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ARTICLE

Infinitival Constructions in the German Dialects of Austria: On Variation, Constraints, and Change of a Prominent Syntactic Feature

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Abstract

Infinitival constructions (ICs) have received considerable attention from syntacticians and typologists, but less so from variationist linguistics. Based on new data from a comprehensive dialect survey, this study investigates the variation and change of ICs in Austrian dialects. The results reveal clear geographical patterns for different IC variants in Austria. Regarding linguistic factors, several constraints are identified, most importantly with respect to the IC's syntactical function and governing element (e.g., phase verbs). Moreover, an apparent-time analysis shows that one variant (*zum* + infinitive) has been grammaticalized and spread at the expense of all other variants, presumably due to both dialect leveling and dialect-standard advergence.

Keywords: infinitival constructions; morphosyntactic variation; language change; Bavarian dialects; Alemannic dialects; German in Austria

1. Introduction

Over the last decades, infinitives and infinitival constructions (ICs) have been investigated from different perspectives. Many studies focused on the IC's syntactic properties such as rising, control, (in-)coherence, etc. (for German see Bech 1955, Kiss 1995, Wurmbrand 2001). Studies have also been conducted on the variation and change of ICs. Diachronic research, for instance, has revealed that infinitives are not universal, unmarked verb forms, but rather the product of complex grammaticalization and reanalysis processes (Haspelmath 1989; for a formalist account see Abraham 2004; for ICs with *zu* 'to', see also Smirnova 2017). In addition, typological research has shown that European languages vary greatly in the extent to which they make use of ICs, referred to as their "infinitival prominence" (Mayerthaler et al. 1995). While, for example, Western European languages frequently employ ICs, they occur less often in Southeastern European languages. Mayerthaler et al. (1995) even proposed an implication scale for the "natural order" in which ICs appear in certain languages.

Notably, the form and function of ICs are not only subject to interlanguage differences, but intralanguage ones as well. On average, nonstandard varieties evince a lower infinitival prominence than their respective standard varieties (Fliedl & Winkler 2005:87). This applies to German as well, and as Schallert (2013) argues, such infinitival prominence is a prime example of microtypology and microvariation between different German dialects. The present contribution focuses specifically on this microvariation. We concentrate on ICs in which the "2. Status" of the infinitive (Bech 1955), namely, the infinitive with *zu* ('to'), is obligatory in Standard German (SG) (Rapp & Wöllstein 2013) (1).

(1) SG Nach der Firmung fing er an, Bier zu trinken.
after the confirmation started he PTCL beer to drink
'After the Confirmation, he started to drink beer.'

Various studies have highlighted that a broad range of dialects of German – in particular Upper German dialects such as Bavarian or Alemannic in Germany and Alemannic in Switzerland and in Vorarlberg – are "reluctant" to use ICs with *zu* (Merkle 1976:43–44, Zehetner 1985:148–149, Donhauser 1989, Bayer 1993, Abraham 2004:140, Brandner 2006, Kolmer 2010, Schallert 2013). Consequently, for contexts like (1), Upper German dialects are reported to employ alternative strategies, such as the use of subordinate clauses with the complementizer *dass* ('that') (2), nominalizations (3) or, most importantly for the present contribution, constructions with *zum* ('to') + infinitive (4), where *zum* consists, at least in a diachronic perspective, of the preposition *zu* + *m*, an enclitic form of the definite article *dem* (here: dative singular neuter).

(2) LS-FY[1] noch da fiamung hota ogfongt dara a bia trinkt
after the confirmation has.he started that.he a beer drinks

(3) MI-MY noch da fiamung hotas biatringa ogfongt
after the confirmation has.he.the beer.drink started

(4) ML-FY noch da fiamung hota ongfongen zum bia trinkn
after the confirmation has.he started to beer drink

Interestingly, other research indicates that at least some South Bavarian dialects in South Tyrol (Northern Italy) have fully grammaticalized ICs with *zu* (5) (Scheutz 2016:126–127), while other dialects maintained older constructions with a bare infinitive (6) (= "1. Status" of the infinitive according to Bech 1955), a variant which is typical for Alemannic dialects (Brandner 2006:207–208). Additional realizations include proclitic *z'* (7), a variant which may be interpreted as a reduced form of either *zu* or *zum* (Weiß 1998:235–239).

(5) HO-MO noch da firmung hota ungehebt bia zu trinkn
after the confirmation has.he started beer to drink

[1] The dialectal examples here and in the following are taken from the corpus on which the present analysis is based (see section 3 for details). The abbreviations stand for the location (e.g., LS = Lasern in Upper Austria), the gender (F = female, M = male), and the age group (O = older, Y = younger) of an informant.

(6)	LA-FY	noch	da	firmig	häta	agfange	bier	trinka
		after	the	confirmation	has.he	started	beer	drink

(7)	LA-FY	noch	da	fiamung	hota	ogfongt	bia	z'tringa
		after	the	confirmation	has.he	started	beer	to.drink

That said, empirical evidence of and research into this type of variation is rather limited for Upper German dialects[2] (see, for example, Donhauser 1989, Seiler 2005, Kolmer 2010, Scheutz 2016, Glaser 2021, Seiler et al. 2021) – and practically nonexistent for the dialects in Austria. Little is known about which of the aforementioned constructions are used in which dialects and contexts in Austrian dialects and what the linguistic factors for their distribution may be.[3] To date, there has been no systematic overview, let alone an in-depth study on the variation of IC constructions in the Alemannic and Bavarian dialects of Austria. Thus, there is a compelling need for additional research, specifically of research within a variationist framework that is capable of attending to both "external," for example, geographic, factors and linguistic factors which can ultimately help to explain language change.

