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Translating "*natural selection*" in Japanese: from "*shizen tōta*" to "*shizen sentaku*", and back?

KIJIMA Taizo* & Thierry HOQUET**

* *University Hosei, Tokyo, Japan. <taizoo@dream.com>.*
** *University Jean Moulin Lyon 3, France. <thierry.hoquet@univ-lyon3.fr>.*

Contents

Abstract

This paper focuses on terminological issues related to the translation of Darwin's concept of "*natural selection*" in Japanese. We analyze the historical fate of the different phrases used as translations, from the first attempts in the late 1870s until recent times. Our first finding is that the first part of the Japanese translations never changed during the period considered: "*natural*" was constantly rendered by "*shizen*". By contrast, the Japanese terms for "*selection*" have dramatically changed over time. We identify some major breaks in the history of Japanese translations for "*natural selection*". From the end of the 1870s to the early 1880s, several translations were suggested in books and periodicals: "*shizen kanbatsu*", "*shizen tōta*", "*tensen*". Katō Hiroyuki adopted "*shizen tōta*" in 1882 and he undeniably played an important role in spreading this phrase as the standard translation for "*natural selection*". The most common Japanese translation of the *Origin* during the first half of the 20th century (by Oka Asajirō in 1905) also used "*shizen tōta*". A dramatic shift occurred after WWII, from "*tōta*" to "*sentaku*". While a linear interpretation could suggest a move from a

"bad" translation to a better one, a closer analysis leads to more challenging insights. Especially we stress the role of the kanji restriction policy, which specified which kanji should be taught in schools and thus should be used in textbooks: "*tōta*" was not included in the list, which may have led to the good fortune of "*sentaku*" in the 1950–1960s. We think the hypothesis of the influence of Chinese translations is not a plausible one. As to conceptual differences between "*shizen tōta*" and "*sentaku*", they remain unconvincing as both terms could be interpreted as a positive or negative process: there is no clear reason to prefer one term over the other from the strict point of view of their meanings or etymology. Then, turning to the way terms are used, we compare translations of natural selection with translations of artificial or sexual selection. First we turn to the field of thremmatology (breeders): there, "*tōta*" (sometimes spelled in hiragana instead of kanji) often bore the meaning of culling; since 1917, breeders often used "*sentaku*" as a translation for "*selection*". However, quite surprisingly, breeders used two different terms for *selection* as a practice ("*senbatsu*"), and "*selection*" as in "*natural selection*" ("*shizen sentaku*"). Finally, we compare possible translations for "*sexual selection*" and "*mate choice*": here again, there are some good reasons to favour "*tōta*" over "*sentaku*" to avoid lexical confusion.

Key words: natural selection, sexual selection, scientific translation, Darwin, Japanese language

This paper[1] takes a terminological perspective on the question of how Darwin's ideas have been accepted and modified in Japan. Our aim is to contribute to the general reflection on nomadic concepts, and to the analysis of local and global science, especially with regards to the case of Darwin's ideas (see for instance Glick 1972, Glick *et al.* 2001). We take the Japanese translation of Darwin's main concept, "*natural selection*", as a case study for clarifying some conceptual issues linked to the introduction of that idea in Japan. Our paper is a contribution to the flourishing field of translation studies in science (e.g., Montgomery 2000; Elshakry 2008, 2010).

Studying translations of Darwin's masterpiece is often taken, at best, as an interesting pastime for historians obsessed with cultural diversity and the variety of contingencies that may affect (and often obstruct) the reception of "true" science. Such study is taken as a recreation that biologists may indulge in when they are close to retirement, but with no actual interest for biologists active in the field or in the lab. Besides, the vocabulary of "reception" suggests an Aristotelian dualism between matter and form, or passivity and activity, with a passive recipient "receiving" the impression of the active component: speaking of "reception" suggests that Japan is a sort of wax while *Darwinism* is a form of seal. This presentation is clearly flawed, since "Darwinism" is not an unchanging immaterial essence that may affect several kinds of inert substrates (Hull 1985). The local context is not only distorting the original conceptual framework. As we have shown earlier (Hoquet 2011), the local context clearly impacts on the original formulations by putting their clarity into question. Not unexpectedly, Darwin's own reflection on the term he coined, "*natural selection*", was clearly influenced by discussions related to the translation of his work in France or Germany (two foreign languages he could read). In the case of Japan, studies on the "reception" of Darwin's ideas were characterized by an over-inflated focus on Japanese warped "social Darwinism", an all-embracing term which historians and biologists tend to disentangle from "social Spencerism"[2].

Standard histories of Darwinism in Japan present it as a political and social theory (Shimao 1981; Nagazumi 1983). This paper suggests that this is not the only way to approach the topic of the reception of Darwin's ideas in Japan, and it focuses on the terminological issues related to the translation of the Darwinian concept "*natural selection*" in Japanese.

Our aim in this paper is twofold: (1) to show that translations may actually and actively contribute to the general understanding of "Darwinism" and enlighten the conceptual issues related to key terms like "*selection*" (be it natural, sexual or artificial); (2) to compare the case of Japanese (a non-Indo-European language) with translations in French and German previously studied (Gliboff 2008; Hoquet 2011). Since the

1. In this paper, the names of Japanese and Chinese persons (including one of the authors) are given according to the Eastern order (family name first, followed by the individual's name). For example, in 加藤弘之 (Japanese) and 馬君武 (Chinese), 加藤 (Katō) and 馬 (Ma) are the family names, and 弘之 (Hiroyuki) and 君武 (Junwu) are the individual names.
2. For instance, Roughgarden (2009). On the history of "Spencerian science", see for instance Renwick (2009).

Japanese language is totally different from English in the roots or constructions of its words, Japanese translators were necessarily facing different kinds of lexical and conceptual difficulties from the ones met by the first European translators. On that matter, it is interesting to compare the Japanese case with the cases of some European languages. While European languages did not have an equivalent for "*selection*" and ended up using a mere transliteration (rather than a translation), the Japanese language, although also lacking any accurate equivalent for it, had to translate it anyhow, since transliteration was not an option.

After providing general elements of context (Section 1), we give an overview of suggested translations for "*natural selection*" and come to the conclusion that two of them have been especially influential: "*shizen tōta*" (自然 淘汰) and "*shizen sentaku*" (自然 選択) (Section 2). Then we consider their various historical fates and changing popularity over time, identifying WWII as a clear watershed (Section 3): before WWII, "*tōta*" had clearly the favours of Japanese speakers, while, after WWII, "*sentaku*" seemed to gain in both momentum and popularity. In Section 4, we ponder whether this is a change in translation for the better. We compare translations for "*natural selection*" with translations for other neighbouring concepts ("*artificial selection*", "*sexual selection*") and also with the verb "*to select*": we see how these competing translations affect each other and may lead to favouring one term over the other.

1. Darwin in Japan: general facts

Before we address the question of translation of "*natural selection*", it may be useful to outline the main features of the introduction of Darwinism in Japan and its subsequent flourishing. First we give an overview of the literature on that topic, stressing the question of social Darwinism. Then we focus on Darwin's *Origin of Species*.

1.1. A general concern for social Darwinism

Strikingly enough, the fate of Darwinian ideas did not depend at first on Darwin himself, but on some of his followers. Japan had an idea of Darwinian ideas long before the first partial (not to mention complete) translation of Darwin's *On the Origin of Species* in Japanese. Studies of Japanese "Darwinism" have mostly focused, and often with good reasons, on its socio-political contexts. Before World War II, most Japanese linked Darwin's *magnum opus* with a political interpretation, a tendency that remained quite strong in the post-war period. Focusing on socio-political aspects of Darwinism has its own historical rationale, although the resulting warped social Darwinism was undoubtedly a misled and misleading movement in itself. Figures like the American naturalist and Christian missionary John Thomas Gulick (1832–1923) also played an important role: Gulick, a socialist, gave a number of lectures in Kyoto around 1883 and he published several papers on the social implications of Darwinism (Amundson 1994, Laurent 1994). Lectures given by Ernest F. Fenollosa (1853–1909) on Spencerian and Darwinian social theory in the University of Tokyo around 1880 were yet another source of Japanese social Darwinian tradition (Yokoyama 2005). This tradition covered a broad political spectrum: from the conservative nationalist Katō Hiroyuki (1836–1916) who attacked the Movement for Citizen's Rights and Freedom (Jiyū Minken Undō: 自由民権運動) from the viewpoint of social Darwinism (e.g. Murakami 1980; Davis 1996; Yokoyama 2005) to Ōsugi Sakae (1885–1923), an anarchist activist and a translator of Darwin's *Origin* in 1914 (Yokoyama 2005).

