

Babel support for the German language (post-1996 orthography)

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Abstract

This manual documents babel language support for German (post-1996 orthography), including support for the Austrian and Swiss varieties of German. The manual is part of the babel-german bundle.

1 Aim and usage

The babel ‘language definition file’ `ngermanb.ldf` documented in this manual provides the babel package with all language specific strings, settings and commands needed for writing German texts, including texts in the Austrian and Swiss varieties of German.¹ Furthermore, it is assured that the correct hyphenation patterns for the respective language or variety are used (see sec. 3 for details). The file, and hence this manual, addresses the contemporary (‘reformed’, i. e., post-1996) orthography. For traditional (1901–1996) German orthography support, please refer to the complementary `germanb` manual.

In order to use the language definitions provided here, you need to use the babel package and pass the respective language name as an option, either of

- `\usepackage[ngerman]{babel}`
- `\usepackage[naustrian]{babel}`
- `\usepackage[nswissgerman]{babel}`
- `\usepackage[nswissgerman.toss]{babel}`²

New feature
in v. 2.10!

Using multiple varieties in parallel is possible; consult the babel manual [2] for details.

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¹ The file `ngermanb.ldf` started as a re-implementation of the package `ngerman.sty` by Bernd Raichle (cf. [7]), which itself builds on `german.sty`, originally developed by Hubert Partl (cf. [5]) and later maintained by Bernd Raichle as well. The initial re-implementation was done by Johannes Braams.

² See sec. 4 on the `toss` modifier.

2 Shorthands

For all three varieties of German, the character " is made active in order to provide some shorthand macros for frequently used special characters as well as for better control of hyphenation, line breaks and ligatures. Table 1 provides an overview of the shorthands that are provided by babel-german for ngerman, naustrian and nswissgerman.

Table 1: The extra definitions made by ngermanb.1d.f

New feature in v. 2.9!	"a	Umlaut ⟨ä⟩ (shorthand for \a). Similar shorthands are available for all other lower- and uppercase vowels (umlauts: "a, "o, "u, "A, "O, "U; tremata: "e, "i, "E, "I).
	"s	German ⟨ß⟩ (shorthand for \ss{}); but cf. sec. 4.
	"z	German ⟨ß⟩ (shorthand for \ss{}). Differs to "s in uppercase version; but cf. sec. 4.
	"S	\uppercase{s}, typeset as ⟨SS⟩ (⟨ß⟩ must be written as ⟨SS⟩ in uppercase writing).
	"Z	\uppercase{z}, typeset as ⟨SZ⟩. In traditional spelling, ⟨ß⟩ could also be written as ⟨SZ⟩ instead of ⟨SS⟩ in uppercase writing. Note that, with reformed orthography, the ⟨SZ⟩ variant has been deprecated in favour of ⟨SS⟩ only.
	"	Disable ligature at this position (e. g., at morpheme boundaries, as in Auf" lage).
	"-	An additional breakpoint that does still allow for hyphenation at the breakpoints preset in the hyphenation patterns (as opposed to \-).
	"=	An explicit hyphen with a breakpoint, allowing for hyphenation at the other points preset in the hyphenation patterns (as opposed to plain -); useful for long compounds such as IT"=Dienstleisterinnen.
	"~	An explicit hyphen without a breakpoint. Useful for cases where the hyphen should stick at the following syllable, e. g., bergauf und "~ab.
	" "	A breakpoint that does not output a hyphen if the line break is performed (consider parenthetical extensions as in (pseudo"~)"wissenschaftlich).
	"/	A slash that allows for a linebreak. As opposed to \slash{}, hyphenation at the breakpoints preset in the hyphenation patterns is still allowed.
	" "	German left double quotes ⟨„⟩.
	" "	German right double quotes ⟨”⟩.
	"<	French/Swiss left double quotes ⟨«⟩.
	">	French/Swiss right double quotes ⟨»⟩.

Table 2 lists some babel macros for quotation marks that might be used as an alternative to the quotation mark shorthands listed above.

Table 2: Alternative commands for quotation marks (provided by babel)

\glqq	German left double quotes ⟨„⟩.
\grqq	German right double quotes ⟨”⟩.
\glq	German left single quotes ⟨,⟩.
\grq	German right single quotes ⟨’⟩.
\flqq	French/Swiss left double quotes ⟨«⟩.
\frqq	French/Swiss right double quotes ⟨»⟩.
\flq	French/Swiss left single quotes ⟨<⟩.
\frq	French/Swiss right single quotes ⟨>⟩.
\dq	The straight quotation mark character ⟨"⟩.