The aim of the present article is to offer such an investigation in an explorative apparent-time study – in fact, the first ever study on ICs in the dialects of Austria – based on a large-scale survey and a resulting dialect corpus with data from 163 speakers from 40 locations throughout Austria. By conducting this study, the following research questions will be answered:

1. Which variants of the Standard German infinitival construction with *zu* are used in which Austrian dialects and in which contexts?
2. Can we identify any geographical patterns of these variants?
3. Can the use of these variants be explained by any linguistic constraints?
4. Can we identify an ongoing language change, and if so, are there any indications for a particular direction and motivation of change?

In section 2, we provide more information on the forms and functions of ICs in varieties of German. In section 3, we outline the data and methods of the present study, and in section 4, we present results based on our empirical studies. Section 5 concludes with a discussion and summary of our key findings.

[2] The lack of empirical overview studies is particularly noticeable in research on Bavarian dialects. Previous studies – many of them formalist accounts in the tradition of Generative Grammar (e.g., Bayer 1993, Weiß 1998, Bayer & Brandner 2004) – are often based on introspection, anecdotal evidence or small data sets, and have, in part, produced contradictory evidence (see section 2.2).

[3] Traditional dialect grammars of Austrian dialects which, in general, hardly ever deal with syntactic phenomena, do not address the use of ICs at all (e.g., Schatz 1897, Lessiak 1903). Pohl (1989:63) has only a short paragraph on *dass*-constructions in Carynthian dialects, which are reported to replace infinitival constructions in this dialect. Even in the few older studies on dialectal syntax in Austria, there are either no indications of ICs (Freitag 1935, Eckner 1973) or hardly any (Patocka 1997:159–160 mentions the variation of bare infinitives and ICs with *zu*/*zum*/*ins* in the Bavarian dialects in Austria but does not address reasons for this variation). Mayerthaler et al. (1995) and Schallert (2010, 2013) appear to be the only studies on this topic in Austrian dialects.

2. Infinitival Constructions in German Varieties

2.1. *Infinitive Syntax in Standard German*

SG has two main forms of the infinitive: bare infinitives ("1. Status" infinitives, according to Bech 1955), marked with the suffix *-en* (e.g., *les-en* 'read'), and *zu*-infinitives ("2. Status" infinitives), marked with the suffix *-en* and the left-adjacent particle *zu* (e.g., *zu les-en* 'to read'), which may be analyzed as a prefix (Zifonun et al. 1997:2159, Eisenberg 2020:382–383).[4] Which (status) form is used depends on syntactic factors, such as the syntactic head governing the infinitive (*Statusrektion* 'status government'; Bech 1955). Modal verbs like *können* ('can') or *wollen* ('want'), for instance, govern "1. Status" infinitives (8), while propositional verbs like *behaupten* ('claim') or *bestreiten* ('deny') govern "2. Status" infinitives (9) in SG.[5]

(8) SG Peter wollte unbedingt das Buch lesen.
Peter wanted definitely the book read
'Peter really wanted to read the book.'

(9) SG Peter bestritt entschieden, das Buch zu kennen.
Peter denied firmly the book to know
'Peter strongly denied knowing the book.'

ICs such as in (8) and (9) also vary in relation to "coherence" (see, for example, Bech 1955, Kiss 1995, Zifonun et al. 1997:2186–2205, Wurmbrand 2001, Müller 2002:37–46, Osborne 2005, Haider 2010:274–286, Rapp & Wöllstein 2013). Coherent and incoherent ICs differ in how "close" the connection between the matrix verb and the infinite is (Eisenberg 2020:391). While incoherent ICs are often considered a separate constituent, coherent infinitives are regarded as part of the verbal cluster (for a formalist model see Haider 2010:274–284). Thus, examples like (8) can be interpreted as monoclausal structures, while examples like (9) are biclausal structures, which include an independent infinitive clause (often called *satzwertiger Infinitiv* 'clause-value infinitive'; Duden 2022:118–120, Rapp & Wöllstein 2013; for a critical review see Kiss 1995:14-20). We will not go into the problem of this differentiation in detail, as our analyses focus on incoherent ICs in Austrian dialects.

Incoherent ICs with *zu* can have different syntactical functions, which we will illustrate with examples from SG. To start with, they can be an object (10) as well as the subject (11) or an adverbial (12). In the latter case, the IC is usually combined with a complementizer, such as *um* ('for') or *anstatt* ('instead'). Moreover, *zu*-ICs can be complements of nonverbal heads like adjectives (13) or (often deverbal or deadjectival) nouns (14) (Rapp & Wöllstein 2013:341-346).[6]

[4] The "3. Status" is the past participle (e.g., *ge-les-en*). Because it does not play a role for our study, it will not be discussed further in what follows.

[5] In SG, only a few verbs allow both bare and *zu* infinitives without changing semantics (e.g., *lernen* 'learn').

[6] When the IC is used as an object other than the accusative object, as a subject or an adverbial, or when it is governed by a noun, we assume that the IC is obligatorily incoherent (Rapp & Wöllstein 2013). When the IC is governed by an adjective, it is either obligatorily or facultatively incoherent (cf. Ørsnes & Cook 2010).

(10) SG Peter beginnt(,) [ein gutes Buch zu lesen]
Peter starts a good book to read
'Peter starts to read a good book.'

(11) SG [Ein gutes Buch zu lesen(,)] erfreut Peter
a good book to read pleases Peter
'Reading a good book gives Peter pleasure.'

(12) SG Peter schlief, [anstatt das Buch zu lesen]
Peter slept [instead the book to read
'Instead of reading the book Peter slept.'

(13) SG Peter war [bereit, [das Buch zu lesen]]
Peter was willing the book to read
'Peter was willing to read the book.'

(14) SG [Peters [Bereitwilligkeit, [das Buch zu lesen,]]] erfreute ihn
Peter's willingness the book to read pleased him
'Peter's willingness to read the book pleased him.'

However, none of these functions can be completely fulfilled by *zu*-ICs. With regard to ICs in complement function, it is noteworthy that there are no predicates in SG selecting exclusively such constructions.

