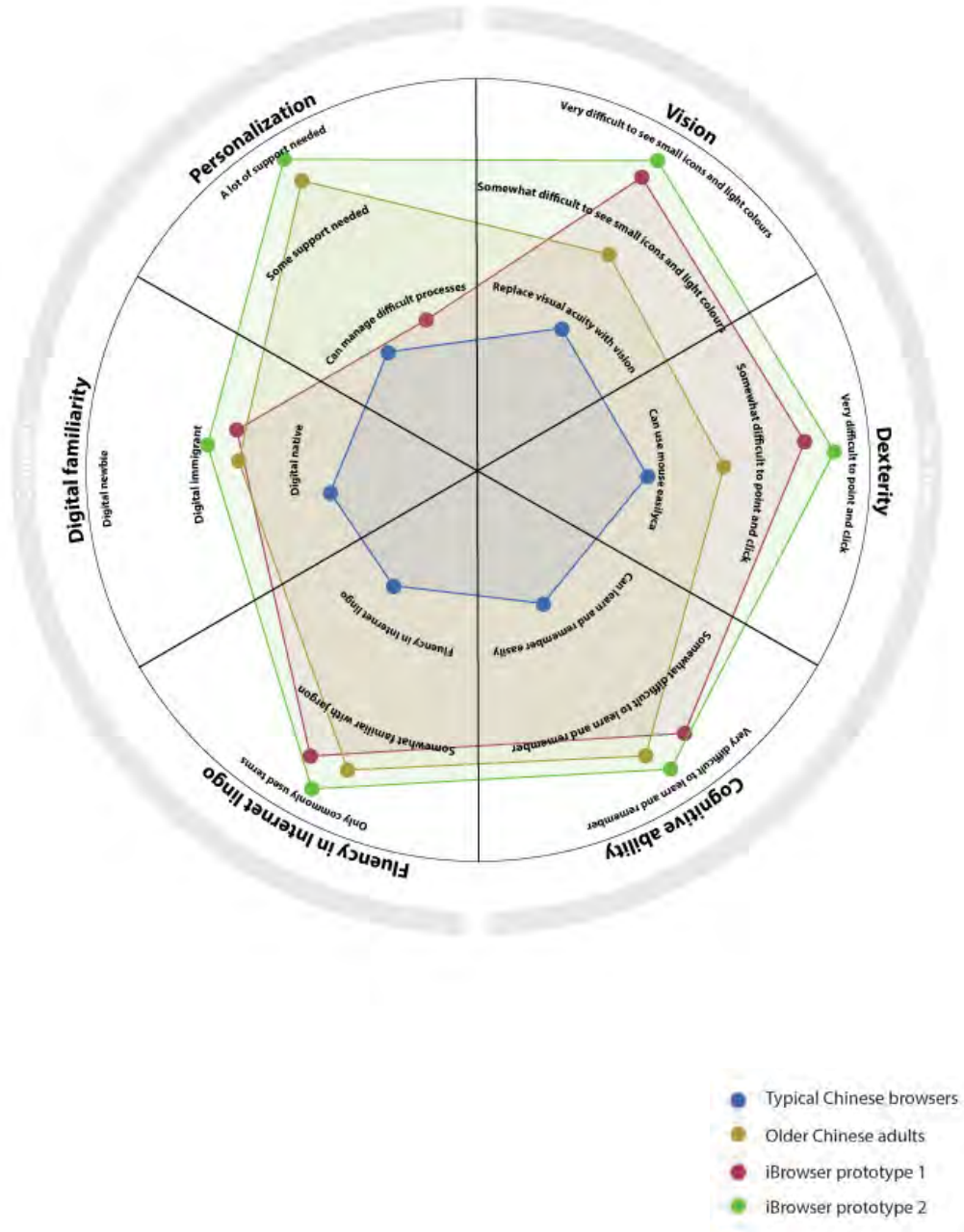


Figure 14: User States & Contexts Diagram



At the centre of the diagram are typical users whose design assumptions guide the design of typical browsers. Users with a variety of diverse and unique profiles and needs could be visualized as we move outward towards the edge. In a nutshell, the diagram shows how the scope of typical browsers (blue line) falls short of meeting the requirements of the older Chinese adults as edge case users (brown line). It also shows how the iBrowser prototype 1 stretched the design of browsers to include the edge users' requirements in all ways except personalization, and how the iBrowser prototype 2 stretched that last aspect to completely include the designated edge users.