According to historians (Murakami 1980; Shimao 1981; Isono 1987), Darwin's ideas were first (and inaccurately) mentioned in a refutation of Christianity, published under the title *Hoku gō dan* (『北郷談』, *A Talk facing the Pole Star*; 1874), a book written by Aoikawa Nobuchika (葵川信近), a priest of Shinto. But historians have credited the first full-blown introduction of Darwin's theory to Edward Sylvester Morse (1838–1925) in his series of lectures on evolution from 1877 to 1879, given at the newly established Tokyo University. He prompted the translation of Huxley's *Lectures on the Origin of Species* and wrote a preface to

it (Huxley 1879; see also Cross 1996, 1998). Morse's lectures were translated into Japanese under the title *Dōbutsu shinkaron* (『動物進化論』, *Animal Evolution*; Morse 1885). Several historians (e.g., Isono 1987, Cross 1996) have considered his lectures and this book as a milestone in the introduction of Darwin to Japan.

After this first introduction, the idea of evolution thrived in Japan and was accepted broadly and rapidly as an established theory among both laymen and specialists, without any strong resistance. Such smooth acceptance of evolution in Japan makes a significant contrast with what happened in many countries of the western world. Five possible factors have been suggested to account for such absence of resistance: (1) Japanese religious background assumes that everything is in a state of constant changing, humans and other animals can be reincarnated interchangeably, and mankind is not a special created being but a part of the natural world; (2) Japanese people are familiar with monkeys, as people and animals sometimes share the same habitat—such familiarity might alleviate resistance to the *common descent theory*; (3) drastically changing social conditions in the earliest period of modern Japan might have made it easier for the Japanese to accept the idea of evolution and *struggle for existence*; (4) the Japanese disliked Christians in general who tended to treat the Japanese as morally inferior heathens: this may have accelerated the propagation of evolution by Morse, who shared a dislike for Christianity and loved Japanese people; and, last but not least, (5) the commitment of some natural scientists to a static worldview had provided a theoretical motivation of anti-evolutionism such as (for example) Agassiz's; but since this view was not developed in Japan, this source of reluctance to accept transformism was removed (Isono 1987).

These factors, which focus mostly on absences (absence of Christian religion, lack of western science), have been challenged by recent literature in the view of a general reappraisal of the reception of Darwinian ideas worldwide and of a renewed interest in the positive features of the Japanese context (Checkland 2003). First, it is now well established that evolutionary ideas were widely spread in Europe and in Britain before Darwin's *Origin*, and that these ideas enjoyed a considerable popularity among the lay public (Corsi 1978, 1988*a*, 2005, 2011). This has been especially shown in the case of the *Vestiges of Creation*, a book anonymously published in 1844 by the Scottish publisher Robert E. Chambers, with an enduring success (Secord 2000). Other cases have been studied, like the reverend Baden Powell (Corsi 1988*b*) or the conservative geologist and Belgian senator Jean-Baptiste d'Omalius d'Halloy (De Bondt 2007). Similarly, the prompt acceptance of Darwin's ideas in Japan may be related to a general interest for natural kinds in Japan, in a context of debates between Linnaean taxonomy and Chinese herbalism (Hung 2009). As to the question of Christian religion, the traditional motif of a war between religion and evolution has been critically assessed and historians have emphasized the role of Japanese Christians like Uchimura Kanzō (1861–1930) in introducing Darwin to Japan (Hung 2009).

More recently, historians have stressed the importance of book-retailers like Maruzen or Maruya & Co., who were selling English copies of Darwin's *Origin* as early as 1876 (Cross 1996; Checkland 2003). Probably also Dutch and German copies of Darwin's books were circulating in Japan, in places like Nagasaki and Yokohama, where westerners and students of western learning had settled (Harper 2010).

Besides, while the idea of evolution pervaded Japanese thinking in social and political contexts, Japanese professional biologists paid less attention to evolution during the Meiji era (1868–1912) and after. This may be partly due to the uncritical reception of evolutionary ideas and to the subsequent absence of debates over it, and partly due to the fact that Japanese biologists neglected natural historical research, which should function as the foundation of evolutionary theory. These general trends in Japanese Darwinism, formed over 100 years ago, may not be easy to change (Isono 1987). As Isono puts it, there had been a strong tendency, from the Meiji era to the 1980s, to think that evolution was not a subject for scientific research but belonged to philosophical speculation (on that topic, the names of Kimura Motoo and Ōta Tomoko are notable exceptions). However, since the 1980s, the neo-Darwinian method has been diffused in Japan with success, and the social interpretation of Darwinism seems attenuated, although it remains alive to some degree.

While this overview seems correct on the whole, one may add, as a cautionary note, that a socio-political interpretation of the Darwinian theory is by no means specific to the Japanese reception of Darwin: similar interpretations were widely spread in the Western world, especially in the USA or Germany (e.g., Hofstadter 1992, Crook 1994). In Japan, the growing field of evolutionary genetics and ethology ultimately led to the

decline of speculative anti-Darwinian evolutionary theories (notably Imanishi Kinji (今西錦司)'s). Similar patterns could be identified in the Western countries.

1.2. Japanese translations of the Origin

In this Section, we give an overview of how the *Origin* was progressively translated into Japanese. In most cases, Japanese translations of the *Origin* have adopted short titles and dropped the English subtitle in their book covers and the first pages. When they contain translated subtitles, they often drop its second half "*or the preservation of favoured races in the struggle for life*" and keep only the first half "*by means of natural selection*".

The first translation of a book by Darwin was published in 1881: a translation of *The Descent of Man*, titled as *Jinsoron* (『人祖論』, *On the Ancestor(s) of Man*; Darwin 1881). The translator was a scholar of education, Kōzu Senzaburō (神津専三郎). In spite of its title, the book was actually a hybrid, which included a mixture of chapters of the *Descent* (namely, chapters 1–7 and 21) together with other texts: the *Historical Sketch* that Darwin appended to the third edition of the *Origin* (1861), and some sections taken from Thomas Huxley's *Evidence as to Man's Place in Nature* (Kaneko 2000). So this book can also be described as the first publication including a partial translation of a text from the *Origin*.

In 1896, the first full translation of the *Origin* was published by a scholar of English literature Tachibana Senzaburō, under the title: *Seibutsu shigen ichimei Shugenron* (『生物始源 一名 種源論』, *Origin of Living Things: [in other words:] On the Origin of Species*; Darwin 1896).

The third translation was published in 1905, titled *Shu no Kigen* (『種之起原』, *The Origin of Species*; Darwin 1905). This version was the first translation of the *Origin* by a professional biologist: it was edited by Oka Asajirō, a zoologist and popularizer of Darwinism, famous for his bestseller, *Shinkaron kōwa* (『進化論講話』, *Lectures on Evolution*) (Oka 1904).

From Oka to WWII, the *Origin* was translated by biologists as well as non-biologists. Besides Oka, other biologist translators were: Miyake Kiichi, botanist, who served as the editor of the 1928 edition (but its translator is anonymous); Koizumi Makoto, zoologist, who translated the book in 1929; Ishida Shūzō, physiologist, who was the joint translator with Uchiyama Kenji, a professional translator, for Japanese versions of the *Origin* after 1939. Several physicians also gave translations: Matsudaira Michio translated a new edition in 1924; Hori Nobuo was the translator for the 1948 edition and others too. Other translations were given by non scientists: Ōsugi Sakae, an anarchist activist, the translator of the 1914 edition; the aforementioned Uchiyama, a professional translator, had been the single translator for the 1927 edition and others. As was noted by Shimao (1981: 97): "*No language seems to have produced more different versions of the* Origin of Species *than Japanese*". However, we are unable to offer a sufficient explanation for such a multiplication of translations in Japanese. It may be a general feature of the Japanese publication market in which the multiplication of translations is an ordinary feature.

The Japanese title *Shu no Kigen* (chosen by Oka for his 1905 translation) was followed by all the subsequent translations, in two different forms, as『種の起原』or as『種の起源』. Both translations are pronounced "*shu no kigen*". They are composed of two parts, connected by a particle, 之 or の ("*no*"), (the Japanese "*A* no *B*" is translated in English "*B* of *A*"). The first part of the title consists of *kanji*, a kind of ideogram, 種 ("*shu*") meaning "*species*"; the second half of the title is made of two different *kanji*: ("*ki*") means "*beginning*" or "*rising*", while both 原 and 源 ("*gen*") mean literally "*fountain*" and derivatively "*origin*". One may claim that 原 is slightly more abstract than 源 , but both 起原 and 起源 may be taken as meaning "*origin*" (for historical details about these different translations, see Setoguchi 2010 and Setoguchi & Kijima 2012).

As we have argued elsewhere, translations may be indicative of some difficulties present in the original term (Hoquet 2009, 2010, 2011). For instance, the German translations "*natürliche Zuchtwahl*" or "*natürliche*

Züchtung", reveal that the English originals contains two different meanings: on the one hand, "*choice*", rendered by German "*Wahl*"; on the other hand, "*breeding*", indicated by the German root "*Zucht*" (Gliboff 2008). We have suggested that translations may function "*as a prism that diffracts the white light emanating from the* Origin *and help us improve our understanding of Darwin's intentions and aims*" (Hoquet 2011: 2). We would like to further test this hypothesis on the Japanese language case and see just how it may shed further light on the meaning of Darwin's concept.