The most important alternative to *zu*-ICs are subordinated clauses with the complementizer *dass* ('that') (see (2) and (4) above). In SG, clauses with *dass* can replace ICs in many contexts (see (15) and (16)), but not all (see (17) and (18)) (Eisenberg 2020:68).

(15) SG Peter verspricht(,) das Buch zu lesen
Peter promises the book to read
'Peter promises to read the book.'

(16) SG Peter verspricht, dass er das Buch liest
Peter promises that he the book reads
'Peter promises that he will read the book.'

(17) SG Peter versucht(,) das Buch zu lesen
Peter tries the book to read
'Peter tries to read the book.'

(18) SG ?Peter versucht, dass er das Buch liest
Peter tries that he the book reads
'Peter tries to read the book.'

Various studies have attempted to determine which factors modulate the choice of *zu*-ICs and *dass*-constructions in such contexts in SG (see, for example, Zifonun et al. 1997:1449, Wöllstein 2015, Rapp et al. 2017, Brandt & Bildhauer 2019). It has been argued that, although ICs are more economical, they are less explicit. This is because

they have no overt subject, only limited morphological markers for tense, and have no morphological marker for mood (see, for example, Rapp et al. 2017:196).[7] Therefore, for instance, *zu*-ICs are preferred with (control) verbs where the covert subject of the infinitive tends to correspond to a complement of the matrix clause (e.g., in *versuchen* 'try'). Where this is not the case (e.g., in *erzählen* 'tell'), *dass*-constructions may be preferred. According to Rapp et al. (2017:219), these preferences can be "entrenched" and thus ultimately become part of the verb valence.

2.2. *Infinitives in (Upper) German Dialects*

ICs already occur in the earliest stages of German, that is, in Old and Middle High German (Schrodt 2004:5–9, Paul 2007:314–315, Dal & Eroms 2014:108–124) – this applies to both ICs with bare infinitives (19) and ICs with *zu*. The latter were grammaticalized from a combination of the preposition *zu* ('to') with a nominal infinitive (Haspelmath 1989, Smirnova 2017). In the historical stages of German, the infinitive regularly – but not always – showed dative inflection; see (20) for Old High German (for Middle High German see Paul 2007:314; for Early New High German see Ebert 1993:396).

(19) OHG[8] then fáter hort er spréchan
the father heard he speak
'He heard the father speak.'

(20) OHG[9] uuas giuuon ther grauo ziforlazzanne einan themo folke
was accustomed the governor to.release-DAT one to-the people
'the governor was accustomed to release one (prisoner) to the people'

Not only is the question controversial concerning when the *zu*-ICs became fully grammaticalized as a verbal form, but also how this grammaticalization process took place (Haspelmath 1989, Demske 2001, Abraham 2004, Smirnova 2016, 2017). In any case, (various) German dialects do not seem to have grammaticalized such ICs to the same extent as has SG (Schallert 2013:105–107). In what follows, we will focus on the situation in the Upper German dialects, in particular (Central) Bavarian, which have been most thoroughly researched to date – except for Bavarian dialects in Austria (see footnote 3).

In Bavarian dialects in Germany, ICs with *zum*, among other variants (see section 1), are frequently used instead of *zu*-ICs in SG. However, as Bayer (1993:52–53) argues, there might be some "deep rooted differences" between both constructions. For example, *zum*-ICs allow for noun incorporation (21), and they may occur without particle separation (22). In contrast, in SG, *zu* always appears left-adjacent to the verb stem, and

[7] With regard to tense, ICs can only be used in the present and the perfect tense, for example, (*zu*) *lesen* ('read', infinitive present) versus *gelesen* (*zu*) *haben* ('read', infinitive perfect). As for mode, there are no markers at all.

[8] Otfrid I.25.15, quoted in Demske (2001:74).

[9] Tatian 310.20–21, see http://e-codices.ch/en/csg/0056/310> [retrieved 1 August 2023], see Masser (1994:631). This passage (from the Passion, Matthew 27:15) is also quoted in Dal & Eroms (2014:117–118).

nominal constituents governed by the infinitive as well as separable verb particles appear obligatorily on the left, (23), (24).

(21) AB-MY hota ogfongt zum bia tringa
has.he started to beer drink
'He has started to drink beer.'

(22) AP-MY um a floschn wei söwa zun austringa
to a bottle wine self to out.drink
'. . . to drink a whole bottle by yourself.'

(23) SG hat er angefangen(,) Bier zu trinken / *zu Bier trinken
has he started beer to drink / to beer drink
'. . . has he started to drink beer.'

(24) SG um eine Flasche Wein selber auszutrinken / *zu austrinken
to a bottle wine self out.to.drink / to out.drink
'. . . to drink a whole bottle by yourself.'

These facts – along with some other distributional differences between *zu*-ICs in SG and *zum*-ICs in Bavarian – are taken as evidence by Bayer (1993: 58) "that B[avarian] retains the prepositional nature of *zu*." A similar claim is made by Donhauser (1989), who concludes that *zum*-ICs in Bavarian show a "more nominal character" than *zu*-ICs in SG. For instance, she finds that ICs in older Bavarian are mostly used as adverbials or attributes, with either directive or purposive semantics. Due to (contact-induced) change, only very recently have ICs been used as verbal complements, although in most cases still without any complements governed by the infinitive. Consequently, *dass*-sentences remain the main strategy to date to produce propositional complements (Donhauser 1989:295–298).

