

Confusing German *Eszett* (ß; ß) with Greek *beta* (β) in Biomedical Writing

Jaime A Teixeira da Silva

In scientific writing, there is a need to be as precise as possible. Non-English letters, such as from the Greek alphabet, are frequently used in biomedical research while mathematics uses an even wider range of symbols. In this note, the importance of not confusing the German special character, the Eszett (uppercase ß; lowercase ß), with the lowercase Greek beta (β), is emphasized. Three examples are provided within the wider context of science's erroneous literature and the postpublication peer review movement.

Science writing occasionally requires the use of non-English letters and special characters that can easily be confused, or mistaken. Academics from culturally diverse backgrounds may also have unique letters specific to their language's alphabet. Ideally, in science writing, there is a desire to represent both accurately.

In the German alphabet, there is a unique special character, the *Eszett* (uppercase ß; lowercase ß) that has specific orthographic uses. Except for German names (e.g., scientists or cities/locations in Germany) or other very specific uses exclusive to the German language, it is rare, if not altogether out of place, to use ß/ß in science writing.

In contrast, in Greek, lowercase *beta* (β), the second letter of the Greek alphabet, is commonly used in biomedical research, as are other Greek letters, e.g., names of compounds (β-carotene) or proteins (amyloid-beta, Aβ), in mathematics, or in statistics. However, the wrong letter might be used, i.e., instead of the Greek β, the German Greek β might be inserted. When the terms "beta" (or "β") are searched on PubMed, over 1.1 million results are returned¹ suggesting that authors, publishers, and platforms like PubMed allow for use of the alphabetized version of this Greek letter or the Greek letter itself.

German authors whose names are misrepresented with a Greek β are within their right to request an erratum from a journal to accurately represent their name in the scientific

literature, or if the Greek β is erroneously represented as the German ß/ß, based on the premise that any error can and should be corrected, if possible.²

Some academics (or publishers) may argue that their computers do not have such letters, but most word processors globally have special character functions that allow these letters to be selected. Here, too, it is important to know which letter corresponds to which codes, and these are determined by a universal standard, the Unicode.³ The Unicodes for the Greek β and the German ß and ß are U+03B2, U+1E9E, and U+00DF, respectively.

In a word processor, how can one capture the correct German or Greek letter? In Microsoft Word for Windows, especially in later versions, there is an input method editor pad that shows the Unicode for non-English letters and special characters. For example, as indicated above, the Unicode for the Greek β is U+03B2, uppercase German ß is U+1E9E, and lowercase ß is U+00DF. To find these letters in Word, simply add the Unicode where desired in the document, place the mouse cursor after the Unicode,³ and then press Alt+x simultaneously. The desired letter should appear.

Three examples in which the Greek β and German ß/ß have been mixed and/or confused, and thus also introducing errors into PubMed, or other databases can be found in Muche et al.,⁴ Pourageaud et al.,⁵ and Camastra et al.⁶ The greater risk is that these errors will be propagated by scientists who might cite this study, but who may be unaware of this fine-scale error. The extent of this type of error in the biomedical literature is currently unknown and a detailed bibliometric analysis is warranted.

Conflicts of Interest

The author declares no conflicts of interest relevant to this topic.

References and Links

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3. <http://www.unicode.org/charts/>

JAIME A TEIXEIRA DA SILVA is an independent researcher in Kagawa-ken, Japan.

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Common Unicode Characters in Scientific Writing

Unicode	Symbol/glyph	Unicode	Symbol/glyph
5E	circumflex accent ^	25A1	white square \square
B0	degree sign $^\circ$	25AB	white small square \blacksquare
B1	plus-minus sign \pm	25FB	white medium square \square
B9	superscript one 1	25FD	white medium small square \blacksquare
B2	superscript two 2	2A7D	less-than or slanted equal to \leq
B3	superscript three 3	2A7E	greater-than or slanted equal to \geq
B5	micro sign μ	3B1	Greek small letter alpha α
D7	multiplicator sign \times	3B2	Greek small letter beta β
F7	division sign, obelus \div	3B3	Greek small letter gamma γ
2012	figure dash $-$	3B4	Greek small letter delta δ
202F	non-breaking thin space for use with units	3B5	Greek small letter epsilon ϵ
207B	superscript minus $^-$	3B6	Greek small letter zeta ζ
2113	ell ℓ	3B7	Greek small letter eta η
2126	unit ohm Ω	3B8	Greek small letter theta θ
221A	square root $\sqrt{\quad}$	3B9	Greek small letter iota ι
221B	cube root $\sqrt[3]{\quad}$	3BA	Greek small letter kappa κ
221C	fourth root $\sqrt[4]{\quad}$	3BB	Greek small letter lambda λ
221D	proportional to \propto	3BC	Greek small letter mu μ
221E	infinity ∞	3BD	Greek small letter nu ν
221F	right angle \perp	3BE	Greek small letter xi ξ
2220	angle \sphericalangle	3BF	Greek small letter omicron \omicron
2221	measured angle \sphericalapprox	3C0	Greek small letter pi π ,
2225	parallel to \parallel	3C1	Greek small letter rho ρ
2229	intersection \cap	3C2	Greek small letter final sigma σ
222A	union \cup	3C3	Greek small letter sigma σ
2234	therefore; masonic abbreviation sign \therefore	3C4	Greek small letter tau τ ,
223F	sine wave, alternating current \sim	3C5	Greek small letter upsilon υ
2248	almost equal to, approximately \approx	3C6	Greek small letter phi ϕ
2282	subset of \subset	3C7	Greek small letter chi χ
22C5	dot operator \cdot	3C8	Greek small letter psi ψ
2300	diameter sign \oslash	3C9	Greek small letter omega ω

List via <https://hamwaves.com/utf-8/en/index.html> (CC-BY-NC-SA)