The components of this diagram are explained below:

**User states:** The three user states chosen are vision, dexterity and cognitive ability. These choices represent the three user states that the home page design focused on supporting as they reduced with age. All three range from high capacity closer to the centre to low near the edge of the diagram.

**Contexts:** The three contexts chosen are fluency in Internet lingo, digital familiarity and browser personalization. Fluency in Internet

lingo is high near the centre and reduces progressively to a low value near the edge. Digital natives closer to the centre, digital immigrants following that, and digital outliers towards the edge represent digital familiarity. Browser personalization is represented by ease of personalization increasing from the centre to the edge.

**Typical user:** User states needing accommodation with respect to vision, dexterity and cognition increase from the centre to the edges. For example, typical users would have high dexterity and so would be able to click on small icons and objects on the screen. In terms of cognition, typical users could be seen as having a very good working memory and as being familiar with the standard icons and terms used on the Internet.

**Edge user requirements (Brown outline):** Using the above user states and contexts, the user requirements of older Chinese adults are mapped on the diagram to create a jagged circular outline based on the values derived from the research for their states and contexts. Although each of the users could be slightly different, none of them had visual, dexterity or cognitive impairments. Their level of interaction

capabilities being closer to the edge is due to their ageing or their status as digital immigrants. Hence only one circle is used to represent all the users as a segment of edge users. They have medium level of visual acuity and dexterity and somewhat lower level of cognitive ability due to compromised working memory; and these could be expected to decrease as they age further. Older Chinese adults, as digital immigrants, are not fully familiar with the online vocabulary for facilitating browsing on the Internet. They would be able to use personalization features if they are easy. These users are, therefore, located more towards the edge.

**Typical Chinese browsers (Blue outline):** An aggregated representation of the design characteristics of the typical Chinese browsers used by the user group, most of which have similar features, is indicated by another jagged circular outline. While this outline includes typical users, it excludes the edge user group, in that it falls short of supporting their level of visual acuity, dexterity and cognitive ability and meeting their requirements for personalization.

**iBrowser prototype 1 (Red outline):** Design characteristics of the first prototype of iBrowser are represented by the red outline. While

this design stretched to meet all other user requirements, it fell short in personalization because the cards in this design were fixed and could not be altered by the user.

**iBrowser prototype 2 (Green outline):** Completely encompassing the users' outline is the jagged circle representing the capabilities offered by the iBrowser home page prototype 2. This prototype, which was refined based on user feedback into five different personalized home pages, with user-controlled personalization built into it, further stretched the design along the personalization parameter to completely include the user requirements. This demonstrates that the design created through this research is able to stretch browser home page offerings farther to the edge of user requirements, to include older Chinese adults with respect to a greater number of requirements. The prototype took into account extreme user requirements with respect to visual, dexterity and cognitive abilities as well as their need to personalize the home page.

Superimposing the four outlines on the same diagram reveals how they correlate; that is, the extent to which typical browsers fail to meet

the requirements of older adults and the extent to which the inclusively designed browser surpasses the requirements, in the chosen areas. The idea of the design is to encompass users as far out to the edge as possible. The iBrowser prototype 2 encompasses the requirements of all the users that participated in the design evaluation. Thus, designing with older adults helped in stretching the design to include more users by reaching out to the edge.

## **8 Conclusion**

In China, care for the grey-haired within the family is not merely a cultural expectation based on the Confucian tradition of respect for age and experience, but also a legal obligation under a law passed in 1996 (Kuhnt & Steinbach, 2015). Their age and experience entitle old people to the respect of young people. Undoubtedly, they should be taken care of well in this Internet society.

### **8.1 Contribution to Interface Design**

To this end, user-centred design of a personalizable home page was undertaken in this project with five older adults in China. Based on design considerations derived from literature review, environmental scan and user survey, a home page was designed for older Chinese adults. A novel design idea named as ‘Literal Cards User Interface’ was conceived and implemented, which presented interaction points on the home page as large colourful cards marked with large text words. Conducting the entire research online was another unique point.

The design of the iBrowser homepage is more accessible than some typical browsers in the following ways:

1. Integrated and personalizable homepage
2. Simple and customizable functions
3. Simple user interface layout
4. Easily understandable graphical user interface
5. Semantic content

## **8.2 Contribution to Inclusive Design**

This research contributed to the three dimensions of inclusive design<sup>13</sup> as follows:

Recognizing the diversity of web users in terms of age and culture, a group of older adult web users living in China was selected as the edge user group with its unique visual, dexterity and cognitive requirements for online interaction. Inclusive processes were used such as ethical protocols, communication methods suitable to the user group, an inclusively designed online survey and a detailed tutorial for easy installing of the home page. The impact of the design in terms of how it stretched the design of typical browsers currently used by the users to included the user group's requirements, was depicted through a user

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<sup>13</sup> <http://idrc.ocadu.ca/index.php/resources/idrc-online/library-of-papers/443-whatisinclusivedesign>.

states and context diagram, which is a contribution in itself to the evolving field. The Literal Card User Interface is a novel design that could prove useful for all web users with similar visual, dexterity and cognitive requirements.

