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SYMBOL EQUIVALENCE IN PHONETICS

"A thing is identical with itself.' There is no finer example of a useless proposition, which yet is connected with a certain play of the imagination. It is as if in imagination we put a thing into its own shape and saw that it fitted."
(Wittgenstein 1958:84)

I. TYPES OF EQUIVALENCE

A basic principle of the International Phonetic Alphabet is to use one symbol for one sound: When two sounds occurring in a given language are employed for distinguishing one word from another, they should whenever possible be represented by two distinct letters without diacritical marks. (IPA 1984:1) Roach (1989:70) states even more forcefully, Only one way of representing a given sound should be allowed on the [IPA] chart. However, each symbol is by the use of diacritical marks, equivalent to other symbols, for example, è • u̇ v̇ • f. The following is an analysis of the meaning of equivalence in phonetic symbolism, and a demonstration of how equivalence may be used to show relationships between sounds and produce narrow transcription. (Phonetics is in larger type or []) It is observed that each sound may be defined by various combinations of these symbols to produce equivalencies and similarities. Equivalencies are shown to be 1) stipulated, 2) tautologies or identities, 3) circularities, 4) question begging, 5) synthetic or descriptive. The descriptive and definitional equivalencies show how the relationships and the combinations of symbols may be used to produce greater phonetic accuracy and narrow transcription. In this way, IPA symbolism is extended in its use and its full heuristic power is manifested. Extensive equivalencies are given for each IPA (1989) vowel and consonant.

First, the notion of *equivalence* must be clarified. Equivalence may be analyzed into a number of types:

1. Stipulation

This is arbitrary, such as, *Let unstressed O* • «. As stipulative, it is devoid of descriptive content. One symbol merely stands for another. Nothing new is known about the sound, O. It is like giving a cat a new name. In phonemics, as opposed to phonetics, an abstract or ideal symbol is stipulated to represent all allophones and instances of a sound in a broad transcription (cf. Standwell 1991:138-139).

2. Tautology or Identity

Tautologies are less than synonyms. They are empty stipulations. Thus, symbolic logicians say that they say nothing about anything. No two sounds can be identical and still be two sounds. Wittgenstein (1958:84) pointed out that it is singularly uninformative to say of something that it is identical with itself. Twins are not identical, but similar. There is no absolute equality. Therefore, identity becomes similarity (\approx), ($= > \approx$) if it is to be intelligible.

3. Circularity

By *analytic* in the philosophy of science, is meant that the predicate is contained in the subject. No empirical evidence is needed for its assertion because it is true by definition. The denial of the predicate results in a contradiction, e.g., *Phonetics is the study of speech sounds, Speech is sounds, Pharyngeal constriction = retracted tongue root*. Or, where C refers to a consonant, $C^x = C^{\hat{}}$ $C = C$, $C^w = C^{\bar{}}$

4. Begging the Question

A form of circularity or equivalence is to assume what is to be proved. Phonemics would beg the question by using universal, broad transcription to obtain narrow transcription. To always use « for a reduced vowel, or generic /r/, begs the question as to their actual phonetic values.

5. Synthetic Statement

According to the philosophy of science, these are empirical statements requiring experience and evidence for their assertion. In order to know what the Chinese , is like, we must listen, observe the articulation, and gather experimental evidence. The denial of the predicate, does not result in a contradiction. *í is a voiced, palatal plosive*, is a synthetic statement.

6. Descriptive Equivalence

Descriptive statements are synthetic statements. What is described in phonetics are symbols or statements which are operationally defined to give as much precise descriptive information about a sound as possible.

Category-mistakes result when one type of equivalence is confused with another. $\dot{\imath}$ may be stipulated or analytically defined as being equivalent to $\dot{\imath}$. But $\dot{\imath}$ may be perceived to have a different sound quality than $\dot{\imath}$ such that they are not equivalent. We may distinguish $\dot{\imath}$ from $\dot{\imath}$ in narrow transcription. Similarly, $\dot{\imath}$ may be distinguished from $\dot{\imath}$. Thus, although these two symbols may be *defined* as being equivalent, they may be *described* as being different.