3 Hyphenation patterns

The question which hyphenation patterns are used by Babel in case of the varieties of German needs some elaboration. There is a set of established hyphenation patterns for pre- and post-1996 German orthography that has been available with T_EX distributions for a long time (currently, these are shipped in form of the `dehyph` and `dehyphn` files). These patterns, though, have many flaws (they produce wrong hyphenations, and not much is known about their construction). Therefore, a group of people developed completely new patterns that do much better, the so-called ‘experimental’ new hyphenation patterns of German, distributed in the `dehyph-exptl` package [3]. As opposed to the old patterns, the new ones undergo constant improvement. The price for this, however, is that hyphenation and thus the typeset document is subject to change with, and only due to, pattern updates.

Modern engines (i. e., `xetex` and `luatex`) have already embraced those new patterns, i. e., they are activated on these engines by default. The classic T_EX engines (`tex`/`pdf``tex`), however, haven’t: they continue to use the old patterns. The reason for this is one of T_EX’s quality standards: refrain, if ever possible, from changing the output of user’s documents in the wake of software updates.

This means that you need to explicitly activate the new patterns for a given document with the classic engines, should you want to use it instead of the old ones. With Babel, this can be done quite easily by means of the `hyphsubst` [4] package, like this (please refer to [3] and [4] for details):

```
\RequirePackage[ngerman=ngerman-x-latest]{hyphsubst}
\documentclass{...}
...
\usepackage[ngerman]{babel}
```

For `naustrian` and `nswissgerman`, the code needs to be adapted accordingly.

4 Variety-specific options

New feature
in v. 2.10!

In Swiss (and Liechtensteinian) German writing, the use of ⟨ß⟩ is rather uncommon. Swiss writers would normally use ⟨ss⟩ where German or Austrian writers use the ⟨ß⟩ character (e. g., *Buße* vs. *Busse*). When texts (or names) from other German speaking areas are quoted, however, the spelling and hence the ⟨ß⟩ is often maintained (particularly in scholarly writing where the spelling of quoted text is not supposed to be touched).

We assume that Swiss writers will normally input ⟨ss⟩ directly when they mean ⟨ss⟩, and we assume furthermore that the ⟨ß⟩-related shorthands “s and “z are useful also for Swiss writers when they actually need ⟨ß⟩, the more so since the ⟨ß⟩ is not as directly accessible on Swiss keyboards as it is on German and Austrian ones. On the other hand, there might be occasions where writers want to transfer a text from German or Austrian Standard into Swiss Standard German and adapt the spelling on the fly, i. e., transform all ⟨ß⟩ into ⟨ss⟩.

For this special case, we provide an option to make the ⟨ß⟩-related shorthands "s and "z expand to the respective digraphs³, ⟨ss⟩ and ⟨sz⟩, rather than to ⟨ß⟩. This is not the default behavior with `nswissgerman` since, as mentioned, there are situations when the ⟨ß⟩ is (and has to be) used in Swiss writing, and normally, no shorthand is needed to input (or output) two simple ⟨s⟩ characters. You can opt-in (and out) digraphical expansion of "s and "z on a global and local level:

- To globally switch on the digraphical expansion, use the Babel modifier `toss` (read: ‘to ⟨ss⟩’) with `nswissgerman`. I.e., pass `nswissgerman.toss` (rather than `nswissgerman`) as `babel` option.
- To switch on the digraphical expansion only locally, you can use the boolean switch `\ntosstrue`. Likewise, `\ntossfalse` switches off (both locally and globally set) digraphical expansion.

Both these changes result in the following deviant behavior of two shorthands:

"s Expands to digraph ⟨ss⟩
 "z Expands to digraph ⟨sz⟩

5 Implementation

5.1 General settings

First, we define some helper macros that help us to identify later on which variety of German we are currently dealing with.

```
1 \def\bbl@opt@ngerman{ngerman}
2 \def\bbl@opt@ngermanb{ngermanb}
3 \def\bbl@opt@naustrian{naustrian}
4 \def\bbl@opt@nswissgerman{nswissgerman}
```

If `ngermanb.ldf` is read via the deprecated `babel` option `ngermanb`, we make it behave as if `ngerman` was specified.

```
5 \ifx\CurrentOption\bbl@opt@ngermanb
6 \def\CurrentOption{ngerman}
7 \fi
```