Weiß (1998) holds a different view. He argues that there are already verbal *zum*-ICs present in older Bavarian corresponding to *zu*-ICs in SG (Weiß 1998:235). Weiß (1998) also distinguishes between two diachronically distinct "infinitive systems" in Bavarian: In the older system, *zum*-ICs are already frequently employed in numerous functions (Weiß 1998:240). Specifically, he maintains that *zum*-ICs are used (a) as complements of nouns and adjectives, (b) as adverbials (corresponding to adverbials with *um zu* 'in order to' in SG), (c) with noun incorporation, or (d) as part of the verbal cluster in coherent ICs with certain matrix verbs (e.g., *kriegen* 'get'). Although some of these ICs may be interpreted as prepositional phrases (e.g., ICs with noun incorporation; Weiß 1998:252–255), *zum*-ICs are clearly verbal in others (e.g., in coherent ICs; Weiß 1998:247–252, 262–263). In the more recent system, these functions of Bavarian *zum*-ICs are extended by their general use as complements in incoherent ICs. According to Weiß (1998:265–272), this was triggered by contact with SG, a process which expanded verb by verb (starting with phase verbs like *anfangen* 'start'; see also Donhauser 1989:297). Thus, although there are still some differences in the complexity and frequency of ICs, ultimately, the infinitive syntax in Bavarian is becoming increasingly similar to SG. The remaining differences between Bavarian and SG can mainly be attributed to modality-related factors, such that Bavarian is used

nearly exclusively as a spoken variety, while SG is both a spoken and a written variety (Weiß 1998:262, 272).

Weiß (1998:235–239) also discusses ICs with proclitic *z'*, which he regards as an abbreviated form of *zum* in present-day Bavarian (although diachronically it may have evolved from *zu*, as Weiß argues). According to Weiß, *z'* and *zum* are synonymous and can often be used to fulfil the same functions. However, *z'* is more restricted, and cannot occur, for example, with noun incorporation (*bier z'tringa*, see (7), but not **z'bier tringa*). In addition, the use of *z'* is constrained in certain phonological and morphological environments (for example, in stressed positions or with prefixed infinitive verbs; see Weiß 1998:245–248). Some further constraints in the use of the clitic are investigated in Bayer & Brandner (2004). They suggest, for example, that the clitic is restricted to transitive infinitives combined with weak indefinite quantifiers (e.g., *etwas* 'something' or *nichts* 'nothing'; see also Donhauser 1989:296). In addition, the matrix verb has to be an "empty verb," that is, a verb which has the primary goal of highlighting a presupposition of existence (e.g., *haben* 'have' or *kriegen* 'get').

In addition to *zum*- and *z'*-ICs discussed above, there are two other forms of ICs in Bavarian corresponding to SG *zu*-ICs, namely ICs with bare infinitives and *zu*-ICs. This is already indicated by data from the Wenker corpus, reported in Schallert (2013).[10] With respect to the sentence *Es hört gleich auf zu schneien* (lit. it stops soon PTCL to snow 'It's about to stop snowing'), *zum*-IC are widespread in the central and eastern parts of Austria,[11] whereas *zu*-ICs are frequently reported in the south and west, in particular in Tyrol. In Tyrol (as well as in Alemannic Vorarlberg and neighboring Switzerland), ICs with bare infinitives are also used (Schallert 2013:120), for example, *Es hört gleich auf schneien*. Scheutz (2016:127) confirms these results for South Tyrol (Northern Italy).

Taken together, these findings point towards geographical variation in Bavarian dialects (see also Mayerthaler et al. 1995).[12] That said, since most research on Bavarian dialect syntax focuses on Central Bavarian in the German federal state of Bavaria, the constraints on the use of ICs in the Bavarian dialect areas in Austria are yet comparatively unclear.

[10] The 40 "Wenker sentences" are Standard German stimulus sentences which Wenker had developed originally to explore phonetic structures for his *Sprachatlas des Deutschen Reichs* project, which ultimately fed into the DSA (1927–1956). Sentences 2 (*Es hört gleich auf zu schneien* . . .), 3 (. . . *daß die Milch bald an zu kochen fängt*), and 16 (. . . *um eine Flasche Wein auszutrinken*, corresponding to example (25) and item #11 in table 1 below) contain ICs and have been used in various studies on German dialect syntax (e.g., Kakhro 2005, Schallert 2013, Fleischer 2017, 2019). The Wenker data are not least referred to here because they allow for a real-time comparison between the findings of the present study and older results on Austrian dialects.

[11] Interestingly, for Bavarian in neighboring Bavaria, the *zum*-IC is rarely reported in the Wenker data; in the corresponding map of the *Atlas zur deutschen Alltagssprache* (AdA), however, these constructions also are dominant in Bavaria and even in Alemannic in neighboring Swabia and Vorarlberg; see www.atlas-alltagssprache.de/runde-7/f13b-d/>, map 13c [retrieved 01.08.2023]. This discrepancy could partly be due to the fact that the Austrian DSA data were collected about 30 years later (1926–1933) than the Bavarian data in Germany (1887); see www.uni-marburg.de/de/fb09/dsa/recherche-und-dokumentationszentrum/wenkersaetze≥ [retrieved 01.08.2023], which would point to dialect change. The differences could also be partly due to the fact that the AdA data reflect the use in nonstandard regiolects. In any case, the *zum*-IC seems to represent a more recent variant.

[12] Mayerthaler et al. (1995:39) also suggest that South Bavarian, in particular Tyrolean, dialects generally have a higher infinitive prominence compared to other Bavarian varieties. This, however, must be attributed to the fact that they do not interpret *zum*-ICs as verbal forms but as prepositional phrases.

For Alemannic dialects, the situation is different. Here, the widespread use of ICs with bare infinitives is well documented. As Brandner (2006:208), among others, notes, "Alemannic allows bare infinitives in lexical environments ... and syntactic positions (extraposition) where SG uses a *zu*-infinitive." However, while ICs with bare infinitives can replace SG *zu*-ICs in some contexts (for example, with phase verbs or in subject function), this is not possible with others (for example, as complements of propositional or factive verbs) (Brandner 2006:213; see also Schallert 2013:106-107, 119-120).[13] Consequently, other variants are also regularly used in Alemannic, for example, subordinate clauses or nominalizations. In addition, *zum-* and *z'*-ICs are documented, which may occur for purposive clauses or as attributes of nouns and adjectives (for purposive clauses in Alemannic see also Seiler 2005). In such ICs, *zum* and *z'* can be doubled in Alemannic (Brandner 2006:215, Schallert 2013:121), with *zum* acting as a complementizer and preceding all elements governed by the infinitive (25) (Brandner 2006:216-219).