In actual transcription there is less subtle confusion because $\dot{\imath}$ is often used interchangeably with $\dot{\imath}$, meaning that the reader would not know which pronunciation is the correct one. An examination of five dictionaries produced the following variations for *city* :

siti, sltɪ, sl.ti, sɪti, sltɪ\i. Jones (1973) gives for British *play*, pɫeɪ, instead of pɫei, [it] for *it*, but he proceeds to use i̇ also for i̇ (Jones 1967: xlv). Kenyon & Knott (1949: 331) render *pity* as pɪtɪ, instead of pɪti. Ladefoged (1975: 53) gives seɪf for *safe*, not self, but he says *bid* can be translated as bɪd, instead of bɪd. Catford (1988: 40), for the German *ich*, gives i̇ instead of i̇. Einarsson (1945) uses l for i̇, and i̇ for l in the transcription of Icelandic. Huang (1969: 2) is incorrect in holding that l̥ does not exist in Chinese. It appears, for instance, in *Ch'in t̥, l̥*. l̥ is not equivalent to i̇, and a fortiori, neither is l̥ equivalent to i̇. We may, however, use l̥ for a raised l̥, and i̇ for a lowered i̇, where there is no equivalence.

Phonetic descriptive equivalence requires a standard symbolism based upon intersubjective phonetic research. For this purpose the IPA (1989) chart is used, which is widely available. In addition, an extended IPA vowel chart is given, as it is intended to provide more information and precision than is available with the IPA (1989) chart (Shibles 1993 a, b, c).¹

II. SYMBOL EQUIVALENCE

Each vowel may in some sense be described, and so defined, in terms of every other vowel. It is in these senses that the symbols may be seen to be equivalent. These equivalencies reveal: a) the connections of sounds (or articulations) to symbols, b) the relationships between symbols, c) the relationships between the sounds (or articulations). Each symbol reduces to concrete acoustic, articulatory, or other features which are thus related to each other. By *equivalence* is not meant equality or identity (=), but that close similarity (≈) prevails based on certain features of the sounds. Each equivalence may then be explicated for the insight it may give toward more accurate acoustic description, better understanding of the articulations involved, display of the relationships to other symbols, clarity for the language learner, etc.

Ladefoged (1975: 65) states, There is no such thing as a single correct form of transcription of English; different styles are appropriate for different purposes. Because in the philosophy of science there are no literal or essentialistic definitions, to define is to take a model or metaphor. Thus, equivalencies provide such alternative possibilities. A knowledge of the possible equivalents for a particular sound gives the phoneticist or language learner choice as to which equivalence best represents the sound in question, as the following example illustrates.

The plosives, p, t, k, are labeled unvoiced aspirates, and b, d, g are their voiced, unaspirated counterparts. They may be stipulatively defined this way such that *p is an unvoiced aspirate*, is a tautological equivalent. Alternatively, they may be described this

¹ For "Symbols and Abbreviations" and "Vowel Charts" see p. 53-55 in this volume.

way on the basis of empirical evidence. The definition is not the same as a description. On the definition that p = aspirated and voiceless, and that b = unaspirated and voiced, unaspirated p equals b^h [$p^h \cdot b$]; aspirated b • voiced p , [$b^h \cdot p$], etc. McKenna (1988:39) states in regard to German, *It would seem that the [t] of treu is completely unaspirated, and the [d] of den completely devoiced—the end result of both operations being, auditorily, the same.* In practice, however, it may be observed that a sound can be closer to p^h than to b^h because the p quality is retained. In this case, p^h is not descriptively equivalent to b^h [$p^h \quad b^h$]. If other characteristics are added to the plosives such as lip pressure, lip protrusion, force, duration, etc., these plosives may lack equivalence as well. We may accordingly consider the description of plosives in various languages.

In Mandarin Chinese, *Ta* (Wade romanization) = $d^h a$, $T'a = t^h a$, but $d^h \quad t^h$. d^h may have the quality of d more than of t . In Bavarian, we may not be able to distinguish between s or z^h or p^h , e.g., between *Packen* and *backen*. In Irish, *ispín* $IS.b^h p^h in$, b^h and p^h may be indistinguishable. In Swiss, *dann* may be $d^h \epsilon n$ or $t^h \epsilon n$. It may be hard to tell the difference between d^h and t^h . [q] can mean not just voiceless, but partially voiced. In Icelandic, which has a special kind of syllabic aspiration, Einarsson (1945) gives $E\hat{i}p\ddot{o}ll$ for what may rather be rendered as $E.h.b^h li$. In *saddur*, $d^h \approx t^h$, in *lamb* $b^h \approx p^h$.