Quite unexpectedly, the Japanese translation of the title, *On the Origin of Species*, seems less problematic than the German and French translations. Certainly, it should be noted that there is the possibility that the great difference between English and Japanese might make it more difficult to find what is really problematic in those translations. In other words, Japanese and English might be too different to be fruitfully compared. Nevertheless, in the following, we suggest that the two languages are indeed comparable and commensurate enough to reveal interesting problems. In the remainder of this paper, we will focus on the Japanese translations of Darwin's key concept, *natural selection*.

2. Two *kango* for "*natural selection*": linguistic and lexical aspects

This Section's aims are twofold: first, we make some preliminary remarks, both linguistic and lexical, in order to explain the specific difficulty of translating "*natural selection*" into Japanese; secondly, we give an historical overview of the standard Japanese translations of Darwin's concept, "*natural selection*".

2.1. Introducing a foreign word in Japanese: the range of possibilities

Darwin borrowed the concept of "*selection*" from the field of animal breeding, a practice that was highly specific to English breeders. In countries where the term was absent (like France or Germany), it was difficult to find an accurate equivalent to "*natural selection*", and this in turn contributed to making Darwin's ideas more difficult to understand. Presence *vs.* absence of a term for "*selection*" was revealing of differences in the practices of breeders and strongly influenced the reception of Darwin's ideas. Besides, in French or German, readers of Darwin were facing an alternative between two possibilities: (1) translating the concept of the British naturalist, i.e., finding a local equivalent for the term; (2) merely transliterating it, i.e., keeping the same word with a different idiomatic ending.

In French, an early review published in the popular journal *Magasin populaire* (1860) is a good example of those two possibilities. The anonymous reviewer hesitated between the two solutions and accordingly, entitled his article "*Choix de la nature. Sélection naturelle*" ("*Choice by Nature. Natural Selection*"), suggesting both a possible translation (Nature's choice) and a transliteration (turning the English "*selection*" into the French "*sélection*", which was a neologism at the time).

Transposed to the Japanese language, this issue takes a rather different shape, due to the fact that Japanese words fall into three categories. The first one includes Japanese traditional vocabulary, and is called *yamatokotoba* ("*Japanese words*"). They used to be written in *hiragana,* or *kanji* with *hiragana*. The second category includes Chinese words imported in several periods, called *kango* ("*Chinese words*"). They used to be written in *kanji*. A third category includes those words that have been imported from other languages (mainly from the West): they are called *gairaigo* ("*foreign imported words*") and are usually written in *katakana*.

How does this three-fold division apply to "*selection*"? A translator of Darwin's concept faces three possibilities: he/she could use the word "*erabi*" (選び), which belongs to *yamatokotoba* and means "*choice*" (or "*selection*"). Then he/she will get (perhaps) "*shizen no erabi*" (自然の選び) as a Japanese equivalent of "*natural selection*".

In contrast with other domains, where the use of *yamatokotoba* is routine[3], this practice is rare in the case of scientific terms. In the field of biology, it is the case with terms like "*nawabari*" (なわばり , "*territory*") or *surikomi* (刷り込み , "*imprinting*"). In the case of "*natural selection*", no translation using *yamatokotoba* can be found.

Another possibility is very close to forgoing a translation of the phrase, and simply transliterating it as a new *gairaigo* written in *katakana*. Recently, this practice has become quite widespread. For example, Japanese philosophical books commonly use *gairaigo* like "*posutomodanizumu*" (ポストモダニズム , "*postmodernism*") or *torōpu* (トローブ , "*tropes*"). In the case of "*natural selection*", the result would be ナチュラルセレクション , which reads "*nachuraru serekushon*". However, so "defeatist" a gesture has never yet been attempted, except in cases where the translator intended a direct citation of the original term in *katakana*, for example in order to discuss the merits of possible translations.

If both the use of *yamatokotoba* and of transliterating in *gairaigo* were rejected, the only realistic strategy that remains is the third possibility: namely the use of Chinese roots, which belong to *kango* and the translation of the words "*to select*" or "*selection*".

2.2. Japanese standard translations for "selection"*: what differences?*

Japanese translators have used two standard *kango* translations for "*natural selection*": (1) "*shizen tōta*" (自然淘汰), together with "*jin'i tōta*" (人為淘汰) (in which "*jin'i*" means "*artificial*") for "*artificial selection*" and "*sei tōta*" (性淘汰) (in which "*sei*" means "*sex*" or "*sexual*") or "*shiyū tōta*" (雌雄淘汰) (in which "*shiyū*" means "*female and male of animals*") for "*sexual selection*"; (2) "*shizen sentaku*" (自然選択), together with "*jin'i sentaku*" (人為選択) for "*artificial selection*" and "*sei sentaku*" (性選択) or "*shiyū sentaku*" (雌雄選択) for "*sexual selection*".

Both translations share their first half: "*shizen*" (自然), which means "*natural*" or "*nature*". Comparing "*nature*" (or "*natural*") with "*shizen*" (which originally means "*spontaneous*") or its synonyms "*ten*" (天) or "*ten'nen*" (天然) (which means "*heavenly*" or "*heavenly given*") may require an overall comparison between the Western and Eastern views of nature—a goal that is clearly beyond the scope of this paper. Besides, this task was beautifully undertaken by Thomas (2001). Her book has shown the various problems related to "*shizen*", and how different terms were used at first, before they coalesced into "*shizen*" by the late 1890s. The striking fact in the case of natural selection is that while the translation of "*selection*" changed over time, "*natural*" was constantly translated by "*shizen*". So, within the limits of our project, we will provisionally assume that the term "*shizen*" is a satisfying equivalent to the Western term "*nature*". Setting aside the question of translating "*nature*", we will focus on the two possible translations used in Japanese for the English term "*selection*". In this Section, we focus on the second halves of the Japanese translations of "*natural selection*": "*tōta*" and "*sentaku*", which correspond to "*selection*". Although our focus is mostly on the semantic aspects (the way words were actually used), we will first recapitulate some etymological aspects and analyse how the two words may differ in several respects.

The word "*tōta*" originally derives from "*tō*" (淘), "*washing by water*", and "*ta*" (汰) which means "*water becoming muddy*". Then the most original sense of "*tōta*" is "*to clean by washing*" or "*sorting pure gold from mixture of gold and dirt, by soaking them in water*"[4]. According to this original meaning, doing "*tōta*" amounts to sorting grains into useful (e.g., grain of gold) and useless (e.g., grain of mere dirt). And naturally, "*to sort*" is its first derivative meaning. In geology, "*tōta*" (淘汰) or "*tōta sayō*" (淘汰作用) (in

3. For instance, Christian ecclesiastical terms: "*inori*" (祈り , "*prayer*"), "*sukui*" (救い , "*salvation*"), "*aganai*" (贖い , "*redemption*"), etc.
4. According to *Dai kanwajiten* (Morohashi 1955–1960) and the Appendix to *Toushisen kokujikai* (Hattori 1982). See Tarumi (2009).

which "*sayō*" means "*effect*" or "*function*") are used as a translation of "*sorting*" mineral sediments. This use of "*tōta*" preserves its more original sense, used in mining. For example, the standard and the most detailed Japanese dictionary, *Nihon kokugo daijiten* (『日本国語大辞典』, *Unabridged Dictionary of the Japanese Language*) explains the meaning of "*tōta*" as "*to sort by washing, and derivatively, to reject bad items and to select and preserve good items*". According to this, "*tōta*" has a two-sided meaning: "*preserving good things*" but also "*rejecting bad things*". In English, "*to sieve*", "*to strain*", "*to shift*" or "*to winnow*" have similar meaning, at least originally. But in recent Japan and China, "*tōta*" is strongly associated with "*(selectively) rejecting*", rather than "*(selectively) preserving*". For example, the shorter Japanese dictionary *Kōjien* (『広辞苑』, *Broadened Word-Garden*) explains the standard meaning of "*tōta*" simply as "*to take away useless things, or to expel disqualified persons*". Another significant fact about this word is that, without exception, every Japanese dictionary indicates its other meaning, which is explicitly Darwinian: for example, *Nihon kokugo daijiten* explains this as "*in a biological population, for only the individuals which have certain characteristics to propagate, that is a phenomenon in which fit ones are selected and unfit ones are taken away*"; similarly, *Kōjien* defines it as "*a phenomenon in which those which are fit to their environment or conditions survive and those which aren't die*". Hence "*tōta*" has the Darwinian meaning of "*selection*" even when it occurs alone, without the adjective "*natural*". Such usage of the term was explicitly registered in word dictionaries after the 1940s, but it seems to have been common long before then.

On the other hand, "*sentaku*" derives from two different *kanji*: 選 ("*sen*") (or 撰 , "*sen*"), meaning "*to select or to choose*" and 択 ("*taku*"), which means also "to select or to choose". According to the dictionary *Nihon kokugo daijiten*, "*sentaku*" means "*to pick out* ("*erabi dasu*", 選び出す)*; to take up a thing which one judges to be fit to one's aim out of more than one [thing]*", and according to *Kōjien*, "*sentaku*" means "*to choose; to pick out suitable thing; to take up good thing and discard bad thing*".