### **8.3 Future work**

Following upon this work, other elements of the browser will be developed using a similar approach of inclusive design and user-centred techniques. Designing for old adults and seniors is not merely for them, but also for the designer's own future self.



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## **Appendix A: Web browsing practices survey**

Please see next page for survey.

# Web browsing behaviour survey

Participant Number:

## Please answer the following questions.

---

1. 网龄 Internet Usage (please select any one)

Mark only one oval.

- 1年以下 Less than 1 year
- 1-3 年 years
- 3-5 年 years
- 5 年以上 More than 5 years

2. 经常使用的浏览器? What browsers do you often use?

Mark only one oval.

- IE 浏览器
- 360 浏览器
- 遨游浏览器 Aoyo Browser
- Chrome 浏览器
- QQ 浏览器
- 火狐 Firefox
- 搜狗浏览器 Sogou browser
- Other: .....

3. 您给您的浏览器打几分? Please rate the browser you are using very often (1 is worst; 5 is best)

Mark only one oval.

- 1
- 2
- 3
- 4
- 5

4. 您为什么给出这样分数？ Why? Please write if you want to say more.

.....

.....

.....

.....

.....

5. 您了解浏览器的功能吗？ Are you familiar with the features of a browser?

Mark only one oval.

- 非常了解 Very familiar
- 了解一点 Familiar a little
- 一点也不 Know nothing
- Other: .....

6. 上网做什么？ What activity do you do often when you get online?

Check all that apply.

- 看新闻 News
- 看视频或电影 Video or Movie
- 音乐或广播 Music or Redio
- 玩游戏 Game
- 发邮件 Email
- 交朋友 Making friends
- 购物 Shopping
- Other: .....

7. 如果您对你的网页浏览体验不满意，主要原因是什么？ What are the reasons if you are unhappy with your web surfing experience

Check all that apply.

- 界面复杂 Complex interface
- 运行太慢 Too slow
- 推荐内容不满意 Unsatisfactory content that the browser recommended
- 不安全 Unsafe
- Other: .....

8. 您为什么选择这个/些原因? Why did you choose the browser(s)? Please write details.

.....  
.....  
.....  
.....  
.....

9. 浏览器对您的影响有多大? How important is a browser to you (1 is not at all important; 5 is very important)?

Mark only one oval.

- 1
- 2
- 3
- 4
- 5

10. 您觉得您的浏览器还欠缺什么功能? 为什么? What features do you think a browser should include in the future? and why?

.....  
.....  
.....  
.....  
.....

11. 您认为浏览器的发展方向是? What is the way of a good browser should go?

Mark only one oval.

- 简单易用 Efficiency; simple and easy to use.
- 全能型, 集成多种应用于一身 All-round; integrate diverse apps into one browser.
- 个性化 Affords personalization.

12. 您为什么选择这个? Why did you choose that option? Please write if you want to say more.

.....

.....

.....

.....

.....





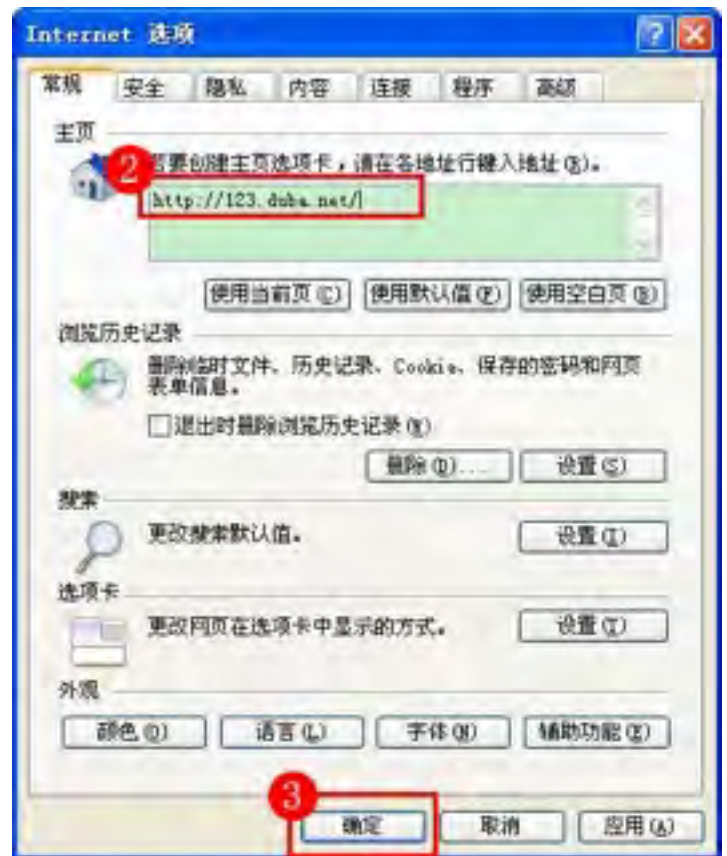
## **Appendix B: Tutorial to set home page in the browser**