The macro `\LdfInit` takes care of preventing that this file is loaded more than once with the same option, checking the category code of the @ sign, etc.

```
8 \LdfInit\CurrentOption{captions\CurrentOption}
```

If `ngermanb.ldf` is read as an option, i.e., by the `\usepackage` command, `ngerman` could be an ‘unknown’ language, so we have to make it known. We check for the existence of `\l@ngerman` and issue a warning if it is unknown.

```
9 \ifx\l@ngerman\undefined
10 \nopatterns{German (new orthography)}
11 \addialect\l@ngerman0
12 \fi
```

³In graphematics, the term *digraph* denotes two characters that make a functional pair (which means, depending on the theoretical assumptions: they represent a single sound or they are semantically distinctive).

We set `naustrian` and `nswissgerman` as dialects of `ngerman`, since they use the same hyphenation patterns than `ngerman`. If no `ngerman` patterns are found, we issue a warning.

```

13 \ifx\CurrentOption\bbl@opt@naustrian
14   \ifx\l@ngerman\@undefined
15     \@nopatterns{German (new orthography), needed by Austrian (new orthography)}
16     \adddialect\l@naustrian0
17   \else
18     \adddialect\l@naustrian\l@ngerman
19   \fi
20 \fi
21 \ifx\CurrentOption\bbl@opt@nswissgerman
22   \ifx\l@ngerman\@undefined
23     \@nopatterns{German (new orthography), needed by Swiss German (new orthography)}
24     \adddialect\l@nswissgerman0
25   \else
26     \adddialect\l@nswissgerman\l@ngerman
27   \fi
28 \fi

```

5.2 Language-specific strings (captions)

The next step consists of defining macros that provide language specific strings and settings.

`\@captionsngerman` The macro `\@captionsngerman` defines all strings used in the four standard document classes provided with \LaTeX for German. This is an internal macro that is inherited and modified by the following macros for the respective language varieties.

```

29 \@namedef{@captionsngerman}{%
30   \def\prefacename{Vorwort}%
31   \def\refname{Literatur}%
32   \def\abstractname{Zusammenfassung}%
33   \def\bibname{Literaturverzeichnis}%
34   \def\chaptername{Kapitel}%
35   \def\appendixname{Anhang}%
36   \def\contentsname{Inhaltsverzeichnis}%
37   \def\listfigurename{Abbildungsverzeichnis}%
38   \def\listtablename{Tabellenverzeichnis}%
39   \def\indexname{Index}%
40   \def\figurename{Abbildung}%
41   \def\tablename{Tabelle}%
42   \def\partname{Teil}%
43   \def\enclname{Anlage(n)}%
44   \def\ccname{Verteiler}%
45   \def\headtoname{An}%
46   \def\pagename{Seite}%
47   \def\seename{siehe}%
48   \def\alsoname{siehe auch}%
49   \def\proofname{Beweis}%

```

```

50 \def\glossaryname{Glossar}%
51 }

```

`\captionsngerman` The macro `\captionsngerman` is identical to `\@captionsngerman`, but only defined if `ngerman` is requested.

```

52 \ifx\CurrentOption\bbl@opt@ngerman
53   \@namedef{captionsngerman}{%
54     \@nameuse{@captionsngerman}%
55   }
56 \fi

```

`\captionsnaustrian` The macro `\captionsnaustrian` builds on `\@captionsngerman`, but redefines some strings following Austrian conventions (for the respective variants, cf. [1]). It is only defined if `naustrian` is requested.

```

57 \ifx\CurrentOption\bbl@opt@naustrian
58   \@namedef{captionsnaustrian}{%
59     \@nameuse{@captionsngerman}%
60     \def\enclname{Beilage(n)}%
61   }
62 \fi

```

`\captionsnswissgerman` The macro `\captionsnswissgerman` builds on `\@captionsngerman`, but redefines some strings following Swiss conventions (for the respective variants, cf. [1]). It is only defined if `nswissgerman` is requested.

```

63 \ifx\CurrentOption\bbl@opt@nswissgerman
64   \@namedef{captionsnswissgerman}{%
65     \@nameuse{@captionsngerman}%
66     \def\enclname{Beilage(n)}%
67   }
68 \fi

