What's in a PreCure name?*

Kawahara Shigeto
Keio University

PreCure [purikjua] is a popular anime series broadcasted in Japan, in which to simplify drastically, girls transform into "PreCure," and fight against villainous monsters.[1] PreCure stands for "pretty cure (girls)"—pretty girls who heal ("cure") people's feelings. The PreCure series is usually—though not always—watched by girls. Its first series (*Futari-wa PreCure*) started in 2004, and as of 2019, there have been 16 TV series, and there are now in total 61 PreCure characters (2 of them have only appeared in a movie series).

Any linguist who has watched *Fresh PreCure!* (2009-2010) should notice that all the PreCure characters' names begin with either [p] or [b], or a labial stop: i.e. Cure Peach, Cure Pine, Cure Berry, and Cure Passion.[2] Once we examine all the PreCure series with this observation in mind, we also notice that only one of the 16 TV series, *DokiDoki! PreCure*, has no PreCure whose name begins with a labial consonant. Table 1 provides the list of all PreCure names, organized according to whether or not their names start with a labial consonant—the set of labial consonants in Japanese includes [p], [b], [m], [ɸ], and [w]. Most names are transliteration of English (and sometimes French) nouns. For the sake of readability, Table 1 uses English/French transcription based on the English wikipedia articles[3]—the Japanese PreCure names are transcribed in IPA in Table 2. It is clear from Tables 1 and 2 that labial consonants are overrepresented in the initial syllables of the PreCure names.

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[1] `http://www.toei-anim.co.jp/tv/precure/` (last access, May 2019).

[2] I admit that it was not until when a 4-year-old daughter of mine asked me to be Cure Berry and my wife to be Cure Pine, when she herself was acting as Cure Peach, that this generalization came to my mind.

[3] `https://en.wikipedia.org/wiki/Pretty_Cure` (last access, May 2019).

Table 1: The list of the PreCure names as of May 2019. C_1 = name-initial consonants. English "f" is produced as [ɸ] in Japanese. "(Cure) Whip" in *Kirakira PreCure a la Mode*— is pronounced as [hoippu], and does not begin with [w].

Series	C_1=labial	C_1=non-labial or none
Futari-wa PreCure Max Heart	(Cure) Black	(Cure) White
		Shiny Luminous
Futari-wa PreCure Splash Star	(Cure) Bloom	(Cure) Egret
Yes! PreCure 5 GoGo!	(Cure) Mint	(Cure) Dream
	Milky Rose	(Cure) Rouge
		(Cure) Lemonade
		(Cure) Aqua
Fresh PreCure!	(Cure) Peach	
	(Cure) Pine	
	(Cure) Berry	
	(Cure) Passion	
HeartCatch PreCure!	(Cure) Blossom	(Cure) Sunshine
	(Cure) Marine	
	(Cure) Moonlight	
Suite PreCure	(Cure) Melody	(Cure) Rhythm
	(Cure) Beat	
	(Cure) Muse	
Smile PreCure!	(Cure) Peace	(Cure) Happy
	(Cure) Beauty	(Cure) Sunny
	(Cure) March	
Doki Doki! PreCure		(Cure) Heart
		(Cure) Diamond
		(Cure) Rosetta
		(Cure) Sword
		(Cure) Ace
HappinessCharge PreCure!	(Cure) Princess	(Cure) Lovely
	(Cure) Fortune	(Cure) Honey
Go! Princess PreCure	(Cure) Flora	(Cure) Twinkle
	(Cure) Mermaid	(Cure) Scarlet
Witchy PreCure!	(Cure) Magical	
	(Cure) Miracle	
	(Cure) Felice	
Kirakira PreCure a la Mode	(Cure) Macaron	(Cure) Whip
	(Cure) Parfait	(Cure) Custard
		(Cure) Chocolat
		(Cure) Gelato
Hugtto! PreCure	(Cure) Macherie	(Cure) Yell
		(Cure) Amour
		(Cure) Ange
		(Cure) Etoile
Star⋆Twinkle PreCure	(Cure) Milky	(Cure) Star
		(Cure) Soleil
		(Cure) Selene
Movie series	(Cure) Mofurun	(Cure) Echo

Table 2: The Japanese PreCure names in IPA.