Please see next page for tutorial.

## 1.在IE浏览器里如何将linyu6518.wix.com/ibrowser设为主页?

点击浏览器上方菜单的“工具(Tools)”选项选择“Internet 选项 (Internet Options)”，如右侧图所示：

在弹出的对话框中“主页”空白处填入http://linyu6518.wix.com/ibrowser，然后点“确定”即可。如右侧图所示：



## 2.在猎豹浏览器里如何将linyu6518.wix.com/ibrowser设为主页?

打开 猎豹浏览器，点击左上角的猎豹图标，选择"选项"，如右侧图所示：

打开 猎豹 浏览器选项窗口，在 猎豹浏览器的基本设置，"启动浏览器时"，选择"打开主页" - 添加新网页后面里输入网址 <http://linyu6518.wix.com/ibrowser/>，或者直接点击下方"使用金山安全导航"按钮,如右侧图所示：

关闭猎豹 浏览器，重启浏览器后主页就是 [linyu6518.wix.com/ibrowser](http://linyu6518.wix.com/ibrowser/) 了。



### 3. 在傲游浏览器里如何将linyu6518.wix.com/ibrowser设为主页？

打开傲游浏览器，点击菜单里的工具 - 傲游设置中心选项，如右侧图所示：

打开傲游设置中心窗口，在常规选项 - 主页的文本框里输入网址 <http://linyu6518.wix.com/ibrowser/> 并选择 傲游启动时 打开主页，如右侧图所示：

关闭傲游浏览器，重启浏览器后主页就是 [linyu6518.wix.com/ibrowser](http://linyu6518.wix.com/ibrowser/) 了。

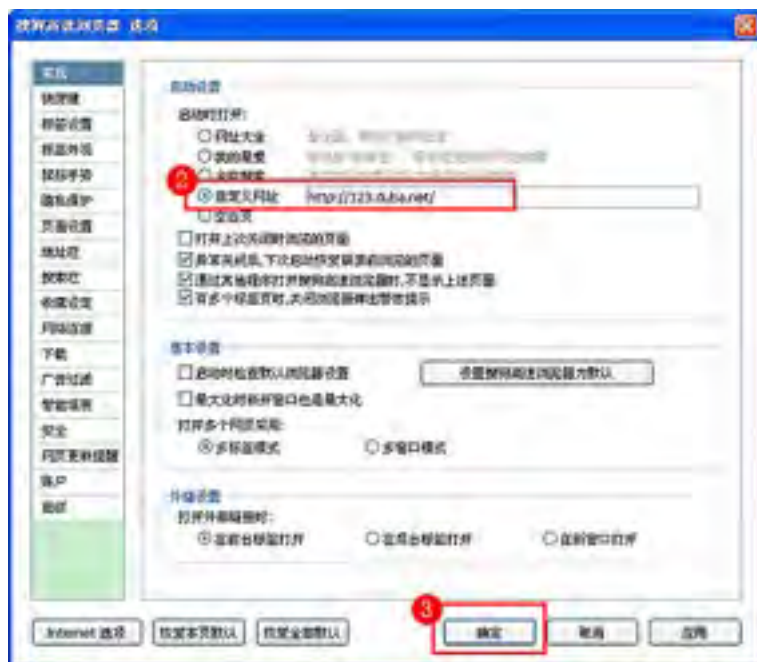
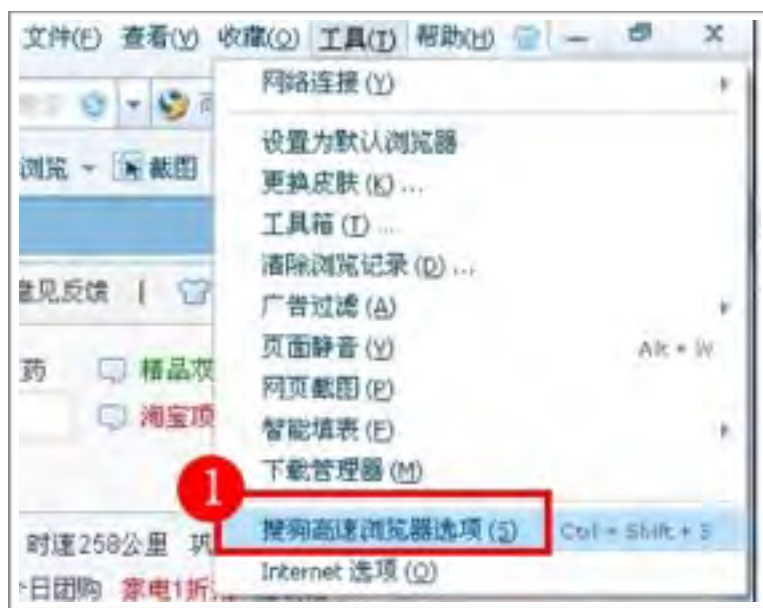