```

5.3 Date localizations

`\month@ngerman` The macro `\month@ngerman` defines German month names for all varieties.

```

69 \def\month@ngerman{\ifcase\month\or
70   Januar\or Februar\or M\arz\or April\or Mai\or Juni\or
71   Juli\or August\or September\or Oktober\or November\or Dezember\fi}

```

`\datengerman` The macro `\datengerman` redefines the command `\today` to produce German dates. It is only defined if `ngerman` is requested.

```

72 \ifx\CurrentOption\bbl@opt@ngerman
73   \def\datengerman{\def\today{\number\day.\~\month@ngerman
74     \space\number\year}}
75 \fi

```

`\datenswissgerman` The macro `\datenswissgerman` does the same for Swiss German dates. The result is identical to German. This macro is only defined if `nswissgerman` is requested.

```

76 \ifx\CurrentOption\bbl@opt@nswissgerman

```

```

77 \def\datenswissgerman{\def\today{\number\day.\~\month@ngerman
78 \space\number\year}}
79 \fi

```

`\datenaustrian` The macro `\datenaustrian` redefines the command `\today` to produce Austrian versions of the German dates. Here, the naming of January („Jänner“) differs from the other German varieties. The macro is only defined if `naustrian` is requested.

```

80 \ifx\CurrentOption\bbl@opt@naustrian
81 \def\datenaustrian{\def\today{\number\day.\~\ifnum1=\month
82 J\"anner\else \month@ngerman\fi \space\number\year}}
83 \fi

```

5.4 Extras

`\extrasnaustrian` The macros `\extrasngerman`, `\extrasnaustrian` and `\extrasnswissgerman`, respectively, will perform all the extra definitions needed for the German language or the respective variety. The macro `\noextrasngerman` is used to cancel the actions of `\extrasngerman`.
`\extrasnswissgerman` The macro `\noextrasnaustrian` and `\noextrasnswissgerman` behave analogously.
`\noextrasngerman` First, the character " is declared active for all German varieties. This is done once, later on its definition may vary.

```

84 \initiate@active@char{"}

```

Depending on the option with which the language definition file has been loaded, the macro `\extrasngerman`, `\extrasnaustrian` or `\extrasnswissgerman` is defined. Each of those is identical: they load the shorthands defined below and activate the " character.

```

85 \@namedef{extras\CurrentOption}{%
86 \languageshorthands{ngerman}%
87 }
88 \expandafter\addto\csname extras\CurrentOption\endcsname{%
89 \bbl@activate{"}}

```

`toss` For Swiss German, we allow optionally to expand the ⟨ß⟩-related shorthands the Swiss way, i. e. as ⟨ss⟩ (globally, if the modifier `toss` is used or locally if `\ntosstrue`).

```

\ntosstrue
\ntossfalse
90 \newif\iftoss\ntossfalse
91 \newif\ifbbl@ntoss\bbl@ntossfalse
92 \ifx\bbl@mod@nswissgerman\undefined\else
93 \expandtwoargs\in{,toss,}{,\bbl@mod@nswissgerman,}
94 \fin@
95 \ntosstrue
96 \fi
97 \addto\extrasnswissgerman{%
98 \iftoss\bbl@ntosstrue\else\bbl@ntossfalse\fi}
99 \fi

```

Next, again depending on the option with which the language definition file has been loaded, the macro `\noextrasngerman`, `\noextrasnaustrian` or `\noextrasnswissgerman` is defined. These deactivate the " character and thus turn the shorthands off again outside of the respective variety.

```

100 \expandafter\addto\csname noextras\CurrentOption\endcsname{%
101   \bbl@deactivate{"}}
102 \ifx\CurrentOption\bbl@opt@nswissgerman
103   \addto\noextrasnswissgerman{\bbl@ntossfalse}
104 \fi

```

In order for \TeX to be able to hyphenate German words which contain ‘ß’ (in the OT1 position ^^Y) we have to give the character a nonzero `\lccode` (see Appendix H, the \TeX book).

```

105 \expandafter\addto\csname extras\CurrentOption\endcsname{%
106   \babel@savevariable{\lccode25}%
107   \lccode25=25}

```

The umlaut accent macro `\` is changed to lower the umlaut dots. The redefinition is done with the help of `\umlaulow`.

```

108 \expandafter\addto\csname extras\CurrentOption\endcsname{%
109   \babel@save{"\umlaulow}

```

```

110 \expandafter\addto\csname noextras\CurrentOption\endcsname{%
111   \umlauthigh}