From this first characterization, we gather that "*sentaku*" makes a sharp contrast with "*tōta*": "*tōta*" is a relatively unusual word, which may have been re-introduced (if not invented from scratch) with the special aim of translating "*natural selection*" by someone who had some (even if only partial) understanding of Darwin's idea. In contrast, "*sentaku*" is a very usual word and it may be the most natural and neutral translation of "*selection*" (and also of "*choice*"). Indeed, "*shizen sentaku*" can be seen as the most ordinary lexical translation of "*natural selection*", one at which several persons can arrive independently only by consulting a word-dictionary for "*natural*" and "*selection*". Moreover, in contrast with "*tōta*", "*sentaku*" is a broad and neutral term which does not usually have any Darwinian sense by itself—with the possible exception of when it occurs in some limited and technical context related to evolutionary biology. In other terms, "*tōta*" may be considered as scientific jargon, whereas "*sentaku*" is a more ordinary term.

We must mention that there is another translation for "*selection*" which is used technically in the field of breeding science: "*senbatsu*" (選抜), in which 抜 ("*batsu*") means "*to pull up*" or "*to draw up*". "*Senbatsu*" means clearly "*picking up*", closer to "*sentaku*" than to "*tōta*". Thus it may be available to translate "*natural selection*" as "*shizen senbatsu*" (自然選抜) and indeed this term was once proposed by the biologist Shibatani Atsuhiro (柴谷篤弘), in the late 1980s and 1990s (Shibatani 1999: 143–144). But this translation has never gained any popularity, in spite of the fact that "*jin'i senbatsu*" (人為選抜) has been widely accepted as a translation of "*artificial selection*" since the 1950s. Indeed "*senbatsu*" and "*jin'i senbatsu*" are virtually synonymous terms.

All previous facts and analyses are summarized in table 1. Our conclusion is that, by now, "*shizen tōta*" and "*shizen sentaku*" are the only two possibilities actually in use for translating natural selection. Both translations have gained comparable popularity, but this situation has changed across time as we will see in the next Section.

TABLE 1. Some terms used in Japanese for the translation of terms related to the concept of "*natural selection*".

Translation for "*selection*"	Translation for "*natural selection*"	Other uses	Original meaning	Popularity
淘汰 . *tōta.*	自然淘汰 . *shizen tōta.*	人為淘汰 (*jin'i tōta*): *artificial selection.* 性淘汰 (*sei tōta*), 雌雄淘汰 (*shiyū tōta*): *sexual selection.*	A technical, rather unusual word, tightly associated with its Darwinian meaning: (1) To sieve, to winnow. (2) To reject, to expel (sometimes synonymous with *culling*). (3) May have a double meaning of rejecting the bad and keeping the good.	First used in 1878. Became standard by the 1880s until the 1940s. Currently regaining momentum?
選択 . *sentaku.*	自然選択 . *shizen sentaku.*	人為選択 (*jin'i sentaku*): artificial selection. 性選択 (*sei sentaku*), 雌雄選択 (*shiyū sentaku*): sexual selection.	A very common word for *to choose.* No technical value. Used both for selection and choice.	First used in 1878. Used by breeders, but rare until the 1950s. Official translation after WWII. Currently losing momentum?
選抜 . *senbatsu.*	自然選抜 . *shizen senbatsu.*	人為選抜 (*jin'i senbatsu*): artificial selection.	To pick up.	Very rare as *natural selection.* Popular as *artificial selection.*

3. From "*tōta*" to "*sentaku*"? A historical overview

In this Section, we give an historical overview of the changing fate of different translations of "*natural selection*" in Japanese. We identify WWII as a clear historical watershed, leading from the use of "*tōta*" to a preeminence of "*sentaku*".

After the introduction of Darwinism in Japan in the late 1870s had been triggered by Morse's series of lectures, a variety of translations of "*natural selection*" were suggested (see Table 2). Both "*shizen tōta*" and "*shizen sentaku*" were used at the earliest stage of this period. We found the first identified occurrence of "*shizen tōta*" in an article by William Keith Brooks, translated by Suzuki Yūichi (Brooks 1878). Published in March and April 1878, it seems to be the first Japanese translation of the term. As to "*shizen sentaku*", it was first used by Funakoshi (Inoue) Tetsujirō's translation of William Edwin Parson's lecture in May 1878 in what we identify as the second translation of the term (Parson 1878). But the two terms took very different courses after this initial introduction. We will look at each of them respectively.

3.1. From the Meiji era to World War II: early trials and the rise of "shizen tōta" (自然淘汰)

To begin with "*shizen tōta*", as already mentioned, this translation is not usual and, consequently, it must have been coined by someone who was somehow familiar with Darwin's original idea. It seems Suzuki was the first *user* of the term at least in the published media. But we are not certain as to whether he was also its *inventor* or not. The name of Katō Hiroyuki was suggested as the inventor (Yokoyama 2005; Tarumi 2009). But Katō, in his manuscript for a lecture in November 1879 (Katō 1976), used another peculiar translation, "*shizen kanbatsu*" (自然簡抜). "*Kanbatsu*", which is very similar to "*senbatsu*", means "*to select and pick up*". The term never found any followers. As to "*shizen tōta*", it was not used by Katō in his published material until 1882 (Katō 1882). This fact may suggest that the inventor was another person, though we

cannot deny the possibility that Katō had coined several tentative terms including "*shizen tōta*" and used them in private conversations earlier. As Katō was the president of the University of Tokyo, we cannot neglect his influence on the students of his university and his role in the term's popularity[5]. "*Shizen tōta*" seems to have met the approval of many users, and it became the standard translation of "*natural selection*" by the middle 1880s[6]. For instance, "*shizen tōta*" as well as "*jin'i tota*" and "*shiyū tōta*" were used in Oka's 1905 translation of the *Origin* (the first complete translation of Darwin's masterpiece, edited by a naturalist).

TABLE 2. Early attempts (1878–1883) to translate "*natural selection*" in Japanese. This table is adapted from Isono (1987: 313). It shows a sample of the main terms used in journal articles and pamphlets when referring to "*natural selection*" from 1878 to 1883.

Year (month)	Translator (or user)	Natural selection
1878?	Unknown [Aruga, Nagao?]	自然淘汰 shizen tōta
1878 (March–April)	Suzuki, Yūichi (translation of Brooks 1878)	自然淘太 shizen tōta
1878 (May)	Funakoshi (Inoue), Tetsujirō (translation of Parson 1878)	自然選択 shizen-sentaku
1878 (November–December)	Geijutsu-sōshi, Volumes 20–25 (on Morse 1878)	天撰 tensen
1879	Katō, Hiroyuki (manuscript published as Katō 1976)	自然簡抜 shizen kanbatsu
1879	Ishikawa et al. (Morse 1879)	天撰 tensen
1880 (March)	Inoue, Tetsujirō	自然陶汰 shizen tōta
1880 (June)	Nakaguma, Keizō	自然陶汰 shizen tōta
1880 (July)	Inoue, Tetsujirō	自然陶汰 shizen tōta
1881 (April)	Inoue, Tetsujiō et al.	自然陶汰 shizen tōta
1881 (July)	Kōzu, Senzaburō	天然撰択 ten-nen sentaku, 天撰 tensen
1881 (October–Nobember)	Katō, Hiroyuki (Tōyō Gakugei Zasshi, Volumes 1–2)	自然淘汰 shizen tōta
1882 (July–March)	Editorial (Tōyō Gakugei Zasshi, Volumes 4–6)	自然淘汰 shizen tōta
1882	Katō, Hiroyuki	自然淘汰 shizen tōta
1882 (December)	Yatabe, Ryōkichi	自然淘汰 shizen tōta
1883 (April)	Ishikawa, Chiyomatsu (Morse 1883)	自然淘汰 shizen tōta

In contrast, "*shizen sentaku*" (自然選択), first used by Funakoshi (Inoue), was adopted by very few writers, for instance by Izawa Shuji's in his translation of Huxley (1889). Some translations are close to "*shizen sentaku*". An interesting case is the translation of Morse's texts: in the manuscript versions (Morse 1878, 1879), we find "*tensen*" (天撰), in which "*ten*" (天) means originally "*heavenly*" and derivatively "*natural*", and "*sen*" (撰) is almost synonym with "*sen*" (選), meaning "*to select or choose*"[7] ; or in 1881 (Darwin 1881), we find "*ten'nen sentaku*" (天然撰択), in which "*ten'nen*" (天然) is almost equivalent to "*ten*", namely "*natural*". But in the published edition (Morse 1883) the translator Ishikawa used "*shizen tota*", "*jin'i tota*" and "*shiyu tota*".