#### 4. 在搜狗浏览器里如何将linyu6518.wix.com/ibrowser设为主页？

打开搜狗浏览器，点击菜单里的 工具 - 搜狗浏览器选项，如右侧图所示：

打开搜狗浏览器选项窗口，在常规 - 启动设置里选择自定义网址，在自定义网址里输入 网址 <http://linyu6518.wix.com/ibrowser/>，点击确定如图：

关闭搜狗浏览器，重启浏览器后主页就是 [linyu6518.wix.com/ibrowser](http://linyu6518.wix.com/ibrowser/) 了。



## 5.在火狐浏览器里如何将linyu6518.wix.com/ibrowser设为主页?

打开火狐浏览器，点击菜单里的工具-选项，如右侧图所示：

打开选项窗口，在主页设置里输入 linyu6518.wix.com/ibrowser 网址 <http://linyu6518.wix.com/ibrowser/>  
启动时显示主页选项前打勾，  
如右侧图所示：

关闭 firefox 浏览器，重启浏览器后主页就是 linyu6518.wix.com/ibrowser 了。

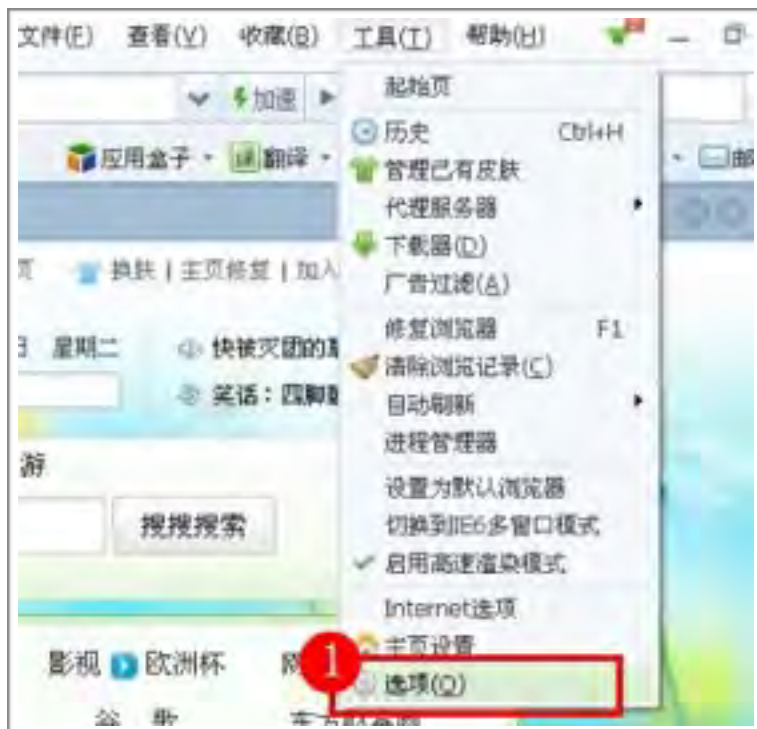


## 6.在360浏览器里如何将linyu6518.wix.com/ibrowser设为主页?

打开 360 浏览器，点击菜单里的工具 -360 安全浏览器选项，如右侧图所示：

打开 360 浏览器选项窗口，在 360浏览器选项的常规 - 主页设置里输入 linyu6518.wix.com/ibrowser 网址 <http://linyu6518.wix.com/ibrowser/>，启动时显示主页选项前打勾，如右侧图所示