Series	C_1=labial	C_1=non-labial or none
Futari-wa PreCure Max Heart	[burakku]	[howaito]
		[ɕaini: ɾuminasu]
Futari-wa PreCure Splash Star	[buɾu:mu]	[i:guretto]
Yes! PreCure 5 GoGo!	[minto]	[doɾi:mu]
	[miɾuki: ɾo:zu]	[ɾu:ʑu]
		[remone:do]
		[akua]
Fresh PreCure!	[pi:tɕi]	
	[paiɴ]	
	[beɾi:]	
	[paɕɕoɴ]	
HeartCatch PreCure!	[buɾossamu]	[saɲɕaiɴ]
	[maɾiɴ]	
	[mu:ɴɾaito]	
Suite PreCure	[meɾodi]	[ɾizumu]
	[bi:to]	
	[mju:zu]	
Smile PreCure!	[pi:su]	[happi:]
	[bju:ti:]	[sani:]
	[ma:tɕi]	
Doki Doki! PreCure		[ha:to]
		[daiamondo]
		[ɾozetta]
		[so:do]
		[e:su]
HappinessCharge PreCure!	[puɾinsesu]	[raburi:]
	[ɸo:tɕuɴ]	[hani:]
Go! Princess PreCure	[ɸuɾo:ɾa]	[tuwiŋkuɾu]
	[ma:meido]	[sukaːɾetto]
Witchy PreCure!	[maʑikaɾu]	
	[miɾakuɾu]	
	[ɸeɾi:tɕe]	
Kirakira PreCure a la Mode	[makaɾoɴ]	[hoippu]
	[paɾuɸe]	[kasuta:do]
		[ɕokoɾa]
		[ʑeɾa:to]
Hugtto! PreCure	[maɕeri]	[e:ɾu]
		[amu:ɾu]
		[aɲʑu]
		[etowa:ɾu]
Star⋆Twinkle PreCure	[miɾuki:]	[suta:]
		[soɾeiju]
		[seɾe:ne]
Movie series	[moɸuɾuɴ]	[eko:]

The list in Tables 1 and 2 shows that 29 out of 61 PreCure names (47.5%) start with a labial consonant, and this occurrence of labial consonants seems unusually high. While it would be informative to get a measure of variability of this percentage, we have but one sample of the PreCure set. Therefore, to get the estimates of the variability of this percentage, a bootstrap analysis using resampling with replacement (Efron & Tibshirani, 1993) was run with R (R Development Core Team, 1993–). In this analysis, we artificially create 50,000

"alternative worlds" with slightly different sets of PreCure girls by way of reampling—in each alternative world, there are always 61 PreCure girls, just as in our own world, but there can be, for example, two Cure Pines but no Cure Peach. Among these 50,000 artificially-created alternative worlds, 95% of the time (i.e. in 47,500 worlds), the percentages of the PreCure names beginning with an initial labial consonant fit within the range from 34.4% to 60.7%—this is the bootstrap 95% Confidence Interval (CI).

Is the high probability of having an initial labial consonant due to chance, or merely coming from a distributional skew that is present in Japanese girls' names in the first place? To address this question, I first compared the PreCure names against the top 50 popular names for "regular girls" in Japan in 2016, compiled by Meiji Yasuda Seimei, which was analyzed in my previous work (Kawahara, 2017; Kawahara & Monou, 2017).[4] This dataset shows that only 7 out of 50 names start with a labial consonant (e.g. Mei and Fuuka: 14%, bootstrap CI=6%-24%), and the difference between the PreCure names and "regular" names is statistically significant by a Chi-square test ($\chi^2(1) = 12.62, p < .001$). One can object to this comparison, because most girl names in Japanese are not based on English and they rarely or never begin with [b] or [p] anyway (cf. Ito & Mester 1999). In response to this possible objection, I also compared the PreCure names against the set of Ultraman names, a TV series popular among boys.[5] The result shows that 5 out of 39 Ultraman names begin with a labial consonant (e.g. Powered and Mebius: 12.8%, bootstrap CI=2.6%-23%), and the difference between the PreCure names and Ultraman names is statistically significant ($\chi^2(1) = 11.28, p < .001$). Let us note that the lower bound of the 95% confidence interval for the PreCure names (34.4%) is higher than the upper confidence interval bounds of the other two conditions (24% and 23%).

As I presented these analyses at an undergraduate phonetics class at Keio University, Yuri Okuda (p.c.) pointed out that the best comparison may be between the PreCure names and their "human" names before they transform into PreCure, the latter of which are thus shown in Table 3. Most of these names are "regular" Japanese names, although some of them (e.g. Eren and Rara) are based on English names (i.e. Ellen and Lara). Only 10 out of 61 names in Table 3 start with a labial consonant (and all of them turn out to be [m]: average=16.4%, bootstrap CI=8.2%-26.2%). The difference between before and after transformation is statistically significant ($\chi^2(1) = 12.21, p < .001$). Based on these comparisons, I conclude that PreCure names are more likely to begin with a labial consonant than regular girls or Ultraman names.[6]

[4] `https://www.meijiyasuda.co.jp/enjoy/ranking/index.html` (last access, May 2019).