But, firstly, these attempts also had no successors. And secondly, here we must reiterate that "*sentaku*" is the most usual lexical translation of "*selection*" (and, as we said, "*shizen*" is also the most usual translation of

5. Katō is also credited for coining two versions of the translation of "*survival of the fittest*": one is "*jaku niku kyō shoku*" (弱肉強食 , "*the stronger eats the weaker*") and the other is "*yūshō reppai*" (優勝劣敗 , "*the superior wins and the inferior is defeated*"). Both translations are subject to many criticisms.
6. In the early modern literature, we can find some variants of 淘汰 , such as 淘太 , 陶汰 or 掏汰 , but probably their intended meanings were the same.
7. The same translator(s) translated "*artificial selection*" as "*jinsen*" (人撰), in which 人 ("*jin*") means "*human*"; and "*sexual selection*" as "*danjosen*" (男女撰), in which 男女 means "*man and woman*" (of human being).

"*natural*") so that the translation "*shizen sentaku*" could easily have been coined by many translators independently. Therefore, it is entirely possible that all the above mentioned translations have no connections among each other. At least as for the occurrence of "*shizen sentaku*" after WWII, it is highly plausible that they had no connection with those occurring in the Meiji era.

3.2. After World War II: the growing popularity of "shizen sentaku" *(* 自然選択 *)*

From the 1880s to the 1940s, "*shizen tōta*" has been the almost exclusive translation of "*natural selection*" that was used by Japanese writers, with few exceptions. But this situation began to change after WWII. How can we account for this shift from "*tōta*" to "*sentaku*"?

This change can be seen as an abandonment of "*tōta*" rather than as a positive recommendation of "*sentaku*". It seems that the main reason for this change of terms, if not the only one, is a bureaucratic one. After WWII, the Japanese Ministry of Education[8] launched a campaign of "kanji *restriction*" recommending the use of certain terms in preference to others. The *kanji* policy was embodied in the Tōyō Kanji Hyō (当用漢字表 , the list of *Kanji* for general use) which had been officially published on November 16, 1946[9]. This list may have led to the jettison of "*tōta*" in favour of "*sentaku*", for the list contains neither 淘 ("*tō*") nor 汰 ("*ta*") whereas it contains both 選 ("*sen*") and 択 ("*taku*"). This choice of terms is probably related to the above mentioned fact that "*sentaku*" is a usual or familiar word whereas "*tōta*" is not.

This official lexical policy had immediate effects in a series of the official list of Japanese scientific terms *Gakujutsu yōgo shū* (『学術用語集』, *Japanese Scientific Terms*), issued by The Ministry of Education. Since their earliest versions (we have checked their versions since 1954 for zoology, botany, genetics and the agricultural sciences), they have never contained "*shizen tōta*" as the translation for "*natural selection*", but they have always contained "*shizen sentaku*" (see all references listed under "Ministry of Education").

Another visible effect is the terminology adopted in textbooks. We surveyed a series of high-school textbooks of biology published after WWII[10]: the majority of them used "*shizen sentaku*" rather than "*shizen tōta*". In the 1950s, out of 17 books only 6 adopted the term "*shizen tōta*"[11]. By the mid-1960s, every high-school textbook adopted the term "*shizen sentaku*", and "*shizen tōta*" had totally disappeared.

This may be considered a natural evolution of language. As previously noted, "*shizen sentaku*" is a combination of two rather literal and usual translations of "*natural*" and "*selection*". However, the national policy does not seem to have had any powerful compelling force for active biologists, as almost every biologist continued to use "*shizen tōta*", at least by the late 1960s. In the mid 1970s, users of "*shizen sentaku*" began to grow, although other biologists never gave up "*shizen tōta*". A standard dictionary of biology published by Iwanami Shoten (Yamada *et al*. 1960) even adopted "*shizen tōta*" rather than "*shizen sentaku*" as an official term from its first edition (in 1960) and in the following editions (1977, 1983, 1996)[12].

We searched the database "Magazineplus", which includes articles both from technical and non-technical magazines, for the articles whose title contain "*shizen tōta*" or "*shizen sentaku*"[13]. By the late 1970s or the

8. Now "Ministry of Education and Science", or, in its official English name: "Ministry of Education, Culture, Sports, Science and Technology".
9. We are indebted to Tarumi Yūji's short essay (Tarumi 2009) for the consideration that the *kanji* restriction policy may have played a crucial role in the diffusion of the term "*shizen sentaku*". However, Tarumi's account must be revised on several accounts. First, Tarumi suggests that restriction on the use of 淘 ("*tō*") and 汰 ("*ta*"), is due to the Jōyō Kanji Hyō (常用漢字表 , the list of *kanji* for common use) issued in 1981; but, as we have indicated, these characters had already been expelled from the list of authorized *kanji* by the Tōyō Kanji Hyō in 1946. For the same reasons, we disagree with Tarumi's claim that some versions of the *Japanese Scientific Terms* series contained both "*shizen tōta*" and "*shizen sentaku*" as official terms: we have been unable to find such versions, and we think it is plausible that such versions never existed. Secondly, Tarumi claims that Yasugi Ryūichi first introduced "*shizen sentaku*" in the second edition of his translation of the *Origin* in 1990 and that, until then, Yasugi had adopted "*shizen tōta*". Actually Yasugi already used "*shizen sentaku*" in his first edition, issued in 1963 (Darwin 1963, 1990). (However, it is a fact that Yasugi had attempted to preserve the term "*shizen tōta*" in school textbooks by the 1960s).
10. Our research took place at the Textbook Library of Japan Textbook Research Center, in Kōtō-ku, Tokyo (10 December 2011).
11. "*Tōta*" is usually written in *kanji*. However, there is one occurrence of the word spelled in *hiragana*, とうた (see below, note 16).

1980s, "*shizen sentaku*" became the most commonly used translation, at least among biologists. However, when non-biologist writers of journalism or management appeal to (social) Darwinian metaphors, they use, almost without exception, "*shizen tōta*" and not "*shizen sentaku*".

3.3. Possible influence of Chinese translations?

Should we suppose any direct connection between Japanese and Chinese translations? It may well be that Chinese translations have led Japanese translators to favour one *kango* over the other. The Chinese translator Yan Fu (嚴復) (1854–1921) translated "*natural selection*" as "*tiānzé*" (天択), a translation which is very close to the Japanese "*tensen*" (天撰) (see above, Section 3.1 and Table 2). This occurred in his translation of Thomas Huxley's *Evolution and Ethics* in 1898 (reprinted in Huxley 1998).

It has been suggested that Japanese polysyllabic renderings of Western terms were very influential at the time among the Chinese intelligentsia, and it may well be that Yan suggested simpler translations in order to counter-balance this fashion—"*although his success in this area is doubtful*" (Hahn 2003). In other words, Yan's adoption of "*tiānzé*" seems to be an attempt to avoid polysyllabic terms such as "*shizen tōta*" (in Chinese reading, "*zìrán táotài*") or "*shizen sentaku*" (in Chinese, "*zìrán xuǎnzé*"). Yan's two-syllabic terms are still used in China: as well as "*tiānzé*", "*rénzé*" (人択) for "*artificial selection*" and "*xìngzé*" (性択) or "*lèizé*" (類択) for "*sexual selection*".

Is there a possibility that the term "*shizen-sentaku*" came back into Japanese in the 1950s through modern Chinese translations of the *Origin*? In fact, polysyllabic terms were also popular in China: "*zìrán xuǎnzé*" (自然選択) for "*natural selection*", "*réngōng xuǎnzé*" (人工選択) (in which "*réngōng*" means "*artificial*") for "*artificial selection*" or "*xìng xuǎnzé*" 性選択) for "*sexual selection*". Some Chinese translations of "*natural selection*" used "*zìrán xuǎnzé*" (自然選択)—exactly the same characters as "*shizen sentaku*"—at least since the 1950s[14].

In the first Chinese translation of the *Origin* by Ma Junwu (馬君武) (1881–1940) published in 1920, "*natural selection*" is translated with the term coined by Yan Fu, "*tiānzé (yīmíng zìrán táotài) (*天択 *(* 一名 自然淘汰 *))*" (Darwin 1957). In this translation, "*tiānzé*" was used together with "*zìrán taotai*" with the same characters as the Japanese "*shizen tōta*". In his translation, Ma used both "*tiānzé*" and "*zìrán táotài*" but did not use "*zìrán xuǎnzé*" (自然選択), the same word as the Japanese "*shizen sentaku*".

However, in recent China, the most standard translation of "*natural selection*" is "*zìrán xuǎnzé*": "*tiānzé*" is also sometimes used, but "*zìrán táotài*" (namely "*shizen tōta*") does not seem to be used anywhere[15].

Further study should be undertaken to identify when exactly "*zìrán xuǎnzé*" began to be used and when "*zìrán táotài*" disappeared from Chinese, but this is a topic for a different paper. For our present purpose, at least we may say that it is not plausible that "*shizen sentaku*" was introduced in Japan by means of Chinese translations.