(25) TS-MY du bisch no nit groß gnuag zum a flasche alle usztrinka
you are PTCL not big enough to a bottle alone up.to.drink
'You are not yet old enough to drink a whole bottle by yourself.'

Brandner (2020:29) also reports on intra-Alemannic variation, and claims that in Alemannic varieties in Germany, *zum* generally acts "as a lexical variant of *zu*."[14]

Overall, the evidence to date concerning the variation of ICs in Upper German (Bavarian and Alemannic) paints an incomplete, inconclusive, and even contradictory picture, which is not least due to the extremely heterogeneous data base. Against this background, our aim in the present contribution is to draw on a larger and more consistent empirical dataset from Austria, in order to more comprehensively describe (a) the variation of ICs, (b) their linguistic constraints, and (c) their recent changes.

3. Aim, data, and methods

The present study draws on data from a large-scale dialect survey conducted in the project "Variation and Change of Dialect Varieties in Austria (in Real and Apparent Time)."[15] In the first part of the section, we describe the project design, research locations, and informants (section 3.1). We will then present our questionnaire and items (section 3.2).

[13] For the acceptance of ICs with bare infinitives in different contexts, see also Brandner (2020). She shows that there are considerable differences between different Alemannic dialects concerning contexts which allow the use of bare infinitives.

[14] See also Schallert (2013:121), who argues that at least for more recent varieties of Alemannic, *zum* is clearly an infinitive marker, not (only) a complementizer.

[15] This project (project number FWF F6002-G23), conducted at the Department of German Language and Literatures at the University of Salzburg in collaboration with the Vienna-based Acoustics Research Institute (ARI) of the Austrian Academy of Sciences, is part of a larger project on "German in Austria," which is financed by the Austrian Research Fund (FWF).

3.1. Research Design, Research Locations, and Informants

The data of the present study comprise dialect recordings that were carried out by trained fieldworkers.[16] The dialect survey was conducted in 40 small, rural villages throughout Austria. Figure 1 shows their locations within the dialect regions of Austria (based on the dialect classification of Wiesinger 1983, which essentially used phonetic criteria).

As figure 1 indicates, by far the most research locations are in the Bavarian dialect area, consisting of Central Bavarian, the South-Central Bavarian transition zone, and South Bavarian. In addition, several locations are situated in the Bavarian-Alemannic transition zone and the small Alemannic dialect region in the west of Austria. Alemannic dialects differ from Bavarian dialects in many features of grammar, lexis, and phonology (for an overview on the Austrian dialects see Lenz 2019; for a recent account of syntactic variation in Austria see Vergeiner et al. forthcoming).

Four speakers of the traditional dialect from each location participated in our study.[17] Two informants were chosen from an older (65+ years) and two from a younger (18–35 years) generation, with one male and one female per age group. Based on the apparent-time hypothesis, comparing the data of these two age groups facilitates not only an investigation of dialect variation, but also of recent dynamics in dialect change.

Our sample consists of 163 informants. Apart from age and gender, traditional dialectological criteria for sampling were applied (Chambers & Trudgill 1998:13–31). The older speakers are typical NORM/Fs (= nonmobile, older, rural males/females), and the younger informants can be considered prototypical speakers of the traditional dialects as well. They were all raised in local artisanal or agricultural networks and had not completed any higher education. Their parents were also born and raised in the same location. Both their social and working lives took place in the same local environments.

3.2. Items and Method

We used a traditional dialect questionnaire for this survey. During the interviews, all 163 informants completed the same test battery comprising translation tasks, cloze tasks, and picture naming tasks. In this study, we focus on the translation tasks, in which the informants translated sentences containing an incoherent IC with *zu* into their own dialects; the stimulus sentences were presented to the informants in a SG variety by the explorers. The informants were encouraged to use phonetical, morphological, and syntactical features which they considered most natural in their everyday dialect usage.

Translation tasks have been employed successfully in prior studies to provide insights into the variation with regard to ICs; see Mayerthaler et al. (1995), Scheutz (2016), or Brandner (2020), among others. Mirror effects, that is the adoption of given

[16] We would like to thank Dominik Wallner, Yvonne Rusch (Salzburg), and Jan Luttenberger (Vienna) for their arduous work. Dominik Wallner and Jan Luttenberger are native speakers of Bavarian dialects in Austria; Yvonne Rusch, who conducted the fieldwork in Vorarlberg, is a native speaker of an Alemannic dialect in Austria.

[17] In the village of Ulrichsberg (UB, northwest of Linz) seven speakers were recorded due to an in-depth investigation on sound change in real time.

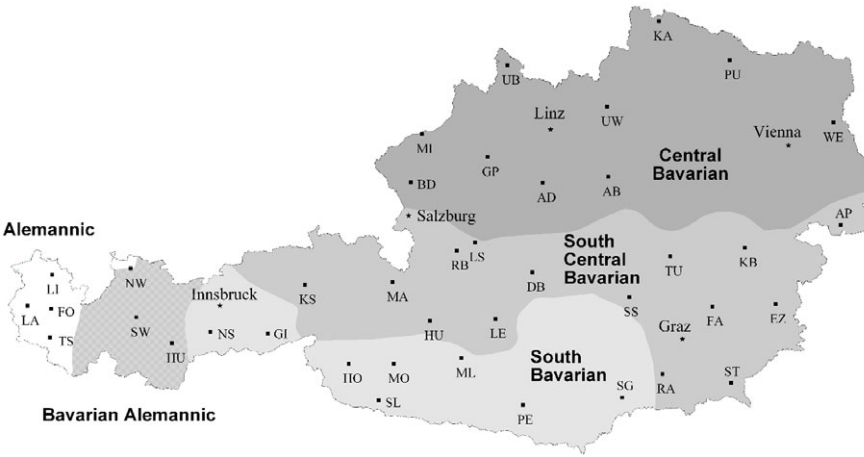

Figure 1. Research locations (the abbreviations are explained in table A1 in the Appendix).

standard language structures, can never be completely ruled out in translation tasks. However, as the results in section 4 below show, most dialect realizations deviate from the structure presented in the stimulus sentence, which indicates that the design worked well.[18]

Table 1 shows the 14 sentence stimuli of interest for the present study.