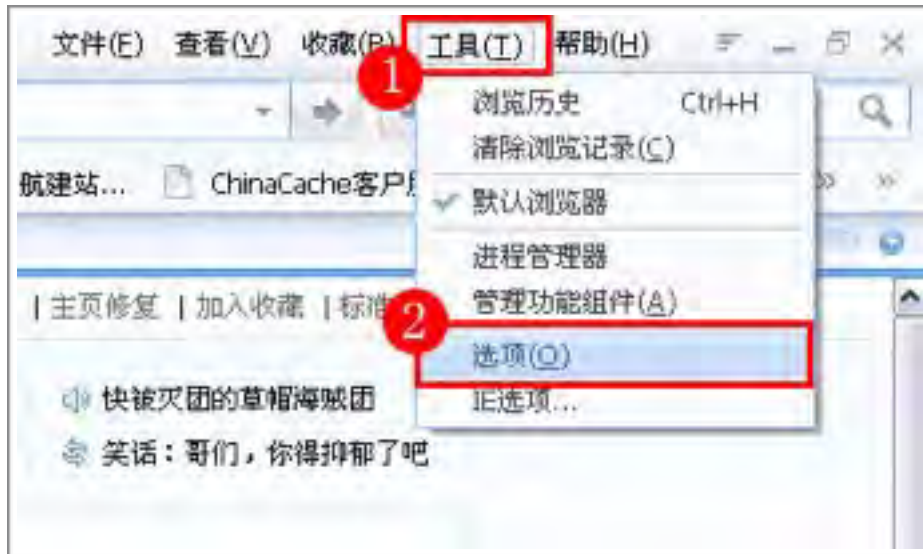
关闭 360 浏览器，重启浏览器后主页就是 linyu6518.wix.com/ibrowser 了。



