Redesigning Culture: Chinese Characters in Alphabet-Encoded Networks

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Abstract

This paper discuss the difference between two ideas of what written language can be--the Roman alphabet versus Chinese characters--and what happens when this difference is embodied in everyday devices such as computers or mobile phones in the People's Republic of China today.

The article's main argument is that this highly contrasted opposition brings to light an alternative to the problem of the concept of "culture," in the specific context of the design and use of artifacts, if we consider it as being related to a specific set of phenomena characterized by the presence of lower-level *cultural elements*.

Keywords

culture, design, technology, actor-network, Chinese script, Roman alphabet, pinyin, Domain Name System

Redesigning Culture:
Chinese Characters in Alphabet-Encoded Networks [1]

Basile Zimmermann

Figure 1. 'The weather is hot, my computer crashes all the time, how is yours?'. Siemens 3618, text-message. Beijing, June 2004.

On April 12, 2006, *The Economist* published an article entitled "Farewell the red soldiers." It discussed how many parents in China, who only a few years ago were choosing rather common Chinese characters, with an often political flavor, now opted for rare characters.

> The problem is that commonly used software for inputting Chinese characters, including that used by police departments responsible for issuing identity cards (which every Chinese must carry), cannot handle very rare characters. In China, the usual way of writing a character on a computer is to enter its pronunciation using Roman letters, and then choose from a list of possible options (most characters have many homonyms). A rare character might not show up on the list. (...)
> For the police all this has become a particular problem with the introduction in 2004 of new identity cards with embedded microchips. Rather than getting better software, a senior police official has announced that the answer is to ban problematic characters.
> Reaction has not been entirely positive. One Chinese newspaper complained that the new regulation would "simply be for the convenience of the police" rather than for the good of the public. A government adviser was quoted in another as saying that the "right of citizens

> to use characters freely" should be respected. The "old hundred surnames", as ordinary citizens are often described in Chinese, would agree. (*The Economist* 2006)[3]

In 2006 Beijing, it was unclear who among the police, the local Chinese people, the government, and the computer technology was responsible for the difficulties that prevented parents from freely choosing their children's names. If the technical difficulties involving Chinese characters and Roman alphabet information can be traced easily by linguists and computer scientists, its theoretical implications are more difficult to grasp. How may we understand the Roman letters, as mentioned by the journalists, and the so-called "rare characters" not to be found in the software? Where does "design" stand in relation to"culture"?

Since many readers are probably unfamiliar with debates in social sciences on the concept of "culture," as well as with the system of Chinese script, it is necessary to succinctly present these two points, as well as the current Chinese language input method used in computers and mobile phones, before we can come back to these questions.

The Concept of "Culture"

The word "culture" is well-known for the difficulty of its definition. More than fifty years ago, anthropologists A. L. Kroeber & C. Kluckhohn (1952) provided no less than 150 different definitions. In a recent update, John R. Baldwin, Sandra L. Faulkner, Michael L. Hecht & Sheryl L. Lindsley (2006) increased that number to 300, taken from a wide array of disciplines. The authors even claim these are actually saturations of an even larger corpus of existing definitions. Within anthropology, which contains the longest and richest debate on the question, this variety is striking: [2].

> Culture, or civilization, taken in its wide ethnographic sense, is that complex whole which includes knowledge, beliefs, art, morals, law, custom and any other capabilities and habits acquired by man as a member of society. (Tylor 1871: 221)

> Culture comprises inherited artifacts, goods, technical processes, ideas, habits and values" (Malinowski 1931: 621). Culture is a well organized unit divided into two fundamental aspects--a body of artifacts and a system of customs--but also obviously into further subdivisions or units. (Malinowski 1931: 623)

> What is called 'culture' is a fragment of humanity which.... presents significant discontinuities in relation to the rest of humanities.... Culture may, at the same time, correspond to an objective reality (Lévi-Strauss 1953: 295). Culture includes a great many things, such as tools, institutions, customs, beliefs, and also, of course, language. (Lévi-Strauss 1953: 68)