Ladefoged (1975: 26, 64) wrote, *There are...disagreements among texts on phonetics on how to transcribe sounds.* The exploration of equivalents reveals the different kinds of nuance a certain basic or Cardinal symbol may reflect. The distinctions are more fine than sounds which are closely related, such as that in the Swiss (Jestetten) variations of *ich*, which are IS , IZ and IX . Each feature description and diacritic may be used to find functional equivalencies, just as differences of pronunciation may be exposed when the orthography of one language is used to render another. For example, rendering English by the Russian Cyrillic alphabet, or Chinese characters. Hausa *so* may be heard as: SO^* , SO' , or SO . Swedish *te* "tea" may be rendered as $te\check{c}^*$ or $te \ \$$ Chinese $an\check{c} \approx an^* \approx a\ddot{o}$. Arabic "one" $waf^h d^h l$ may be rendered by $d^h l$ rather than by d^h or d^h . Dutch X is not equivalent to Arabic X . The former is often more guttural. In regard to h-sounds, Benware (1986: 27) wrote, *There are as many 'h-sounds' as there are vowels.* Bithell (1952: 113) had earlier noted, *There is a question...whether h is a fricative, consonant or a vowel.*

The expansion of the IPA symbolism provides one method by means of which some controversies in phonetics may be resolved. Given a range of equivalencies, a transcriber may choose the most fitting alternative and then compare with the choices of others. This may also serve the purpose of establishing a range of possible pronunciations. The analysis of the symbols may then show the specific differences between them.

The following equivalent or similar forms are given for use in either normal or narrow transcription. These equivalents are based largely on actual (IPA-S) transcription of various languages (*Realphonetik*). For example, the phonetic transcription is given as $[i]$, which

should be [j, i̯, i̯], etc. Where languages are transcribed with a simple Cardinal, it is rather found to be the case that one or another of the simultaneities was in fact the more correct transcription. Each alternate may be examined for its descriptive import, and the most appropriate one may be selected. The list is based on definitional equivalence as well as actual transcription. In a few cases the actual languages have been specified as illustrations. Some similarities occur only in fast speech. It is intended that researchers add their own examples as well so as to build a standard reference corpus. This may then serve as a checklist to see which alternatives would be best in a certain case. For vowels, the cardinal number is given first. (=) means: a) is defined as, b) is very similar, or c) is somewhat similar. ≠ means *is not equal, or not similar to*.

The following examples show:

1. Expanded Cardinal number equivalent.
2. Definitional equivalents.
3. Simultaneous-sound equivalents.
4. Equivalents based on diacritical modification.
5. Similarities based on diacritical modification.
6. Similar forms characteristic of particular languages.
7. Equivalents and similarities based upon actual transcription experience.
8. Examples of the use of the symbol for various languages.

For additional definitions of the symbols see also Pullum & Ladusaw (1986), and Catford (1988). For an inventory list of the sounds occurring in the major languages of the world, see Maddieson (1984). (V = vowel, C = consonant, # = Cardinal number, M = Maddieson 1984.)

III. EQUIVALENTS OR SIMILARITIES

A. Vowels

#	Vowel =	≈ Alternative Similarities for Narrow Transcription
1	i • y ₁	j, i̯ ≈ j̯, i̯ ≈ i̯, ≈ ie ≈ ie, i̯ • i̯, i ³ , i̯ i̯) i̯(Ik, Jap.)
1.5	l Y ₁	l i̯, l • i̯ { * • l, l̂ • i̯, l ³ (M:249), [3], (CCD) gives range l to «.
2	e P ₁	e̯ • e̯(Swedish); E̯, e ³ , e̯(Ik)
2.5	e ^α P ^α ₁	For languages having e ^α see (M:249-250).
3	E {	E̯ ≈ i̯ (Swedish <i>päron</i> and AP <i>pear</i>), i̯ *, E̯ • E/
3.5	i̯ { α ₁	i̯ ≈ E (definitional), ≈ E, i̯ i̯ (Swiss), i̯ ae