```

The current version of the ‘new’ German hyphenation patterns (`dehyphn.tex`) is to be used with `\lefthyphenmin` and `\righthyphenmin` set to 2.

```

112 \providehyphenmins{\CurrentOption}{\tw@\tw@}

```

For German texts we need to assure that `\frenchspacing` is turned on.

```

113 \expandafter\addto\csname extras\CurrentOption\endcsname{%
114   \bbl@frenchspacing}
115 \expandafter\addto\csname noextras\CurrentOption\endcsname{%
116   \bbl@nonfrenchspacing}

```

5.5 Active characters, macros & shorthands

The following code is necessary because we need an extra active character. This character is then used as indicated in table 1.

In order to be able to define the function of `"`, we first define a couple of ‘support’ macros.

`\dq` We save the original double quotation mark character in `\dq` to keep it available, the math accent `\` can now be typed as `"`.

Furthermore, we define some helper macros for contextual $\langle\beta\rangle$ handling.

```

117 \begingroup \catcode'\ "12
118 \def\x{\endgroup
119   \def\dq{"}
120   \def@SS{\mathchar"7019 }
121   \def\bbl@ss{\ifbbl@ntoss ss\else\textormath{\ss}{\@SS{}}\fi}
122   \def\bbl@SS{SS}
123   \def\bbl@sz{\ifbbl@ntoss sz\else\textormath{\ss}{\@SS{}}\fi}
124   \def\bbl@SZ{SZ}
125 }
126 \x

```


Now we can define the doublequote shorthands: the umlauts,

```
127 \declare@shorthand{ngerman}{a}{\textormath{\{a\allowhyphens}\ddot a}}
128 \declare@shorthand{ngerman}{o}{\textormath{\{o\allowhyphens}\ddot o}}
129 \declare@shorthand{ngerman}{u}{\textormath{\{u\allowhyphens}\ddot u}}
130 \declare@shorthand{ngerman}{A}{\textormath{\{A\allowhyphens}\ddot A}}
131 \declare@shorthand{ngerman}{O}{\textormath{\{O\allowhyphens}\ddot O}}
132 \declare@shorthand{ngerman}{U}{\textormath{\{U\allowhyphens}\ddot U}}
```

tremata,

```
133 \declare@shorthand{ngerman}{e}{\textormath{\{e\}\ddot e}}
134 \declare@shorthand{ngerman}{E}{\textormath{\{E\}\ddot E}}
135 \declare@shorthand{ngerman}{i}{\textormath{\{i\}%
136         {\ddot\imath}}}
137 \declare@shorthand{ngerman}{I}{\textormath{\{I\}\ddot I}}
```

German ß,

```
138 \declare@shorthand{ngerman}{s}{\bbl@ss}
139 \declare@shorthand{ngerman}{S}{\bbl@SS}
140 \declare@shorthand{ngerman}{z}{\bbl@sz}
141 \declare@shorthand{ngerman}{Z}{\bbl@SZ}
```

German and French/Swiss quotation marks,

```
142 \declare@shorthand{ngerman}{' }{\glqq}
143 \declare@shorthand{ngerman}{' '}{\grqq}
144 \declare@shorthand{ngerman}{< }{\flqq}
145 \declare@shorthand{ngerman}{> }{\frqq}
```

and some additional commands (hyphenation, line breaking and ligature control):

```
146 \declare@shorthand{ngerman}{- }{\nobreak\-\bbl@allowhyphens}
147 \declare@shorthand{ngerman}{| }{%
148   \textormath{\penalty\@M\discretionary{- }{\}{\kern.03em}%
149     \allowhyphens}{}}
150 \declare@shorthand{ngerman}{"}{\hskip\z@skip}
151 \declare@shorthand{ngerman}{~}{\textormath{\leavevmode\hbox{- }{- }}}
152 \declare@shorthand{ngerman}{=} {\penalty\@M-\hskip\z@skip}
153 \declare@shorthand{ngerman}{/ }{\textormath
154   {\bbl@allowhyphens\discretionary{/ }{\}{/\bbl@allowhyphens}{}}}
```

\mdqon All that's left to do now is to define a couple of commands for reasons of compatibility
\mdqoff with german.sty.

```
155 \def\mdqon{\shorthandon{}}
156 \def\mdqoff{\shorthandoff{}}
```

The macro \ldf@finish takes care of looking for a configuration file, setting the main language to be switched on at \begin{document} and resetting the category code of @ to its original value.

```
157 \ldf@finish\CurrentOption
```