One particular strength of Baldwin et al. (2006) is that they give a very large and clear picture of the current questioning across the disciplines. Interestingly, the authors come to the conclusion that they should not add a new definition themselves (contrary to what Kroeber & Kluckhohn did in 1952). Rather, they state the complex character of the concept, and the different ways of thinking about it, before "throwing the ball back to the reader" (Baldwin et al. 2006: 72). According to Baldwin et al., the term "culture" is "a vessel (…), an empty sign that people fill with meaning from their own academic

backgrounds or personal experiences. (…) those who choose to define it should ground their definitions in a fuller, multidisciplinary and historicized account of the world." (Baldwin et al. 2006: 24). This conclusion that is close to symbolic interactionism in sociology, which discusses how people embody words with specific meanings. For example, in the 1960s, sociologists noticed that if someone who smoked marijuana could be labeled as a "drug addict" by a group of aristocrats, the label would be different if the same person's activity was described by a group of hippies (Becker 1973). In this perspective, the meaning of "culture" also depends on the people who use the word, and not only on the structure, function or process it relates to.

If people do use words in different ways, and this is certainly the case with "culture", an interesting point can be made by paying special attention to the "laundry list" type of definition of culture as described by Baldwin et al., "with so many elements that it provides little guidance" (Baldwin et al. 2006: 63). For example, in Kroeber & Kluckhohn's definition:

> Culture consists of patterns, explicit and implicit, of and for behavior acquired and transmitted by symbols, constituting the distinctive achievements of human groups, including their embodiments in artifacts; the essential core of culture consists of traditional (i.e., historically derived and selected) ideas and especially their attached values; culture systems may, on the one hand, be considered as products of action, on the other as conditioning elements of further action. (Kroeber and Kluckhohn 1952: 181)

Or in Samovar & Porter:

> For our purposes we define culture as "the deposit of knowledge, experience, beliefs, values, attitudes, meanings, hierarchies, religion, notions of time, roles, spatial relations, concepts of the universe, and material objects and possessions acquired by a group of people in the course of generations through individual and group striving." (Samovar and Porter 1991)

What is interesting about the label "laundry list" is that it can actually be applied to most, if not all, of the definitions listed by the authors. When the reader is asked to compare between points of view in various disciplines, "culture" becomes too many things to simply be a vessel filled with meanings coming from different backgrounds.

The hypothesis of this paper is that when people use the word "culture," be it in academic publications, in the newspapers or in everyday conversation, they are actually pointing at a specific set of phenomena which are characterized not by their final manifestation (such as group identification, communication, institutions, artifacts, knowledge, beliefs, etc.), but by the processes that preceded them. The fact that the word is heavily used in literature is the expression of a situation where everybody talks about one thing which is observed from different angles and in different states.

The idea is better explained by means of a metaphor: imagine we had to give a definition of "matter" (in its popular meaning), but did not know about atoms. We would come up with a definition like: "What we call matter is sometimes solid, sometimes liquid, sometimes in gaseous form, of homogenous or heterogeneous consistence, can be found in a living being but also in inanimate objects or artifacts, on earth or in outer space, and is usually in motion but can sometimes be immobile."

Compared with the definition from Samovar & Porter quoted above, the "laundry-list" look of this imaginary definition of "matter" is equally striking. What we are missing with "culture" is an appropriate concept for its "atoms": lower-level elements, located sometimes in artifacts, sometimes in human beings, and sometimes traveling from one to another. In the lines below, I will call these lower-level elements *cultural elements*. Of course, this affirmation does not make things simpler. On the contrary, it makes an already complicated question even more complex, to say nothing of the attempt to discuss it in such a short article. In the following lines, Chinese characters, as opposed to the Roman alphabet used inside technological devices, will be seen as an ideal combination to test the concept of the possible existence of *cultural elements*, in that the two writing systems provide high contrast incidents of what is going on inside artifacts, between people who speak or write different languages, and between people and artifacts.

The System of the Chinese Script

Chinese script is not an alphabet. It is made of Chinese characters, which are, strictly speaking, logograms. They are not symbols of sound but symbols of meaning. A consequence of this particularity is that there is no strict limit to their overall number.[4] Schoolchildren learn about 2,000 characters, educated people in China know between 3,000 and 4,000, scholars sometimes memorize up to 10,000, and a good dictionary discussing the various uses throughout history exceeds 50,000. Consequently, where a child would need a couple of weeks to memorize the Roman alphabet, several years are required to acquire literacy in the most frequently used characters in modern Chinese.