[5] `https://iso-labo.com/labo/ultra-man_list.html` (last access, May 2019).

[6] A side note on [w] is in order. Despite the fact that labial consonants are overrepresented in the PreCure names, no PreCure names start with [w]. Phonologically speaking, there is a debate in the literature regarding whether [w] is labial (Kubozono, 2015), velar (Tsujimura, 2014) or labio-velar (Labrune, 2012). Kumagai (2017) found via a nonce word experiment that [w] does not trigger OCP([labial]) in that it does not block rendaku resulting in [b] (from /h/); on this basis, he argues that [w] is not specified for [labial] in the phonology of Japanese. Kawahara & Kumagai (2019) found that [w] does not pattern with other labial consonants in sound symbolic patterns in Japanese in that it is not actively associated with the fairy type Pokémon characters. One can thus argue based on the PreCure name patterns that [w] does not behave like other labial consonants either. Evidence is mixed, however, because when it comes to sound symbolism in diaper names, [w] seems to pattern with other labial consonants (Kawahara, 2017; Kumagai & Kawahara, 2017).

Table 3: The PreCure's names before they transform into PreCure. Mofurun is technically a stuffed animal.

Series	C_1=labial	C_1=non-labial or none
Futari-wa PreCure Max Heart		Nagisa
		Honoka
		Hikari
Futari-wa PreCure Splash Star	Mai	Saki
Yes! PreCure 5 GoGo!		Nozomi
		Rin
		Urara
		Karen
		Komachi
		Kurumi
Fresh PreCure!	Miki	Rabu
		Inori
		Setsuna
HeartCatch PreCure!		Tsubomi
		Erika
		Itsuki
		Yuri
Suite PreCure		Hibiki
		Kanade
		Eren
		Ako
Smile PreCure!	Miyuki	Yayoi
		Akane
		Reika
		Nao
Doki Doki! PreCure	Mana	Arisu
	Makoto	Rikka
		Aguri
HappinessCharge PreCure!	Megumi	Hime
		Yuko
		Iona
Go! Princess PreCure	Minami	Haruka
		Kirara
		Tou
Witchy PreCure!	Mirai	Riko
		Kotoha
Kirakira PreCure a la Mode		Ichika
		Himari
		Aoi
		Yukari
		Akira
		Shieru
Hugtto! PreCure		Hana
		Ruuruu
		Emiru
		Saaya
		Homare
Star⋆Twinkle PreCure	Madoka	Hikaru
		Rara
		Erena
Movie series	Mofurun	Ayumi

An interesting question is why the PreCure names start with a labial consonant so often. I believe that there are two possibilities. One is that this is an instance of featural alliteration. Since the name of the TV series—PreCure—begins with [p], it alliterates well, at the featural level, if their names also begin with a labial consonant. However, since most of the PreCure names are prefixed with "Cure [kjua]," if anything, it seems to make more sense if the names alliterate with [k(j)].

The other possibility, which I find more interesting, is that this pattern is due to sound symbolic values of labial consonants. Recent studies show that Japanese speakers often use labial consonants for baby diaper names, and that Japanese speakers may associate labial consonants with images of cuteness and/or innocence (Kawahara, 2017; Kumagai & Kawahara, 2017). Both corpus-based and experimental evidence demonstrates that the labial consonants are often associated with the fairy type of Pokémon characters (Hosokawa et al., 2018; Kawahara & Kumagai, 2019). Kumagai (2019) shows moreover that [p] in particular is associated with images of cuteness in Japanese. There is thus converging evidence that labial consonants are generally associated with images of cuteness in Japanese,[7] and the current finding can be construed as an instance of this sound symbolic association.

Whatever the exact underlying mechanism is, we can conclude from this result that the choice of real words in naming is not random, but instead dictated or at least influenced by, say, a sound-symbolic principle. Take the case of *Fresh PreCure!*. The characters' names in this series are based on fruit names. Therefore, Cure Strawberry or Cure Orange (hypothetical) could have been as plausible as Cure Pine or Cure Peach (existing). When designers of PreCure choose PreCure names, some bias must have been (stochastically) coercing them to use those real words that begin with a labial consonant. If the underlying mechanism at issue is sound symbolism, which I believe is highly likely, it lends support to the idea that sound symbolism can affect the choice of real words (in addition to emerging in the experimental context of, say, judgments of meanings in nonce words) (Kawahara et al. 2018; see also Johansson & Caling 2015 for a possible influence of sound symbolism on diachronic changes).