C. Consonants (Equivalents and Similarities for Alternate Transcriptions)

- b • p^h, b} ≈ p}, b⁷ ≈ p^{-h}, b⁹ ≈ p^{-h} (Swiss), b* ≈ b⁹ bp • b⁹ (Gaelic, Holmer 1962:16), (fast speech) b ≈ p, b⁹ • b«, b⁹ • b}, b* • p*, bî • b» b⁹ • (whispered b) b» bî (Welsh, Zulu)
- Implosive b, (Bantu, Sindhi, Vietnamese, Xhosa), • ¹ } /b (Fula), ◦ (vel.) (Igbo)
- Õ Voiced, trilled bilabial
- b' Ejective b, (Not on IPA chart.)
- d d⁷ t^{-h}, d^h ≈ t (Swiss), d⁹ • |, dⁱ • d', d ≈ t^{3h}, d^l ≈ t³ ≈ d^l d ≈ t^l (Arabic), d^l ≈ t^l d' (Köln, Swiss), d^l • d⁵ d > d^l (AP *width*), d⁹ (Chinese), d* (Farsi). On an analogy b é õ éé d é d^æ We can create an approximant d^æ (Ger. dial. Riesenbeck).
- ë Implosive d, t³ Gullah, Hausa, Hindi)
- ÿ æ³ d° (Buckinghamshire, Gaelic, Hindi, Oxford, Sanskrit, Swedish)
- dž dZ
- dš dS
- f v^ʃ, f (Russian)
- f' Ejective f. Not on IPA chart. (M:235: Kambardian), f⁷ (Bantu)
- F • B⁹ b⁶ P (hissed, Japanese), (AP *campfire*), V^æ ≈ W (Anglo-Irish)
- F' Ejective F. Not on IPA chart. (M:235: Yuchi)
- B ≈ Ä, • F³ b^æ (Bavarian, Frankfurt), (AP *obvious*), W^ʃ (Grandgent 1892:10), b}
- g g ≈ k^{-h} (Swiss), ≈ k^{3h}, Ng • Ng^h (Chinese), g^ʃ • [g] • [x] • i°; Ǿ (Swedish), g} (in double consonants g}.g), Ǿ⁵ (Russian)
- g' Ejective g. Not on IPA chart. (M:217: <Xu)
- Ä Implosive g, ũ³
- G q³
- ì Implosive d, Q³
- h ph ≈ pî, hî (strong asp.), h • î, (aspiration, and consonant lengthener), d.h ≈ dh (Hindi), h • H⁹ (If unvoiced, as in Japanese, vowels become h, creating a different h for each vowel.), h* (Japanese), ḣ (Turkish), h^l (Burmese)
- © • ?⁹ e[©] ≈ e^jE* (Farsi), © • (more fricative) h (Arabic), ≈ X (non-guttural)