To better understand how the system works, one can consider the use of Arabic numbers: '1' has the meaning of one singular and is pronounced 'one' in English. But it can also be pronounced *un* in French, *uno* in Italian, *eins* in German, and so on. Similarly, the character '好' in written Chinese, which means 'good', is pronounced *hao* in Mandarin, *ho* in Cantonese, *hou* in the Min dialect, and so on.

The structure of Chinese characters is, in a way, similar to words in English: where most are made of a combination of twenty-six letters. Chinese characters are made by combining elements from a repertoire of some two hundred parts. The overall number of these parts is limited, making the characters relatively easy to memorize, just as a new word in English is easy to remember for someone who already knows the alphabet.

For example, if the word "script" is composed of the letters "s", "c", "r" etc., the character "好" is composed of "女" and "子". Or a character like "醒" is composed of "酉", "日", and "生". As the letters "s" or "c" are also used to build other words, "女", "子","酉", "日", and "生" are found in the composition of many other characters. This aspect --what the art historian Lothar Ledderose has called a module system (Ledderose 2000)-- makes the task of memorizing them much easier than one would first imagine.

Because written language is not strictly linked to oral pronunciation, Chinese-speaking people enjoy several important advantages. For example, 手 means 'the hand' wherever you are in the country, whatever dialect do you speak, and even if you don't know how to pronounce it in Putonghua (the language spoken in Beijing and also the official language

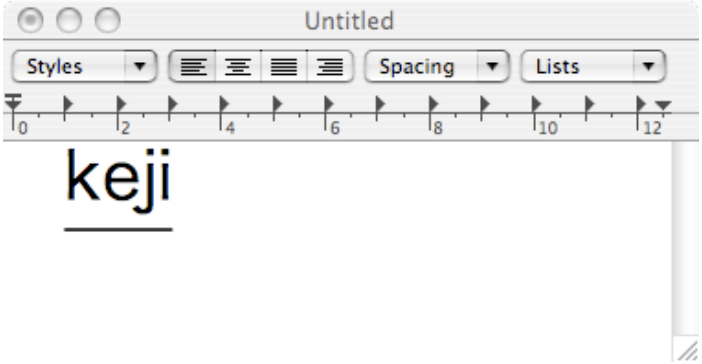
of the PRC). For a country with many dialects, and that is approximately seventeen times bigger than France, this is no small advantage. Web citizens from Guangzhou, in the South of China, have no difficulty understanding what people from Heilongjiang, in the North, write, while many of them would experience problems if they had to communicate orally. Moreover, a twelve-year-old Chinese child is able to understand the meaning of 手, which she has studied at school, whether she reads it in a local newspaper, or in an ancient manuscript from the third century. As discussed by Ledderose, whose explanation informed the above overview of Chinese writing, "Europeans have to learn a new language every time they want to read something written five hundred kilometers away, or five hundred years before. Not so in China." (Ledderose 2000: 23)

The Chinese characters and the pinyin transcription

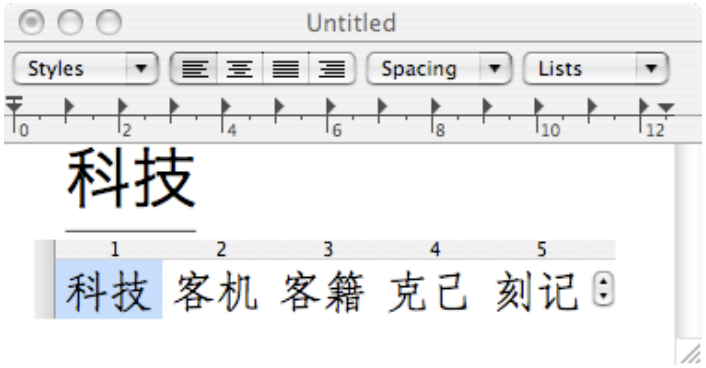
Many of today's technological devices have been created with Western users in mind. In most computers or mobile phones worldwide, the Roman alphabet is ubiquitous . How do Chinese language users deal with this situation?