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12. In its second and third editions (in 1977 and 1983), we find the term "*shizen sentaku*" was adopted to designate Niels K. Jerne's "*natural selection theory of immunology*" exclusively. The theory was eventually replaced by "*clone selection theory*" and thus the heading disappeared in the fourth edition (1996). Similar concern for disambiguation might plausibly account for the conservative terminology adopted by some biologists.
13. The earlier occurrence of "*shizen sentaku*" in an article title was in 1976 (see <http://www.nichigai.co.jp/database/mag-plus.html>). By reviewing two journals of biology or history of biology, we located the first appearance of "*shizen sentaku*" in 1972.
14. By the mid-20th century, "*shizen sentaku*" and "*zìrán xuǎnzé*" were written as 自然選擇 both in Japan and China (also other East-Asian countries). But now such traditional style is used only in Taiwan (and a few other countries), while in Japan and continental China, Chinese characters are written in different simplified styles. In this paper, we write *kango* or Chinese words in Japanese simplified style even if they were originally written in other styles.
15. See for instance the second Chinese translation of the *Origin* published in 1954–1956 and translated by Zhou Jianren (周建人) *et al.* (Darwin 1954).

4. Selection in general: conceptual problems

We have so far dealt with the lexical history of Japanese terms, in order to see what terms were in use and how one term has become prevalent over the other. We have emphasized the role played by the official *kanji* restriction policy after WWII. But an important question has been left open: why did "*shizen sentaku*" become widespread in the 1970s? Several possible causes may be considered: (1) the fact that new generations had been taught the term "*shizen sentaku*" at school may have acted; (2) the publication of a new translation of the *Origin* by Yasugi Ryūichi in 1963 may also have played some significant role in making "*sentaku*" more widespread. This new standard translation, using "*shizen sentaku*" for "*natural selection*", started to be published in 1963 and was completed by 1971.

But several questions are left open: is there any positive, conceptual outcome of this change? In other terms, is it better to say "*sentaku*" rather than "*tōta*"? Or is it just an indifferent matter? Another question is: why "*sentaku*", and not other terms? After all, several other translations were still available and could have taken the place left by "*shizen tōta*". As we have seen, "*shizen sentaku*" was first used in 1878 and was rather neglected until the 1970s. What are the reasons for its unexpected comeback? We have so far listed a set of plausible reasons to account for the progressive abandonment of "*shizen tōta*". Nevertheless this picture does not offer any positive rationale for adopting "*shizen sentaku*" in its stead.

This Section inquires into possible reasons for the prevalence of the term "*shizen sentaku*". We believe that the question of choosing between "*shizen tōta*" and "*shizen sentaku*" is more than a question of lexical policy or pedagogical fashions, as is clearly evinced by the recent fortunes of the two terms. Although "*shizen sentaku*" was more widespread until the 1990s, yet more recently "*shizen tōta*" enjoys an increasing favour, especially among biologists. What are the main incentives for this revival?

The various "external" factors analysed in Sections 3.2 and 3.3 (assessing the possible roles of official lexical policy and of Chinese translations), although undoubtedly important, are by no means sufficient in accounting for the fate of the various Japanese translations of "*natural selection*". We have now to review other factors, which may have favoured "*sentaku*" over "*tōta*", or, on the other hand, "*tōta*" over "*sentaku*". Apart from lexical reasons, some conceptual motives may have fostered the use of one *kango* over the other, especially among specialists of evolutionary biology.

In the following Section, we review three important terminological problems related to translating "*natural selection*". The first one bears on the different connotations of "*sentaku*" and "*tōta*": which is the best competitor for grasping the meaning of Darwin's "*natural selection*" (Section 4.1)? The following Section (4.2) compares "*natural selection*" with "*artificial selection*". A second problem bears on the terminological difference between "theoretical" and "practical" biology, namely between theoretical disciplines (traditionally zoology and botany) and breeding science or thremmatology in Japan. However, the Japanese situation cannot be reduced to a clear theoretical/practical divide: as Tsukuba (1959*b*) argued, Japan has a tradition of theoretical agricultural scientists (including breeding scientists) distinguished from practical agriculturists or breeders. Thus, in the first half of the 20th century, Japanese agricultural scientists were the earliest introducers of the Mendelian genetics and of Karl Pearson's biometry—maybe the most abstract and technical, or the most "theoretical" discipline of biology. Our last Section (4.3) bears on the difference between "*choice*" and "*selection*", a problem already analyzed in other languages like French (see Hoquet 2011). Here, the notable fact is that the concept of "*natural selection*" interacts in the field of evolutionary biology with other related concepts, like "*artificial selection*" and "*sexual selection*".

4.1. "Natural selection"*: conceptual nuances between* "tōta" *and* "sentaku"

Apart from the bureaucratic reason of *kanji* restriction already alluded to in the previous Section, are there any conceptual reasons which favour the use of "*shizen sentaku*" over "*shizen tōta*"? A typical reason is that

"*sentaku*" offers a more accurate and literal translation of "*selection*", whereas "*tōta*" suggests only a negative, rejecting process. But is that so?

Darwin's idea of "*natural selection*" encompasses a creative or innovative process, not a merely negative, conservative one. In other terms, natural selection is more than a new phrase designating the "*wars of nature*" which were already identified by naturalists of the pre-Darwinian era[16]. If we are to take seriously the claim that natural selection is a composer of symphonies rather than a process of rejection, then "*tōta*" seems clearly inadequate, as it hardly captures a positive account of the selection process.

But several other reasons may recommend "*tōta*" over "*sentaku*" (Tarumi 2009). First, terminological conservatism may lead scientists to focus on consistency in their use of terms: "*tōta*" has endured a long tradition since the Meiji era, so that rejecting this term necessarily entails some terminological inconsistency or lexical confusion. Secondly, one may also claim that "*tōta*" does not designate, at least originally, a merely negative or rejecting process of culling, but that it also signifies a form of positive picking process. According to Tarumi, "*tōta*" also means "*seisen suru*" (精選する), i.e., "*to choose (or select) deliberately*" (Tarumi 2009, following Morohashi 1955–1960). In this original sense, "*shizen tōta*" captures the meaning of Darwinian "*natural selection*" better than "*shizen sentaku*", for it nicely meets Darwin's original definition in a famous sentence of Chapter 4 of the *Origin* (1859: 81): "*This preservation of favourable variations and the rejection of injurious variations, I call Natural Selection*". Dictionary entries may support this claim: "*tōta*" originally meant "*to select good things and to reject bad things (at once)*" (Tarumi 2009, following Ōtsuki 1932–1937, vol. **3**: 200). If such meanings are still relevant, then "*tōta*" may be more suitable than "*sentaku*", to express the meaning of Darwin's concept of "*(natural) selection*". Similar reasons have led Watanabe Masataka (渡辺政隆), a recent translator of the *Origin*, to adopt the term "*shizen tōta*" in his new translation of the *Origin* (Darwin 2009*b*).

Following this line, we see no conceptual reason for favouring "*sentaku*" over "*tōta*". But is that so? First, it must be acknowledged that the term "*tōta*" is now quite remote from its original meaning. In modern Japanese, the word "*tōta*" is understood only in its negative sense of "*rejecting*". The same claim could be made about modern Chinese as a modern Chinese-English dictionary defines "*tōta*" as: "*(1) eliminate through selection / competition; (2) die out*", and does not mention any positive sense of "*picking up*" (DeFrancis 1996: 586).

"*Tōta*"'s negative sense of "*rejecting*" may not be so new. For example *Dai genkai* lists the sense: "*to reduce or lessen something*" (Ōtsuki 1932–1937, vol. **3**: 200). An older word dictionary *Dai Nihon kokugo jiten* gives: "*to wash away; to remove useless things*" (Ueda & Matsui 1919, vol. **3**: 437).

Let us also note that translators have to find a term for both the noun "*selection*" and the verb "*to select*". There is a possibility that at least by the Meiji era, "*tōta*" might have been used for the verb "*to select*". We find examples of "*tōta suru*" as translation of the verb "*to select*" in texts written in the Meiji era (for example by Tachibana or Oka). Nevertheless, recent translators who use "*(shizen) tōta*" for translating the phrase "*(natural) selection*" very rarely translate the verb "*to select*" by "*tōta suru*" (淘汰する) but instead by terms like "*sentaku suru*" (選択する), "*senbatsu suru*" (選抜する) or even "*erabu*" (選ぶ) (see for instance Darwin 2009*a–b*). Hence for readers concerned with the lexical consistency of Darwin's terminology, "*sentaku*" may be said to be more accurate as it offers a useful term for both the noun and the verb.

Translators may aim at terminological consistency even at the cost of sacrificing the natural sense of terms: this may be the case for Tokuda Mitoshi (徳田御稔)'s 1959 translation of the *Origin* (Darwin 1959), in which "*tōta suru*" is used for translating the verb "*to select*".

16. Darwin himself refers to "*the elder De Candolle and Lyell [who] have largely and philosophically shown that all organic beings are exposed to severe competition*" (Darwin 1859: 146). See Candolle (1820: 384). On natural selection as a creative process, compared with composing a poem or a symphony, carving a statue or painting a picture, see for instance Dobzhansky (1970).