A total of 2,213 tokens are included in this study. Missing data resulted either from nonresponse items or from translations that differ considerably from the stimulus, for instance, because a different matrix verb was used. For example, some informants translated item #5 not with the given phase verb *anfangen* ('start') but with the copula verb *werden* ('become') and a present participle (26).

(26) UB-MO i glab heit wiads regnad
I believe today becomes.it raining
'I believe it will be raining today.'

For the sake of comparability, we excluded such constructions from our study.

As column 3 in table 1 indicates, the ICs have different syntactical functions in the stimulus sentences:

- In one item, the IC is the subject (#1) of the matrix verb *freuen* ('please').
- In seven items, the ICs can be interpreted as an object (#2–#8). Five of these items (#4–#8) contain a phase verb (*anfangen* 'start', *aufhören* 'stop') as matrix verb.[19]

[18] See also the methodological discussion in Fleischer (2017:140–145) and Fleischer (2019:138) on the benefits and risks of using Wenker material for studies in dialect syntax.

[19] It is disputed whether it is obligatory for phase verbs to be construed coherently (and thus form part of the verbal cluster). According to Haider (2010:277), this is the case in their aspectual usage, that is, when they behave like raising verbs. In contrast, Kiss (1995:154) argues that they can be construed incoherently, even when used as raising verbs. Since this issue depends heavily on theoretical

Table 1. Items

#	Stimulus sentence in SG	Function	Extended IC	Tokens (Σ 2,213)
1	*Es freut mich*(,) [*dich zu sehen*]. lit. 'It pleases me you to see'	Subject	✓	158
2	*Maria glaubt*(,) [*sie zu kennen*]. lit. 'Mary believes her to know'	Object	✓	163
3	*Sie haben uns geholfen*(,) [*das Feuer zu löschen*]. lit. 'They have us helped the fire to extinguish'	Object	✓	160
4	*Nach der Firmung fing er an*(,) [*Bier zu trinken*]. lit. 'After the confirmation started he PTCL beer to drink'	Object	✓	159
5	*Ich glaube, es fängt an* [*zu regnen*]. lit. 'I believe it starts PTCL to rain'	Object	—	146
6	*Es war so kalt, dass es anfing* [*zu schneien*]. lit. 'It was so cold that it started to snow'	Object	—	158
7	*Er fing an* [*zu tanzen*]. lit. 'He started PTCL to dance'	Object	—	159
8	*Jetzt höre ich auf* [*zu fragen*]. lit. 'Now stop I PTCL to ask'	Object	—	158
9	*Ich kam ins Tal, um* [*zu arbeiten*]. lit. 'I came into.the valley for to work'	Adverbial	—	156
10	*Sie geht auf den Markt,* *um* [*die Kirschen zu verkaufen*]. lit. 'She goes to the market for the cherries to sell'	Adverbial	✓	162
11	*Du bist noch nicht groß genug,* *um* [*eine Flasche Wein alleine auszutrinken*]. lit. 'You are PTCL not big enough for a bottle wine alone up.to.drink'	Adverbial	✓	159
12	*Jetzt geht er lieber ins Wirtshaus,* *anstatt* [*zu arbeiten*]. lit. 'Now goes he rather into.the pub instead to work'	Adverbial	—	161
13	*Du hast immer etwas* [*zu jammern*]. lit. 'You have always something to complain'	Attribute	—	152
14	*Habt ihr nichts* [*zu tun*]*?* lit. 'Have you nothing to do'	Attribute	—	162

One item (#2) has a propositional verb (*glauben* 'believe') and one item (#3) a causative verb[20] (*helfen* 'help').

assumptions, we do not expand on this topic here. For further discussion, also with regard to dialect data, see, for example, Schallert (2013:115–119).

[20] As a semi-modal verb, *helfen* can occur with an IC with *zu* or a bare infinitive in SG (Wurmbrand 2001:110).

- In four items, the IC is an adverbial (#9–#12) – in three cases it is a purposive or final adverbial introduced by the complementizer *um* 'for' (#9–#11), in one item it is a contrastive adverbial introduced by the complementizer *anstatt* 'instead (of)' (#12).
- In the remaining items, the IC is an attribute within the accusative object of *haben* ('have'). Both ICs have pronominal heads, consisting of the indefinites *etwas* ('something') (#13) and *nichts* ('nothing') (#14).[21]

Moreover, the items differ in terms of the complexity of the IC in the stimulus sentence. Six items contain an extended infinitive, that is the ICs consist of additional phrases governed by the infinitive verb. Among other things, this allows us to investigate noun incorporation and the incorporation of pronouns.

In terms of research question 3, which addresses linguistic constraints on the use of IC variants, one of the main aims of the present study is to identify which variants are employed in the aforementioned syntactic contexts. As indicated in section 2.2, one might expect that the use of different infinitival and noninfinitival constructions depends heavily on the structure of the stimulus sentence.

4. Results

Table 2 gives a general overview of the variants that were used to translate the *zu*-ICs of the stimulus sentences. It also shows the absolute and relative frequencies of the variants.