While several different software and hardware systems are on the market, in the People's Republic of China today the most common way to input Chinese characters in an alphabet-encoded device is to use *pinyin*, the official Roman alphabet phonetic transcription since 1958.[5] *Pinyin* is based on today's pronunciation of the characters in standard Mandarin (or Putonghua). One types the sound of one character, and then chooses among the different characters that share the same pronunciation.

The system works very well, and a user who enters Chinese into a computer is as fast as a user typing in English. One feature of the relevant software is that it is able to recognize Chinese words, which are often made of two characters, and can also memorize frequently-used expressions. These functions are essential because many Chinese characters share the same pronunciation and are usually differentiated by the context in which they are used. The illustration below shows two screenshots using this method. If one had to choose among about ninety different characters for the syllable "ke," the number of possibilities drops to five pairs of characters for "ke-ji" (the Chinese word for "technology").



Step 1: type the character's pronunciation (Fig. 2a)



Step 2: choose among a selection of homophones (Fig. 2b)

The procedure implies that the character the user is looking for is *already present* inside the machine. Since the task of the software is to provide the user with a choice of characters, a character not available in the database cannot be produced. While many different systems and corpora of Chinese characters have been embodied in computers in the recent past, [6] the story related by *The Economist* shows that the problem was not fully solved, at least not by 2006. If the information provided earlier about the structure of the Chinese script, and the *pinyin* input method do not explain why rare Chinese characters were not available in the databases used by the police departments in China at that time, it does allow two very simple facts to become apparent: first, that computers embody not only wires and cables, but also "cultural elements" like ideas, decisions, choices, mistakes, various kinds of information, and, among many others, Chinese characters. Second, these elements are *in limited quantities*, as the problem of missing rare characters illustrates. In the same way a book does not contain words that have not been printed inside it, or a person does not speak a language she hasn't learnt, a computer does not contain Chinese characters that have not been implemented in its database.

In other words, an artifact, like a human being, can be seen as a kind of container of "cultural elements." These elements come from very different places such as: human beings, other artifacts, some related to languages, some to engineering, and some to design. It is a very long but still *limited* list, which implies dealing with *quantifiable* contents. For a concept like "culture," which often appears increasingly elusive and illusive the more it is examined, having to deal with an object that has physical materiality, and is limited and measurable, is indeed very good news.

Before continuing with other observations on Chinese characters in Roman-alphabet encoded technologies, it is useful to compare the concept of *cultural elements* with two theoretical points taken from the field of Science and Technology Studies (STS), as they provide a similar theorization of the structure of the interactions between Chinese language users and their computers.

Scripting, Modifiability and Circulation of Contents

The concept of *script,* in the field of Science and Technology Studies, refers to the question of the agency of non-humans and the embodiment of designers' ideas inside artifacts. Originally developed in 1987 by the French sociologist Madeleine Akrich, it is

known today as part of the Actor-Network Theory framework, mostly through the writings of Bruno Latour:

> Designers (…) define actors with specific tastes, competences, motives, aspirations, political prejudices, and the rest, and they assume that morality, technology, science, and economy will evolve in particular ways. A large part of the work of innovators is that of "*inscribing*" this vision of (or prediction about) the world in the technical content of the new object. I will call the end product of this work a "script" or a "scenario." [emphasis in original] (Akrich 1992: 208)[7]

From this point of view "design" could be called the science of the script. If we add to it a quote of André Gide who pointed out that to choose means to renounce, "to design" is the art of inscribing a few possibilities and excluding many, many others into something. In the example above, the computer's main physical interface --the ASCII keyboard--, as well as the main internal encoding systems, were created with English language users in mind, not Chinese language users. Similar to the well-known example of Langdon Winner (1980) who describes "(...) how the height of overpasses on the Long Island Parkway was chosen to prevent the passage of buses, the mode of transport most used by blacks, so that the use of leisure zones was effectively limited to whites" (mentioned in Akrich 1992: 209), the *scripts* embodied at various layers in computer technology define a user who is supposed to rely on the Roman alphabet first, as well as on the principle of a limited number of signs, not an unlimited number of logograms.