This conclusion in and of itself is an important contribution to what we know about how we use languages, as linguists are generally not sympathetic to the activity of sound symbolism, especially when it comes to real words.[8] Beyond this, however, I hope that this paper contributes to making linguistics more fun to undergraduate students and general public. When I started studying linguistics, it was not immediately clear to me why we needed to introduce a concept like lability, or more generally, the place of articulation. I kept asking myself why it is important to characterize sounds in terms of place of articulation. I hope that the sort of finding that the current study offers helps make it clear why linguists use the analytical concepts that we use (Kawahara, 2017, 2019; Kawahara & Monou, 2018). As a bonus, with the current PreCure dataset, we are able to teach how a bootstrap resampling method works, and why that is necessary and useful.

Before closing this paper, in addition to the overrepresentation of labial consonants, there seems to be another distributional skew in the PreCure names—the frequent use of [ɾ].[9] 35 out of 61 (57.4%) PreCure names contain [ɾ], and this is slightly more frequent than the occurrence of [ɾ] in regular girl names (18/50, 36%, $\chi^2(1) = 4.21, p < .05$), and clearly more frequent than the occurrence of [ɾ] in the Ultraman names (10/43, 23.3%, $\chi^2(1) = 10.61, p < .01$). The second comparison is telling because both PreCure names and Ultraman names are primarily based on transliteration of non-Japanese words. This comparison thus raises the possibility that the designers of PreCure are favoring those words that contain [ɾ]. From the viewpoint of sound symbolism, this pattern reminds us of the (very) classic observation made by Socrates in *Cratylus* that [r] in Greek is very often used for words that represent movement (427), although we should bear in mind that Japanese [ɾ] is a tap whereas [r] in Greek was (likely to be) a trill. Perhaps more relevant is a report by Isonaka et al. (2015), who found that Japanese [ɾ] is judged to be the most "transparent" among all the

[7] A cross-linguistic study by Wichmann et al. (2010) targeting basic vocabulary items shows that languages tend to use labial consonants for a word meaning "breast," stating that it reflects "the engagement of the suckling child (p.12)." I hope to think that it is not this sound symbolic value of labial consonants that is deployed in the context of the PreCure names.

[8] I say "how we use languages"; i.e. this effect of sound symbolism may be a matter of performance, not competence. This is probably true, as those PreCure names that do not begin with a labial consonant are also perfectly acceptable. Be that as it may, my personal view is that it is fruitful to use a formal grammatical framework to model sound symbolic patterns in natural languages (Kawahara et al. 2019; see also Alderete & Kochetov 2017).

[9] Actual phonetic realizations of this sound differ rather dramatically across speakers and contexts (Arai, 2013; Kawahara & Matsui, 2017).

Japanese consonants. PreCure characters are little girls' idols, and would not transparency be a good feature to have?

I finally would like to add a brief remark on the distribution of voiced obstruents in the PreCure names. As many studies have shown (e.g. Hamano 1986; Kawahara et al. 2008; Kubozono 1999; Suzuki 1962; Uemura 1965), voiced obstruents are generally associated with negative images in Japanese, and rarely appear in female names in Japanese (Kawahara, 2017). The inspection of the list in Tables 1 and 2 shows, however, that 22 out of 59 PreCure names contain voiced obstruents. This can be contrasted with the popular girl names—only 2 out of 50 names contain voiced obstruents (Yuzuki and Tsumugi). If sound symbolic principles affect the choice of real words in naming PreCure characters, why were voiced obstruents not avoided? This question may become more troublesome when we consider the fact that the study by Isonaka et al. (2015) mentioned above found that voiced obstruents are very "non-transparent." The best answer that I can offer is that voiced obstruents symbolically represent strength, and anybody who has watched PreCure knows that they are fighters. Thus, voiced obstruents may be used to symbolically represent their strength, whereas [ɾ] is used to represent transparency. Personality is, needless to say, multi-dimensional. It is thus unsurprising that we find different sound symbolic patterns in action in the same set of the PreCure names.

In summary, I have identified three types of distributional skews in the PreCure names: word-initial labial consonants, [ɾ], and voiced obstruents. I have offered an explanation of these distributional skews in terms of sound symbolic principles. An obvious remaining task for future research is to test the productivity of these sound symbolic patterns via experimentation. Since it would be most informative to target 4-6 year old children—the primary target audience for the PreCure anime series—for this sort of experimentation, it would take some time and effort to run it. For now, I close this paper by reporting that when asked, a 4-year daughter of mine preferred *poron* to *koron* for a new PreCure name.

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