The most common variant is *zum* + infinitive, which accounts for approximately 46 percent of all instances. The second most frequent variant is subordinate clauses with *dass*, which were used in 16 percent of all cases. ICs with bare infinitives are employed with a frequency of 11 percent. Interestingly, the next most frequent variant is ICs with *zu*, which correspond to the SG form, accounting also for about 11 percent of all instances. Constructions with clitic *z'* + infinitive are used in about 9 percent of all cases. V2-clauses and nominalized infinitives (i.e., article[22] + gerund/noun) are minor variants, with a share of about 4 percent each.

This general picture, however, conceals the differences between our research items regarding the frequency of the variants. As discussed in section 3.2, the 14 stimuli utilized in our data collection encompass diverse syntactic, morphological, and/or semantic constructions, such as the distinction between *zu*-constructions and *um zu*-constructions, variations in matrix verbs and syntactic embeddings, and distinct syntactic functions within the sentences. Therefore, a separate examination of each item is necessary to understand potential linguistic constraints, geographical patterns, and intergenerational differences, indicating apparent-time change. To structure our following analyses, we will group the items based on the various functions of the ICs within in the stimulus sentences. As our analyses focus on ICs, the variants 2, 6, and 7 – subordinate clause with *dass*, V2-clause and nominalization – are grouped in the category "alt[ernative] constr[uctions]" in tables 3 to 14 below.

[21] The construction in the items must be distinguished from coherent ICs with modal meaning and *haben* (e.g., *Er hat das zu akzeptieren* lit. 'He has that to accept'). For ICs with *haben* see also Zifonun et al. (1997:1278–1282).

[22] Recall that forms with *zum* are not included in this variant because it is questionable whether the final *-m* can synchronically be analyzed as a clitic article (see section 2.2).

Table 2. Variants

	Variant	Example	Frequency
1	*zum* + infinitive	*ea hot ongfongt zum tonzn* (DB-FY) he has started to dance 'He started to dance.'	1,010 (46%)
2	subordinate clause with *dass*	*es gfreit mi dass i di siach* (AD-MO) it pleases me that I you see 'It's good to see you.'	344 (16%)
3	bare infinitive	*es is so koit gwesn dass aft ogfongt hot schneibm* (KS-MY) it is so cold been that than snow started has 'It was so cold that it started to snow.'	241 (11%)
4	*zu* + infinitive	*olm hosch epas zu sumpan* (GI-FY) always have.you something to complain 'You always have something to complain about.'	240 (11%)
5	*z'* + infinitive	*hobs es nix ztoan* (AP-FY) have.you you nothing to.do 'Don't you have something to do?'	192 (9%)
6	V2-clause	*de geht am moakt und vakaft keaschn* (UW-MO) she goes on.the market and sells cherries 'She goes to the market to sell cherries.'	99 (4%)
7	nominalization	*hiatz hea i es frogn auf* (MI-MY) now stop I the ask PTCL 'I'll stop asking questions now.'	87 (4%)

4.1. Subject Function

In item #1 (*Es freut mich, dich zu sehen*), the (extended) IC in the stimulus sentence is a verbal complement with subject function, governed by the matrix verb *freuen* ('be happy'). The results for this item are presented in table 3, including both the general findings and the findings for each age group individually.

The dominant variant for item #1 is not an IC but an alternative construction, namely the *dass*-clause, which is realized in two-thirds of all cases. Consequently, only in one-third of all cases item #1 is translated with an IC with either *zum*, *zu* or *z'* (ICs with bare infinitives are not used at all by the informants). Significantly, *zum*-ICs occur less often when compared to most other items (and when *zum*-ICs are used, the pronoun is never incorporated).

The results suggest that there are limitations to the use of ICs – in particular ICs with *zum* – with subject function in the investigated dialects. However, as table 3 shows, there are notable differences between older and younger speakers regarding the use of *zum*-ICs. While older speakers rarely employ *zum*-ICs, this variant occurs much more often with younger speakers. In turn, younger speakers use *dass*-clauses less often, which might indicate an apparent-time change.

The geographical patterns are shown in the upper left map (#1) in figure A1 in the Appendix. The most noticeable pattern is that *zu*-ICs dominate in western South Bavarian (in Tyrol and the western part of Carinthia), while *zum*-ICs are generally more frequent in eastern Austria.

Table 3. Results for item #1 (*Es freut mich, dich zu sehen*)

	Bare infinitive	*z'* + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	0%	5%	9%	20%	66%
Old	0%	3%	10%	8%	79%
Young	0%	6%	7%	33%	53%

Table 4. Results for item #2 (*Maria glaubt, sie zu kennen*)

	Bare infinitive	*z'* + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	0%	1%	3%	2%	94%
Old	0%	1%	4%	2%	93%
Young	0%	0%	2%	2%	95%

Table 5. Results for item #3 (*Sie haben uns geholfen, das Feuer zu löschen*)

	Bare infinitive	*z'* + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	18%	12%	18%	45%	7%
Old	28%	15%	18%	32%	8%
Young	9%	9%	19%	58%	6%

4.2. Object Function

In item #2 (*Maria glaubt, sie zu kennen*), the (extended) IC is an object of the propositional verb *glauben* ('believe'). Table 4 shows the results for this item.

Obviously, most informants use alternative constructions for item #2 – either *dass*-clauses or V2-clauses (27).

(27) ST-MY die maria glabt sie kennts
the Mary believes she knows.her

In contrast, ICs are rarely used – in other words, their use seems to be restricted when there is a propositional verb in the matrix clause. Notably, there is no indication of an apparent time change for this item, as the results for older and younger speakers are virtually identical (see table 4). In addition, there are no significant geographical patterns visible (see figure A1, #2).

In item #3 (*Sie haben uns geholfen, das Feuer zu löschen*), the (extended) IC is an object of the causative verb *helfen* ('help'). Table 5 shows the results for this item.