4.2. "Artificial selection" *and the case of Japanese breeders*

For now, we have exclusively focused on "*natural selection*". But it should be reminded that one of the roots of Darwin's natural selection is selective breeding, which was renamed "*artificial selection*". What was the connection between breeding and selection in the case of Japan? In this section, we argue that "*sentaku*" was used by some rather neglected tradition, and that it has been continuously in use in the field of breeding, from 1917 until the 1970s when it became widespread.

First, it should be noted that, in Japan, theoretical biology and breeding science (or the agricultural sciences in general) have slightly different terminological conventions. As mentioned earlier, breeders have translated "*selection*" as "*senbatsu*" (選抜). Another significant terminological difference bears on "*tōta*", taken as a translation of "*culling*" or "*rejecting*" rather than of *selection*, particularly in the field of animal breeding. Thus, according to the contemporary *Japanese Scientific Terms: agricultural science* (Anonymous 1986), "*tōta*" (written in *hiragana* as とうた) is a translation of "*culling*"[17] . However, even in this field, "*shizen tōta*" may be exceptionally regarded as a translation of "*natural selection*".

Both of these usages of "*senbatsu*" for "*selection*" (as the technical term in breeding science) and "*tōta*" for "*culling*" seem to have become popular rather recently, namely between the 1940s and the 1950s[18]. Before that, "*tōta*" had been used as a common translation for "*selection*" in general. Admittedly, even in this time we can find "*senbatsu*" was sometimes used for "*selection*" and "*tōta*" sometimes bore the exclusively negative meaning of rejection, up until then they had not achieved the status of standard technical terms which they enjoyed after the 1950s.

It seems that, in the field of breeding science, "*tōta*" (the traditional translation for "*selection*") became seen as improper, and got a strong connotation of "*rejecting*", already in the pre-war period: as a consequence, the use of "*tōta*" became restricted to the translation of "*culling*" (as in "*selection and culling*"): evidence for such terminological change can be found in Anagama (1948, 1952) and Kamishima (1952). Meanwhile, "*senbatsu*" became the most common translation for "*selection*".

Now, as to "*shizen sentaku*", we have found a possible source of this term in this field. Until the late 1940s at least, "*sentaku*" was used as well as "*senbatsu*" as an alternative to the more traditional term "*tōta*" to signify "*selection*" in breeding. Such use of "*sentaku*" might even go back to the pre-war period in breeding science. This tradition seems to have its origin in a text written by a plant-breeding scientist, Akemine Masao (明峰正夫) in 1917[19] .

Akemine used "*tōta*" for "*selection*" in breeding and "*shizen tōta*" for "*natural selection*" (Akemine 1912: 103). But in the revised edition of the same book, he changed his terminology and used "*sentaku*" for selection and, interrelated with this change, introduced the term "*shizen sentaku*" for translating "*natural selection*" (Akemine 1917: 217–218). Now this terminological change seems his own invention because he claims in the introduction of the book: "*because of enormous lack of technical terms for the breeding science in our country, I audaciously introduced a lot of new terms in this book*" (Akemine 1912: 2, 1917: 5). Both "*sentaku*" and "*shizen sentaku*" seem to belong to these terminological attempts.

There is no evidence that Akemine's new terminology has become widespread. But some of his disciples at Hokkaidō University seem to have inherited his terminology. The most notable of his successors is Nagao Seijin (長尾正人), who once edited essays dedicated to Akemine (Nagao 1938). In Nagao's book, we are told that he was a member of a committee for new scientific terms of breeding science in 1949 (Nagao 1951: 372), and the same book contains his draft for the new scientific terms that includes "*sentaku*" as the translation of "*selection*" for the technical usage in breeding (Nagao 1951: 372–376).

17. Transcription in *hiragana* is a means to keep on using a term under *kanji* restriction (see above note 11). However, such a strategy is rarely attempted because it is a deviation from a traditional writing guideline (if not strict rule), which says that *kango* should be written in *kanji*. It should also be noticed that almost all breeding scientists and geologists write the term "*tōta*" in *kanji* and not in *hiragana*.
18. As for the decline of "*tōta*" as selection and the flourishing of "*senbatsu*", we are indebted to Dr. Ukai Yasuo (鵜飼保雄)'s unpublished research on terminological history in Japanese plant-breeding science.
19. We thank Dr. Ukai for bringing this text to our attention.

As we have seen, by the middle of the 1950s, "*senbatsu*" became the standard term in this field. But at least by the beginning of the 1950s, "*sentaku*" also seemed to be used for signifying "*selection*" as a technical term in breeding, and then was getting less popular. Remarkable textual evidence for this may be found by comparing two editions of Sasaki & Naitō's textbook of animal breeding: the 1953 edition uses "*sentaku*" as the translation of "*selection*", but the term is systematically replaced by "*senbatsu*" in the 1956 edition.

Thus, now we seem to get a plausible account for the seemingly unexpected comeback of "*shizen sentaku*" which had appeared in the early Meiji Era and then rapidly disappeared. The term "*sentaku*" may have its roots in Akemine's (1917) terminology and transmitted subsequently to his followers in the field of breeding. After WWII, when the *kanji* restriction policy was enacted, "*sentaku*" became more popular in biological science in general while in breeding science, "*senbatsu*" achieved the status of standard term.

Although this scenario has some degree of plausibility, it nonetheless raises several difficulties. For instance, "*sentaku*" was not universally and systematically used as a translation for "*selection*". Nagao translated "*selection*" in breeding as "*sentaku*", but "*natural selection*" as "*shizen tōta*" (Nagao 1938: 260). Thus Nagao followed Akemine in using "*sentaku*" as a term in breeding, but not in using "*shizen sentaku*". This fact suggests that, at least by this period, even among disciples of Akemine, "*shizen sentaku*" was not as usual as "*sentaku*" in the context of breeding science. We may add that the same kind of terminological convention is still in use among breeding scientists even now. For, as we noted, Japanese breeding scientists translate "*selection*", having technical meaning in breeding, as "*senbatsu*" while they translate Darwinian "*natural selection*" as "*shizen sentaku*" or "*shizen tōta*".

Recently, such terminological convention seems to have exerted some influence outside the field of breeding. For example, in the new translation of the *Origin* (Darwin 2009b), Watanabe Masataka translated "*natural selection*" as "*shizen tōta*" wheras the verb "*selecting*" became "*senbatsu*", and "*artificial selection*", "*jin'i senbatsu*". Thus, at least among the writers who prefer the term "*shizen tōta*" to "*shizen sentaku*", there seems to be a tendency to emphasize the distinction between natural evolutionary processes and human selecting processes.

What implications does this have? Perhaps it suggests a broadly shared feeling that "*senbatsu*" sounds human-like and bears on intentional agency: hence the reluctance to prefix the adjective "*natural*" to it. On the account of "human-like" aspects (anthropomorphism): "*senbatsu*" is no doubt much more intricate than "*tōta*", and perhaps even a little stronger than "*sentaku*". Seeing this from another viewpoint, "*tōta*" sounds less human-like and designates a more mechanical process. Then, by using the term "*shizen tōta*", Japanese people have been less pressed by the problem of *personification of nature*, a problem posed by the English term "*natural selection*". This problem is related to another topic in the next Section.

4.3. "Sexual selection" *and the confusion with* "mate choice"

Section 4.1 provided some considerations in favour of using "*shizen tōta*" rather than "*shizen sentaku*" as the best equivalent for "*natural selection*". Section 4.2 compared "*natural selection*" and "*artificial selection*". We have now to take "*sexual selection*" into account to get a better understanding of the issue of translating "*natural selection*" within the economy of Japanese evolutionary vocabulary. Another reason to adopt "*shizen tōta*" is linked to recent terminological change among behavioural ecologists, especially with regard to the concept of sexual selection (Tarumi 2009). *The new Japanese Darwin Collection* (Darwin 1999; which so far contains only two works: *The Descent of Man* and *The Effects of Cross and Self Fertilisation in the Vegetable Kingdom*) adopts "*shizen tōta*" (rather than "*shizen sentaku*") for "*natural selection*" and "*sei tōta*" for "*sexual selection*".

In recent evolutionary ecology, the concept of "*mate choice*" is increasingly important. "*Mate choice*" is traditionally divided into "*male choice*" and "*female choice*": it is generally understood as a component of the process of "*sexual selection*", together with the other component, "*intrasexual competition*". In Japan, the concept "*mate choice*" was translated as "*haigūsha sentaku*" (配偶者選択), in which "*haigūsha*" means "*the*

partner of marriage". However, recent translations use "*haigūsha senkōsei*" (配偶者選好性), in which "*senkōsei*" as "*preference*" is intended for disambiguation, by avoiding "*sentaku*", still a common translation of "*selection*" (Hasegawa 2005: 227–228). Using "*sentaku*" for mate choice could cause confusion with "*sexual selection*", translated as "*sei sentaku*" (性選択) or as "*shiyū sentaku*" (雌雄選択), in which "*shiyū*" means "*male and female (animals)*". In such cases, the sentence "*sexual selection occurred by mate choice*" would read something like "shiyū sentaku *occurred by* haigūsha sentaku"—no doubt a very confusing expression. Translating both "*selection*" and "*choice*" by "*sentaku*" blurs the important (and often difficult to grasp) conceptual distinction between "*mate choice*" and "*sexual selection*".