Of course, these remarks do not intend to suggest that a *script* cannot be changed. Computers are often updated, and at least when it comes to software, their contents change, both through automatic procedures and because of users' operations. Akrich's concept of *script* only goes as far as saying that a scenario is always present inside technical objects. Her statement provides a way to look at the complex contents of artifacts. In the similar way that a human being contains languages, habits, customs and ideas which result from his or her past experience, artifacts contain *scripts*, --arrays of choices, decisions, expectations, material and economical constraints, and so on-- that are the result of the complex inscription processes that have produced them. Such processes are often still running while we are looking at them.

A second theoretical point, inspired by the writings of the French philosopher and sociologist Bruno Latour, is necessary to figure out how Akrich's *scripts*, -- a concept narrower but very close to the one of *cultural elements* (a *script* can be seen as a special kind, or array of *cultural element*s)--, circulate between users and devices. In the following excerpt, Latour discusses the idea of heterogeneous networks of interactions, using the example of a presentation by a teacher in a classroom using a computer and slides.

> (…) interactions are not homogeneous. (…) the relays through which action is carried out do not have the same material quality all along. (…) When slides are projected on the screen, how many different successive ingredients are necessary when some writing on a keyboard becomes digitalized, then transformed again in an analogical signal before being retransformed in some sort of slower brain wave into the mind of half-asleep students? (Latour 2005: 201)[8]

In other words, Akrich's *scripts*, as well as the *cultural elements* discussed earlier, also move between artifacts and human beings. To go back to the matter-atoms metaphor, in a similar way that an atom was in a piece of sugar cane somewhere in South America, then traveled to a factory somewhere in Europe, went into a bottle of soda, moved to the cafeteria of a university, was purchased by someone, and ended up in her stomach, "something" travels between computers and people.

Web Technologies

Today, worldwide, a web site's address, or an e-mail address, has to be written "in English." Although it has been technically possible to have a web site URL in a foreign language for several years, encodings, reliability, economic, and compatibility issues between devices have taken a long time to be adapted, if they ever are. Consider Internet Explorer, the world's most widely-used web browser, which recognizes non-English URLs only since 2006; the World Wide Web, as we know it, has existed since... 1992. The discrepancy is even more evident when charted (Figure 3).

Easy to do	Difficult to do
www.yahoo.com.cn	www.雅虎.com
www.lesechos.fr	www.leséchos.fr
www.aljazeera.net	www.الجزيرة.نت
www.yi.cn	(300 possible Chinese characters)

Fig. 3 Comparison chart for web site addresses in a foreign language.

At the moment, the Chinese version of Yahoo.com with Chinese characters inside the URL does exist, while the French version of LesEchos.fr and the Arabic AlJazeera.net do not. The last example, using the transcription *yi* in Mandarin is problematic since there are over three hundred Chinese characters that share the pronunciation *yi* and can only be differentiated by their stroke components. That obscures, for instance, the meaning of a site <www.yi.cn>, for a Chinese native; it could relate to <www.衣.cn> (« clothing »), <www.医.cn> (« medical science »), <www.移.cn> (« move »), or any other sound mates.

As the Internet becomes more and more essential to Chinese society (as it already is in Western countries), the difficulties of using Chinese characters for web-related content become visible in other settings. On newspaper pages, for example, the only non-character information (with the exception of Arabic numbers, or foreigners' names), is often the e-mail address to contact the editorial department, or the journal's own web site address. The illustration below shows the same phenomenon on an advertising board in a street in Beijing. (Figure 4)

Fig. 4 Street in north Beijing, August 2007.

The six Chinese characters displayed in white on a red background read for "Chinese Painting and Calligraphy Online." The company's web site domain name, www.zgshzx.com, stands for "中 Zhong – 国 Guo – 书 Shu – 画 Hua – 在 Zai – 线 Xian", i.e. the first Roman-alphabet letter of each Chinese character's phonetic transcription [9].