- ñ |ʒ, ≈ tʃ, ≈ hʃ, (Irish, Suto, Xhosa, Welsh, Zulu), ñʝ(Icelandic), ñɰ (M:234: Greenland), ≈ ʃ (Welsh)
- L • ñʃ hʃ, (Irish, Xhosa, Zulu)
- m • n (bilabial), range m to n (CCD:1987), mʝ(Bengali), m̃ (Cantonese, Swahili), m̥} (Turkish), m̥ʃ(Bantu)
- μ • m̥ʃ(Duckworth, et al. 1990:276), μʃ(Bantu), (AP *nymf*)
- n n̥} ≈ nʝ(Burmese), n ≈ n̥} n̥ʃ • n+ (Payne 1990), (cf. []), n̥} (Japan.), n̥ʃ(Bantu), n̥ʃ (Icelandic), n̥ (pharyngeal, Dutch), n̥ (Swahili, Tswana)
- Ə Ə, > i̯) (Japanese), (Bantu), • N ʃ nasal release (e.g., p̥N)
- = • n̥, n̥ʃ (/r/ varies), (Marathi, E. Norway, Punjabi, Scot.)
- n̥ʃ (Xhosa), ≈ n̥ʃ, ≈ n̥ʃ (Russian), -(Burmese), (Fr., Ital., Polish, Span.)
- N N̥(Icelandic), N̥ʃ (Japan.), N̥ (Bavarian, Cantonese, S. Sotho, Thai), n̥ʃ, ɡ) N̥ (pal. and velar, Irish), range N to n̥, NN (Ger. dial., Kiel)
- p ≈ b̥}, p̥ ≈ p̥ʃ (Ladefoged 1975:44), • b̥ʃ • b̥ʃ, p̥-h • p̥ (whispered), p̥-h • p̥}, p̥} • b̥}
- p' Ejective p̥
- 1 Implosive p̥, • ɔʝ (Igbo)
- q q̥} • k̥}, q̥ ≈ k̥ (+back vowel), q̥ʃ ≈ k̥ʃ • ɡʃ q̥° (phg., Arabic), q̥-h (Portuguese)
- q' Ejective q̥, (M:217)
- Q Implosive q̥, ɰʝ
- r • trilled d, r̥ʃ r̥ʃ ≈ V (Icelandic), r̥-tr • l (Span.), l̥ʃ (Puerto Rico), ≈ d, ≈ D, ≈ |ʃ, r̥-tr • u̥ʃ, r̥ • v̥ʃ (e.g., Ḁʃ, P̥ʃ), r̥ʃ(forceful) > ʃ (Swedish), r̥ʃ and r̥ʃ(Russian), r̥ > X (Swiss), r̥ʃ-tr (Icelandic), (strong trill, Arabic, Scot.), r̥ʃ-tr (vel. Irish)
- | ʃ d (both one tap) (Irish), (tap) r̥, dʝ t̥-h, r̥ʃ} and |ʃ (Japanese), |ʃ(RP), | ≈ d̥
- È (voiced alveolar lateral flap), d̥ʃ, (Japan., Tswana)
- Ç (Czech.; Grassington, Engl.; Hausa, Hindi, Japan, Oslo, Swahili, Swedish), Çʃ |°
- ʃ ʃʃ ʃʃ ≈ jẼ ≈ j̃, h̃ ≈ hẼ, ʃ • ʃ, Ṽ, Ṽ, aṼ (Danish), ʃʃʃ • Ã, Ã, ʃʃʃ(Irish), ʃʃʃ(AP), ʃʃʃ(Japan.), ʃʃʃ (Ibo, Korean, Zulu), ʃʃʃ(Scot.)
- â (Fr., Ger., -er > â), ẫ, ≈ Ṽ, ÷, Ã, { °, [E, V >
- â (Arabic), • X̃ʃ • ɡ̃ʃ • j̃ʃ, • ç̃â • ʃ, • j̃ʃ, ≈ Ṽ ° (Arabic, Swabian), âʃ and