The concepts of "*sexual selection*" and "*mate choice*" may be a real seed of confusion. In fact, "*mate choice*" is often paraphrased as "*intersexual selection*", in contrast with "*intrasexual selection*", as male-male or female-female competition. However, this synonymy is misleading as the two terms designate two different phenomena. "*Mate choice*" is performed by animals which discriminate with the aid of their sense organs between possible mates; whereas "*sexual selection*" is a process affecting the whole population, a change in the genetic make-up of the population over time.

On the contrary, biologists should always be reminded by a careful choice of terms that mate choice is not equivalent to sexual selection, but only at best a component of it: mate choice can take place without entailing sexual selection (for instance, if the chosen traits are not heritable or in the case of a 1:1 sex ratio); on the other hand, sexual selection can occur without mate choice (in the case of random assortment). Besides, "*preference*" and "*choosiness*" are different things, as choice depends on the circumstances: individuals may have strong preferences but may not take the time to choose.

In spite of this important conceptual nuance, "*choice*" and "*selection*" are, from a purely semantic point of view, tightly connected with each other. On the one hand, this connexion between "*mate choice*" and "*intersexual selection*" explains how animal choice can be an element of the process of natural selection, on the presupposition (shared by sociobiologists and evolutionary psychologists), that the cognitive functions of higher animals (including human beings) are themselves the results of natural selection—a presupposition which is often seen as pointing to the *naturalization of human beings*. On the other hand, the same connection can be seen as explaining a natural process as a kind of choice, which has been criticized as a *personification of nature*, something which has haunted Darwinism since the nineteenth century.

For instance, a term like "*idenshi sentaku*" (遺伝子選択 , gene selection) is especially problematic, as it may suggest that "*genes do make a choice (as an intentional subject)*" whereas the true meaning is that "*genes are selected (in the course of nature)*" (Tarumi 2009). It is important to avoid by all means the confusion between mate choice and sexual selection. In Japanese this conceptual and lexical clarification can be achieved by adopting "*tōta*" as the translation of "*selection*", and by distinguishing "*sei tōta*" (or "*shiyū tōta*") for "*sexual selection*" from "*haigūsha sentaku*" for "*mate choice*". Another advantage of "*shizen tōta*" over "*shizen sentaku*" may lie in the fact that there is less danger of personifying nature if we adopt the former, "*shizen tōta*", for "*sentaku*" (and also "*choice*") has a strong implication of a personal will or judgment, whereas "*tōta*" sounds more mechanical and suggests a tool-like process of sieving. It may be that this connotation of "*tōta*" fostered the introduction of Darwinism in Japan. But we must add that this advantage is a double-edged sword. For the term may fail to capture Darwin's original idea, especially if we conceive "*tōta*" as only a negative process.

We understand that a key issue bears on the difference between "*selection*" and "*choice*". If "*to select*" is not simply synonymous with to choose, and if "*sentaku*" means simply "*to choose*", then it may be an inappropriate translation for "*selection*", and is merely a broad equivalent of "*choice*" or "*to choose*". On that ground, both "*tōta*" and "*sentaku*" can be criticized (Shibatani 1999). One could argue that "*to choose*" is a subjective decision whereas "*to select*" is the mechanical outcome of a process. From this vantage point, one could also argue that the Japanese "*sentaku*" signifies "*choice*" rather than "*selection*"—like for instance in the translation of the phrase "*freedom of choice*" by "*sentaku no jiyū*" (選択の自由). This may be a good reason to value "*haigūsha sentaku*" as a good translation for "*mate choice*" (Shibatani 1999).

It should also be noted that another translation of "*mate choice*" was attempted by the evolutionary ecologist Hasegawa Mariko in 1992 (Hasegawa 2005). She suggested that the word "*erigonomi*" (選り好み) should be adopted, in which "*eri*" (選り) means "*to choose or to select*" and "*gonomi*" or "*konomi*" (好み) means "*to like or to be fond of*". Hasegawa's suggestion aimed at giving a new translation for "*choice*", "*choosiness*" or "*pickiness*"[20]. It is a relatively exceptional attempt to adopt a *yamatokotoba* as a scientific term. However, her attempt failed. In a revised edition of her book, she admitted: "*I have found that this translated term has been adopted by many scientists of animal behaviour in their everyday conversations to a degree. But in technical papers and monographs, male scientists seem to stick to their old habit of using unfamiliar Chinese words, and perhaps as a result of this,* erigonomi *failed to get popularity*" (Hasegawa 2005).

Hasegawa's phrase "*male scientists*" suggests that her failure to promote a *yamatokotoba* may be related to a gender bias. In fact, the various Japanese writings follow a global gender division: technical terms tend to be attributed to men and vernacular ones to women. All Japanese speakers have a vague feeling that *kanji* and *kango* (perhaps also *katakana*) belong to men while *hiragana* and *yamatokotoba* belong to women, a feeling which may be traced to the late ancient age of Japan, where men used to write prose (though not poetry) in Chinese with *kanji* while women used to write in Japanese with *hiragana*. Although this convention was broken by Ki no Tsurayuki (about 868–945/946) in his semi-fictional diary *Tosa Nikki* (『土佐日記』) (935), such gender difference remains somehow alive even today and may account for Hasegawa's failure.

Nevertheless Hasegawa's terminology, relying on the difference between *kango* and *yamatokotoba*, seems to capture nicely the difference between "*selection*" (which she translates with the *kango* "*tōta*"[21]) and "*choice*", which sounds more informal and less technical and whose translation is a *yamatokotoba*. However, the word *erigonomi* was not broadly used as a scientific term, and other *kango* alternatives, such as "*haigūsha sentaku*" or "*haigūsha senkōsei*", were preferred.

Similarly, we can argue that most French translators avoided the lively option of translating "*natural selection*" as "*choix de la nature*" ("*nature's choice*") mainly because of its lack of technical dimension (Hoquet 2009, 2011). On that matter, the French and Japanese situations are, *mutatis mutandis*, quite analogous.

5. Concluding remarks

The Japanese have mostly used two terms, "*shizen tōta*" and "*shizen sentaku*", both being neither an accurate equivalent for the English "*natural selection*" nor a mere transliteration of it. Their meaning can only be understood by considering Japanese linguistic, historical, sociological or political peculiarities. But beyond the importance of local contingencies, we can detect some global patterns unifying European and Japanese translations: for example, the intimate connection between evolutionary biology and breeding science, the tension between technical terms and vernacular ones (with its related problem of gender bias), or the problem of the personification of nature (or naturalization of humans).

Whereas "*tōta*" was more popular before WWII, *kanji* restriction policy led after WWII to its replacement by "*sentaku*". However, this change does not reflect any "progress" in conceptual clarity or accuracy. Rather, it is linked to historical contingencies (like linguistic policies). Although often associated with culling, "*tōta*" remains a popular candidate for translating "*selection*", especially when "*sentaku*" is a very broad term more or less equivalent to "*choice*".

Another upshot of our paper is that the fate of a concept like "*natural selection*" should never be studied on its own, severed from other neighbouring notions, but as a piece in a structure. Translations for "*artificial*"

20. Shibatani also evaluated her choice as preferable to the alternative *kango* term "*senkō*" (選好), "*choice*" or "*preference*", which is largely synonymous with "*senkōsei*" (選好性).
21. Hasegawa belongs to the post-war behavioural ecologists who formerly used "*shizen sentaku*", then switched to "*shizen tōta*".

or "*sexual selection*", but also for the verb "*to select*", or the concept of "*mate choice*", also influence the way "*natural selection*" is translated.

Besides, our paper has clearly evinced a specific feature of the Japanese concept. While in France and Germany, published translations (by Royer in French and Bronn in German) had an important impact on the terms used by speakers in both countries, it seems that, in the case of the Japanese language, a lot of different writers suggested different translations and often suggested their own translations of "*natural selection*": some of them were more technical than others, but all combined two roots, one dealing with nature (or natural), and the other dealing with an equivalent of choosing or picking.

A first approach suggests that those various possible translations were all conceptually equivalent and that preferring one over the others was only a matter of taste or of various official lexical policies. But as we have seen throughout this paper, the problem of the definition looms large over the issue of its translation. Besides, it may well be that the general history of biological ideas underpins much of our story on the translation of the concept of "*natural selection*". We have suggested that the adoption of "*shizen sentaku*" or of "*shizen tōta*" may be in fact partially related to the relationship between evolutionary theory and breeding practices. In this light, changes in Japanese biological terminology might reveal global patterns in the history of evolutionary biology.

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