Inspired by Latour's description of the heterogeneous network of interactions, we can imagine the path that resulted in the display of this advertisement board. At some point in the past, there was the Roman alphabet in some engineers' brains, probably in the United States, --since this is where the ASCII technology (short for American Standard Code for Information Interchange) and the computer mouse were developed (Rogers 2003: 155.. Roughly sketched, ASCII became one of the main coding standards for computers, and the Domain Name System technology (DNS) developed as the main naming system for the Internet. When DNS technology traveled to China, it "collaborated" with a Chinese web designer and ended up in a Chinese company's web site URL. It finally reached an advertising board in the street in Beijing, where it was captured by a digital camera and printed in this journal.

This oversimplified story of Roman alphabet elements traveling West to East does not explain anything about the reasons that made various people choose a particular type of encoding, why the *pinyin* transcription was chosen by the government of the PRC long before computers were widespread, or why the Chinese Painting and Calligraphy Online company opted for this particular name for their website among the thousands of

alternatives they probably had. However, it helps us understand how lower-level elements of culture behave when they are embodied in artifacts, in human beings, or moving between them. The Roman alphabet has indeed, traveled from the United States of America to a street in Beijing through ASCII and DNS technologies, in the same way than an e-mail does. Its journey was complex, interactive, related to many different things, but it also remains a traceable and unique path that only ended on this particular advertisement board.

The Question of Modifiability

Observations about the computer ASCII keyboard and the pinyin input method offer another insight into how *cultural elements* are embodied inside artifacts and human beings. The following description is taken from an article published in the *New York Times* in 2001, the situation it describes can still be observed in China today:

> "There are some characters that I can't write with a pen, but if you give me a computer I can type it out," said Mr. Li, a 23-year-old computer teacher who lives in rural Yangshuo in Guangxi province, in southern China. (…) It has been more than six years since Mr. Li started using a computer for Chinese word processing. It has been just under six years since the characters started slipping away. He estimates that more than 95 percent of his writing is now done by computer. (…) Chinese typing requires users only to recognize characters and not construct them from scratch. More than 97 percent of computer users in China type by phonetically spelling out the sounds of the characters in a transliteration system, called pinyin, that is based on the Roman alphabet. (…) The conflict is a result of forcing the complexities of the Chinese language to conform to a standard Roman-alphabet keyboard. (…) (Lee *New York Times* 2001)

The fact that Chinese language users are using the ASCII keyboard and the *pinyin* phonetic transcription input method to produce Chinese characters reduce their writing skills. The explanation is quite simple: since knowledge of the strokes is not actively required by the procedure, it fades away.

Fortunately, Chinese characters will not disappear anytime soon; attempts to abolish them have been made in the past and all failed miserably. Besides, China is currently investing billions in science and technology innovation. Graphic tablets and competing interface systems, better suited to the Chinese script, are under constant development.[10] Back to the theoretical perspective, we see that if *cultural elements* are sometimes "liquid", e.g. when they travel from the United States to China, along phone lines, through web designers' brains to advertisement boards, --they can also sometimes be "solid." In the case of the ASCII keyboard, the Roman alphabet information is embodied so solidly inside the interface that the user who is not satisfied with it has no choice but to use it, or design another one. Since technologies such as the ASCII standard, or the DNS procedure, required years of work by highly qualified specialists to develop, and millions of dollars have been invested in it, the *cultural elements* embodied inside these technologies are often hard to change.

In other words, the question regarding which part of technology can or cannot be modified, is essential to understanding the movements of cultural elements.[11] In the

same way that it is difficult for a human being to learn something, and maybe even more difficult to forget something already learnt, it is sometimes close to impossible to add or remove cultural elements from an artifact.

Conclusion

The aim of this paper was to suggest a new conceptualization for "culture." Along with situations in China involving Web technologies, ASCII keyboards, and limited encoding structures, two theoretical insights from the French sociologists Madeleine Akrich and Bruno Latour have been presented succinctly. First, we can consider technical objects as embodiments of *scripts* or *scenarios* written by their designers. Second, the interactions between actors, humans or non-humans, should be seen in the shape of heterogeneous networks. These two ideas and the highly contrasted data observed in China are, I believe, starting points for a new approach to the concept of culture. No longer should "culture" be discussed in a deductive manner. Considerations of such entities as "youth culture," "drug culture," "the industry of culture," "cultural goods," or "Chinese culture" too often conclude that things are more complicated than expected. Seen from an inductive point of view, the concept of "culture" is related to tiny parts --labeled *cultural elements* throughout this paper.