5.6 naustrian.ldf, ngerman.ldf and nswissgerman.ldf

Babel expects a $\langle lang \rangle$.ldf file for each $\langle lang \rangle$. So we create portmanteau ldf files for naustrian, ngerman and nswissgerman.⁴ These files themselves only load ngermanb.ldf, which does the real work:

```
158 \input ngermanb.ldf\relax
```

Change History

Version 2.6f	Do not use \@namedef when \noextras is already defined and should not be overwritten. 8
General: Renamed from germanb.ldf; language names changed from german and austrian to ngerman and naustrian. 1	\noextrasnswissgerman: Added \noextrasnswissgerman. 7
Version 2.6j	General: Added support for variety nswissgerman. 1
\noextrasngerman: Deactivate shorthands outside of German . . . 7	Generate portmanteau files naustrian.ldf, ngerman.ldf and nswissgerman.ldf. 10
Version 2.6k	Revised naustrian support. 1
\@captionsngerman: Added \glossaryname 5	Revised documentation: Turn the babel manual chapter into a self-enclosed manual. 1
\noextrasngerman: Now use \providehyphenmins to provide a default value 8	
Version 2.6m	Version 2.8
\noextrasngerman: Turn frenchspacing on, as in german.sty 8	\@captionsngerman: Define trans-variational base captions which are loaded and modified by the varieties 5
Version 2.6n	\captionsnaustrian: Only define \captionsnaustrian if naustrian is requested. 6
\@captionsngerman: Corrected typo \captionnsgerman 5	\captionsngerman: Only define \captionsngerman if ngerman is requested. 6
Version 2.7	\captionsnswissgerman: Only define \captionsnswissgerman if nswissgerman is requested. 6
\@captionsngerman: Changed \enclname in naustrian to <i>Beilage(n)</i> 5	\datenaustrian: Only define \datenaustrian if naustrian is requested. 7
Split \captionsngerman from \captionsnaustrian and \captionsnswissgerman. 5	\datengerman: Only define \datengerman if ngerman is requested. 6
\datenswissgerman: Added \datenswissgerman. 6	
\extrasnswissgerman: Added \extrasnswissgerman. 7	
\noextrasngerman: Deactivate shorthands also outside of naustrian and nswissgerman. . . . 7	

⁴ For naustrian and ngerman, this is not strictly necessary, since babel provides aliases for these languages (pointing to ngermanb). However, since babel does not officially support these aliases anymore after the language definition files have been separated from the core, we provide the whole range of ldf files for the sake of completeness.

\datenswissgerman: Only define	Version 2.10
\datenswissgerman if	\noextrasgerman: Implement boolean
nswissgerman is requested. 6	switch \ntosstrue/\ntosfalse to
General: Only add dialects if the	customize ⟨ß⟩-related shorthands
respective variety is loaded 5	in Swiss German context. 7
Version 2.9	Implement modifier toss to
General: Add "/" shortcut for breakable	customize ⟨ß⟩-related shorthands
slash (taken from dutch.ldf) 9	in Swiss German context. 7
Do not attempt to load	General: Add helper macros to
\l@naustrian or \l@nswissgerman,	identify the current option. 4
which do not exist 5	Improvements to the manual 1

References

- [1] Ammon, Ulrich et al.: *Variantenwörterbuch des Deutschen. Die Standardsprache in Österreich, der Schweiz und Deutschland sowie in Liechtenstein, Luxemburg, Ostbelgien und Südtirol*. Berlin, New York: De Gruyter.
- [2] Braams, Johannes and Bezos, Javier: *Babel*. <http://www.ctan.org/pkg/babel>.
- [3] Deutschsprachige Trennmustermannschaft: *dehyph-exptl – Experimental hyphenation patterns for the German language*. <https://ctan.org/pkg/dehyph-exptl>.
- [4] Heiko Oberdiek: *hyphsubst – Substitute hyphenation patterns*. <https://ctan.org/pkg/hyphsubst>.
- [5] Partl, Hubert: *German T_EX, TUGboat* 9/1 (1988), p. 70–72.
- [6] Manuel Pégourié-Gonnard et al.: *hyph-utf8 – Hyphenation patterns expressed in UTF-8*. <https://ctan.org/pkg/hyph-utf8>.
- [7] Raichle, Bernd: *German*. <http://www.ctan.org/pkg/german>.