	â (Alsace), â > ³ (Swabian), â} (Rhein), â` (Danish), (Northumbrian <i>burr</i> = â W)
õ	(Bengali; Bristol, Engl.; Dutch, Swedish), ≈ l (Chinese, Finnish), õ} (Chinese), °
R	≈ X, R ⁹ • â, ≈ g, R° (Léon 1983:9), (Köln)
[V±]	Generic rhotic quality added to any vowel. Advisable to substitute a specific /r/.
r-tr	(Added here to IPA), (Irish), r to r-tr (Malay)
S	S • z ⁹ ≈ S ⁷ (Köln), S • Z (Ger. dialects), S ^l (Arran Gaelic), S (vel.:Arabic, Irish), S (whistled: Efik, Shona), S ^l (Amharic, M:229), S` (Cambodian, Japan.), S ^s (Russian), S-s and S* (Swiss)
S'	Ejective S (M:235). Not IPA
S	• S ⁵ S ⁷ (Fr.), (grooved vs. slit), S ^s (<i>Duden</i> 1974:13), S ⁵ (Gullah, Turner 1973:246)
§	• r ⁵ , • ½, • r ⁵ , • \r\, s½ ≈ §-, S ⁷ (whistle, Swedish), ≈ S ⁷ (Swedish), § (hiss, Span., Dalbor 1969:92)
H	(Controversial). • S ⁵ x (Swedish, Zulu)
	• (Ger., Norweg.) • J{ sj, ió • ík, x ⁵ (AP <i>hue</i>), j (strongly whispered), • S ⁷ (Swedish), °
J	• J J i
,	(Chinese, Dutch, Köln), ó ⁹ • 5 t ⁵ , ≈ t ⁵ (Japanese), • S, S (pal., Polish), S ^j (<i>Duden</i> 1974:11), S ^j (Ladefoged & Wu 1984:271)
t	t • t-h (Swiss), t} • d}, t* • d*, tî ≈ d ⁹ t-h • , t ^l • t (Payne 1990), t-h • t}, tî ≈ d ⁹ , approximant t • t ⁶ t ⁹ ≈ d (Chinese), t` (Arabic), t ^l (Irish, Liverpool), t ^s (Cockney), t ⁴ (Irish)
tS	t ⁵ • c, • c ⁵ ≈ t ⁴ ≈ t ^s , tS (palatal, Irish), t ⁵ tS (Controversial)
t'	Ejective t Implosive t, • è ⁹ (Igbo), ≈ a click
æ	(Buckinghamshire, Hindi, Norweg.) • r ^l , • t, • \r\, æ ^h • y ⁷ • r-trt, °t, (AP <i>try</i>)
æ'	Ejective æ
T	t ^l (interdental), • s ^l • D ⁹ • D ⁵ groove vs. slit, T s ¼
D	z ^l ≈ d ^l ≈ l (Danish), • T ³ T ^{3h} , T°, d ^l

- v v⁹ • V* (Bavarian), v⁹ • f, fʒ fʒ^h, v_W, v⁷ v⁹ (Icelandic)
- Ã [Bavarian, Dutch (cf. Mees & Collins 1982:6), Finnish, Hindi, Irish, Zulu],
≈ B, w, v_W, v_ʔ endolabial (Kahananui & Anthony 1974:xvii, cf., Catford 1977:
144-145)
- ... Pî, hw⁹ h⁷ hw, í _W, x_W, h_P, P_W, P_W, P
- w w} ≈ u*, u_h, u •, w_V, u_V, v_W ≈ v_u, u⁰ (AP *water* u⁰t^{''}) (e.g., au ≈ aw),
Ã, ow ou, w⁷ w_i w_i (Japan.), w⁹ (RP, Icelandic), w (Breton, M:246),
velar vs. pal. w, onglide or offglide, w_ʔ [w] • (labialized), [w] • [**7**], w >
B (Bavarian, Irish), o_h, u_h • wi, u.E • uWE
- ç (Fr., Span.) (voiced labial-palatal approximant), ≈ w, *consonantal ü* (Duden
1974:11), ç⁷ wi
- x V(xua ≈ hwa, • > x (German), X ʒ g ʔ Oh
- v uvular and velar in Arabic, V⁹ (Ger. dial.), ʒ_ʔ V^ˉ, • g}, g*, [x] (velarized),
ˉ (with friction), x³ a⁵
- ÷ V (non-fric.), w_i¹ ≈ ˉ, (Burma)
- X R, ≈ a⁹ ©, ©_ʒ k_iX (Swiss), x^o a³ strong X (Dutch), X^l (<Xu)
- j [ʃ] (palatization), ≈ j_P, /i, j_W, i_W, v_ʔ ≈ v_i. ejE ≈ eE, ija ≈ ífa (Hausa), ip,
j ≈ i
- Z Z* ≈ S, Z⁹ ≈ S^{-h} (Bavarian), Z⁹ • S* (Swiss), S³ (Payne 1990), Z^x • Z_iˉ (Chinese),
Z^l (Arabic), Z[˘] (Alsace Ger.), Z whistled (Bantu), Z⁷ (whistled, Doke 1954:33)
- Z • Z^o, • S³ (strong) • (Swedish), Z⁷ (Fr.), Z (Bavarian)
- ½ [Buckinghamshire, Castilian Spanish (Dalbor 1969)] S³ Z^o; \r\ʃ (Mandarin)
- ó (Ewe, Frankfurt Ger., Fula, Japan., Norweg., Polish), , ʔ Z (pal.), ó⁷ (Canepari 1983)

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