The argument here is not that everything has an objective and measurable reality. The theoretical framework suggested in this paper aims to place design squarely within larger cultural processes, providing an enhanced, nuanced understanding of our learning and study processes, while maintaining its rich complexity. At the moment, the physical existence of *cultural elements* has yet to be defined properly. It is probably between something concrete, like the number of characters encoded in a computer, and something more abstract, such as the idea of the shape of the computer that is present in its design. *Cultural elements* are probably best understood if compared to sound waves: in a similar way, they travel between people and objects, can be memorized or recorded, transmitted and multiplied through various kinds of materials, are most often shaped and transformed by the media that host them, and often disappear definitively at the very end. As sounds, the formations, transformations and dissipations of *cultural elements* can be followed if they are examined at their lowest level.[12]

Notes

[1] An earlier version of this paper was presented at the *Networks of Design -- Design History Society Conference*, September 3-6, 2008, Falmouth. Some arguments and illustrations have also been discussed, albeit from a different point of view, at the *Internet of Things 2008 -- International Conference for Industry and Academia*, March 26-28, 2008, Zurich (Zimmermann 2008), and in an article from a preliminary research on electronic musicians in Beijing, published in the *Leonardo Music Journal* (Zimmermann 2005).
[2] Kroeber & Kluckhohn (1952), and Baldwin et al. (2006). See also Borofsky et al. (2001).
[3] Special thank to Jonas Oggier who told me about this article.
[4] The Chinese government makes huge efforts to prevent the creation of new characters, and succeeds in doing so, but that is another story. I focus here on the "ideas"

carried by the two script systems.
[5] For information on pinyin, and also a very different point of view on the Chinese script (compared to Ledderose and this paper), see DeFrancis, 1984. DeFrancis, 2006 also discuss briefly the pinyin input method in PCs and mobile phones.
[6] For a summary of Chinese language and computer literacy, see Liu, Y. & Zhang, D. (2006). For information on Chinese characters encodings see Lunde, K. (2008), http://www.unicode.org/history/summary.html, and Steven J. Searle, « Unicode Revisited », http://tronweb.super-nova.co.jp/unicoderevisited.html, consulted November 15th 2008. Sacher (1998) provides with a clear description of the issues faced by designers working on Chinese language input in the United States during the 1990s.
In Chinese, 姚 2004 provides a synthetic and clear picture of the history of the Roman alphabet and the pinyin phonetic transcription in the PRC.
[7] The French version of this article (Akrich, 1987) is a starting point in the famous paper by Latour (1988). See also Law (1991).
[8] See also Leuenberger 2006 for a lengthy and enlightening example of circulation of cultural elements, and Callon 1986 for a mythical STS paper on heterogeneous networks.
[9] I tried to visit the website once again while writing these lines in October 2008, unfortunately it seems the web site had been sold to another company a couple of weeks before (the old website could still be consulted in Google's cache memory).
[10] The *Wubi* ("Five Strokes") is said to be particularly efficient, as it breaks the characters down to five strokes (falling left, falling right, horizontal, vertical, and hook) that are typed in the order in which they would be written by hand. For a detailed presentation of how the system works see 广东省财政厅会计处编 2003.
[11] Many similar observations can be made with web technologies. For example, in HTML it is extremely inconvenient to write Chinese characters in vertical lines, up to down, right to left, as it is the case traditionally in classical Chinese, or in Chinese newspapers, --while it is possible to write horizontally from left to right, or even from right to left for languages such as Arabic or Hebrew. The same observation can be made of computer windows, whose size is expandable only to the right, and not to the left.
[12] Discussions missing here are the comparisons with Appadurai's framework of cultural flows as well as the concepts of hard and soft cultural forms, which are in a way, a macro perspective of the argument presented here (Appadurai, 1990, 1996), and with Philippe Descola's anthropological framework, as the one suggested here implies –using Descola's current categories-- a shift from *naturalism* to *totemism*. (Descola, 2001-2004)

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