## 7.在世界之窗浏览器里如何将linyu6518.wix.com/ibrowser设为主页?

1.在菜单栏打开 工具 → 选项，打开选项设置页面。

2.在主页设置的空白框里输入 `http://linyu6518.wix.com/ibrowser`，然后点击框外的空白处即可自动保存。

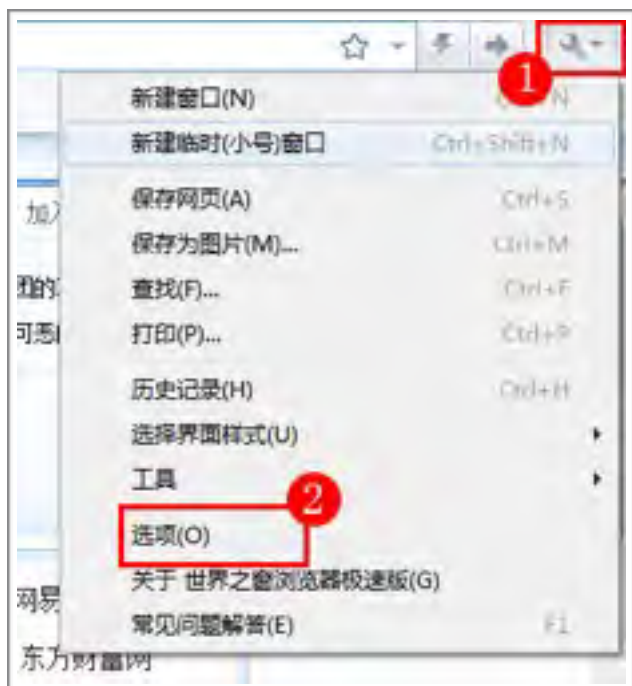




## 8.在世界之窗极速浏览器里如何将linyu6518.wix.com/ibrowser设为主页?

1.点击浏览器右上角的设置图标-选项，打开选项页面。

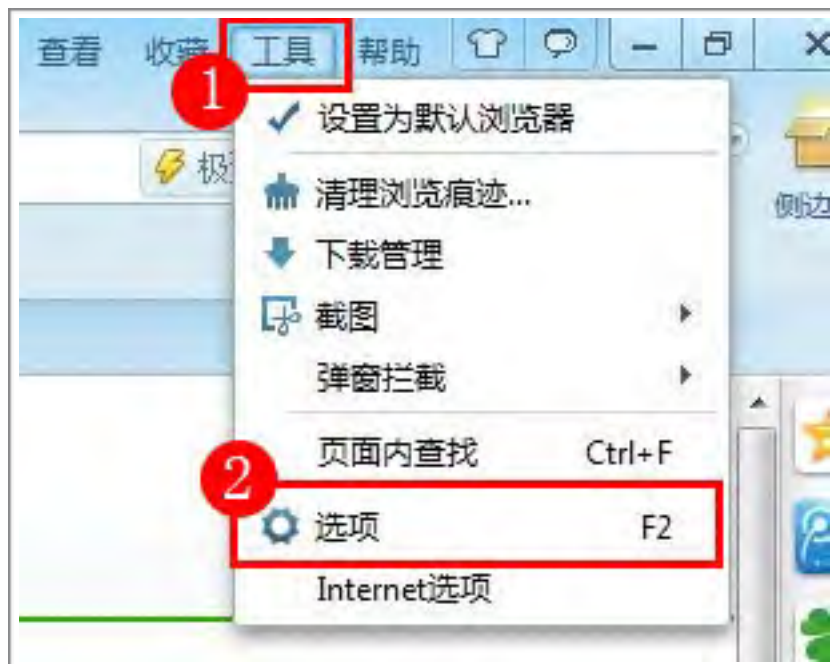
2.在基本设置中，选择打开主页--打开此页--后面框里输入 <http://linyu6518.wix.com/ibrowser>，输入后关闭即可，浏览器会自动保存。



## 9.在QQ浏览器里如何将linyu6518.wix.com/ibrowser设为主页?

1.打开QQ浏览器，点击常用菜单 - 选项，如图所示：

2.选择基本设置选项，勾选自定义网址，并输入http://linyu6518.wix.com/ibrowser，点击保存，就可以设定为主页了。



## 10.在Chrome浏览器里如何将linyu6518.wix.com/ibrowser设为首页?

1.打开谷歌浏览器-点右上角小扳手-设置，如图所示：

2.外观内-勾选 显示主页按钮-点更改

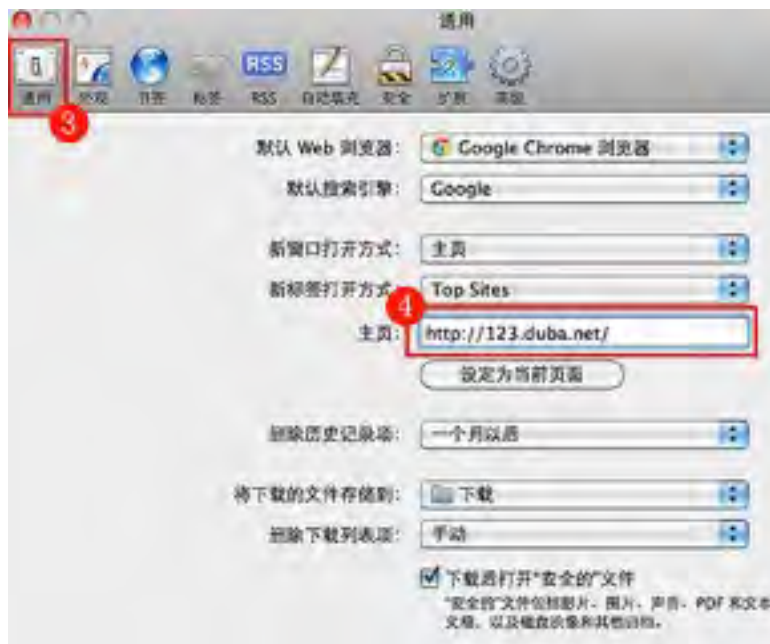
3.在打开此页后输入 <http://linyu6518.wix.com/ibrowser> 确定即可。



## 11.在Safari浏览器里如何将linyu6518.wix.com/ibrowser设为主页?

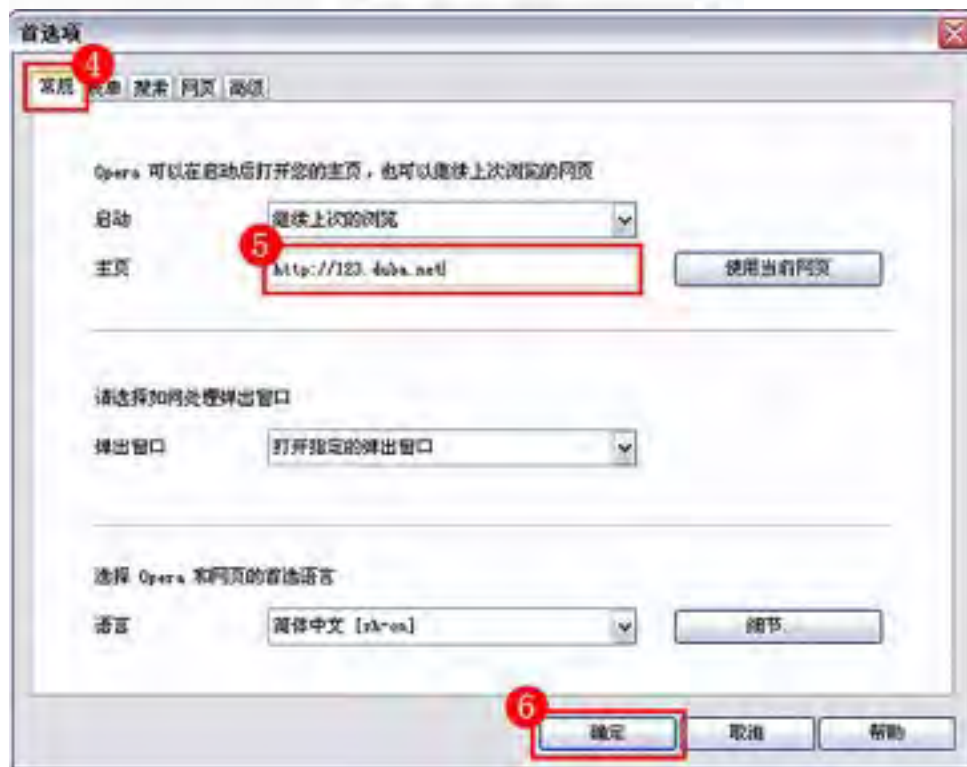
1.打开浏览器-safari-偏好设置，如图所示：

2.通用-主页内输入http://linyu6518.wix.com/ibrowser/ 关闭即可。



## 12.在Opera浏览器里如何将linyu6518.wix.com/ibrowser设为主页?

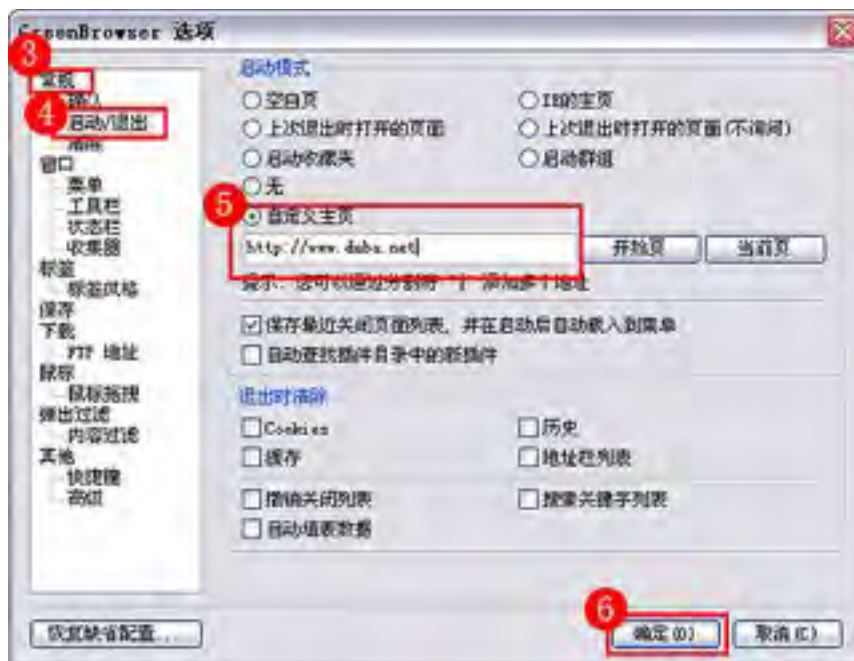
- 1.点击左上角opera浏览器的图标，设置--首选项，弹出首选项对话框。
- 2.选择常规，在主页内容中输入 <http://linyu6518.wix.com/ibrowser>，然后点击 确定 即可设为主页。



### 13.在绿色浏览器里如何将linyu6518.wix.com/ibrowser设为主页?

1.在菜单栏打开 工具 → GreenBrowser选项，弹出主页设置对话框。

2.选择常规-启动/退出-自定义主页，在下面框中输入 <http://linyu6518.wix.com/ibrowser>，然后点击 确定 即可设为主页。



## 14.在KR浏览器里如何将linyu6518.wix.com/ibrowser设为主页?

1.在菜单栏打开 工具 → 修改主页，弹出主页设置对话框。

2.在主页内容中输入 <http://linyu6518.wix.com/ibrowser>，然后点击 确定 即可设为主页。