For item #3, most informants employ ICs in object function. The most frequent variant is the IC with *zum* (in all but three cases from the Alemannic dialect region without noun incorporation, perhaps because the noun phrase is specific and definite). ICs with *zu* or *z'* are also used, but much less than the *zum*-IC. Moreover,

Table 6. Results for item #4 (*Nach der Firmung fing er an, Bier zu trinken*)

	Bare infinitive	*z'* + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	24%	8%	8%	45%	14%
Old	33%	10%	8%	37%	13%
Young	15%	6%	9%	54%	16%

Table 7. Results for item #5 (*Ich glaube, es fängt an zu regnen*)

	Bare infinitive	*z'* + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	27%	7%	9%	55%	2%
Old	28%	9%	10%	52%	1%
Young	27%	5%	7%	57%	4%

Table 8. Results for item #6 (*Es war so kalt, dass es anfing zu schneien*)

	Bare infinitive	*z'* + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	28%	2%	11%	59%	0%
Old	29%	2%	13%	56%	0%
Young	26%	1%	10%	63%	0%

informants use ICs with bare infinitives quite often, but very rarely resort to alternative constructions like *dass*-clauses or nominalizations.

As for change in apparent time, there are considerable differences between the responses of older and younger speakers. Younger speakers use fewer ICs with bare infinitives and *z'* than older speakers, but more ICs with *zum*. Geographically (see figure A1, #3), the most noticeable pattern is again that *zu*-ICs dominate in western South Bavarian, while *zum*-ICs seem to appear more often in eastern Austria. In the western half of the country, there are also more ICs with bare infinitives and ICs with *z'*.

The patterns are similar for items #4 (*Nach der Firmung fing er an, Bier zu trinken*), #5 (*Ich glaube, es fängt an zu regnen*), #6 (*Es war so kalt, dass es anfing zu schneien*), and #7 (*Er fing an zu tanzen*). In all these items, the phase verb *anfangen* ('begin') is the matrix verb. In item #4, the IC is extended, and in items #5 and #6, the matrix phrase containing the ICs is in a subordinate position. The results for these items are shown in table 6, 7, 8, and 9, respectively.

ICs are frequently used for these items, in particular ICs with *zum*. Strikingly, ICs with *zum* are least frequent with item #4, in which the IC is extended. When *zum*-ICs are used in this item, the noun is incorporated in 32 of 72 instances, as in example (28).

Table 9. Results for item #7 (*Er fing an zu tanzen*)

	Bare infinitive	*z'* + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	13%	5%	9%	63%	10%
Old	15%	4%	11%	59%	10%
Young	10%	6%	8%	66%	10%

Table 10. Results for item #8 (*Jetzt höre ich auf zu fragen*)

	Bare infinitive	*z'* + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	5%	5%	11%	73%	6%
Old	5%	7%	13%	63%	12%
Young	4%	3%	10%	82%	2%

(28) FA-MO noch da fiamung hota oghebt zum bia trinkn
after the confirmation has.he started to beer drink
'After the Confirmation, he started to drink beer.'

ICs with *zum* are more frequent with the items #5 and #6, where the matrix phrases containing the ICs are themselves subordinate clauses, and most frequent in item #7, where the IC is neither extended nor deeply embedded. While ICs with *zu* occur with similar frequencies in all four items, ICs with bare infinitives occur less often in item #7 and ICs with *z'* in item #6. When speakers resort to alternative constructions to ICs, they usually employ nominalizations.

Comparing older and younger speakers, the most noticeable pattern is again that younger speakers use more *zum*-ICs, with item #4 (containing an extended IC) showing the greatest difference between older and younger speakers. The spatial distribution of the variants (see figure A1, #4 to #7) indicates once more that ICs with *zu* predominate in western South Bavarian, while ICs with bare infinitives are generally more frequent in the western half of Austria, and *zum*-ICs in the eastern half.

In item #8 (*Jetzt höre ich auf zu fragen*), the IC is an object of the phase verb *aufhören* ('stop'). Table 10 shows the results for this item.

Again, ICs occur very often – in particular ICs with *zum*. As table 10 reveals, younger speakers use these *zum*-ICs much more often, and as the map in figure A1 (in the Appendix) shows, *zum*-ICs predominate everywhere, except for western South Bavarian, where *zu*-ICs prevail.

4.3. Adverbial Function

In the stimulus sentences of item #9 (*Ich kam ins Tal, um zu arbeiten*), #10 (*Sie geht auf den Markt, um die Kirschen zu verkaufen*) and #11 (*Du bist noch nicht groß genug, um eine Flasche Wein alleine auszutrinken*), the IC is used as a purposive or final adverbial introduced with *um*. In item #9 the IC is not extended, while in both #10 and #11,

Table 11. Results for item #9 (*Ich kam ins Tal, um zu arbeiten*)

	Bare infinitive	z' + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	1%	6%	14%	69%	10%
Old	1%	8%	19%	57%	15%
Young	1%	2%	12%	79%	6%

Table 12. Results for item #10 (*Sie geht auf den Markt, um die Kirschen zu verkaufen*)

	Bare infinitive	z' + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	10%	1%	15%	37%	36%
Old	18%	1%	14%	24%	44%
Young	4%	1%	16%	50%	29%

Table 13. Results for item #11 (*Du bist noch nicht groß genug, um eine Flasche Wein alleine auszutrinken*)

	Bare infinitive	z' + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	0%	10%	12%	33%	45%
Old	0%	15%	12%	26%	47%
Young	0%	5%	12%	41%	42%

the verb governs a direct object (#10: *die Kirschen* 'the cherries', #11: *eine Flasche Wein* 'a bottle of wine'). Item #10 contains a prefixed verb and item #11 a particle verb. Furthermore, items #9 and #10 include the motion verbs *kommen* ('come') and *gehen* ('go') as matrix verbs, while the matrix clause in item #11 contains a complex predicate consisting of a copula verb and an adjective. The tables 11, 12, and 13 show the individual results for the ICs used.

ICs – in particular, ICs with *zum* – are the predominant constructions used for item #9, where the stimulus contains no extended IC. Notably, in most of the translations (71 of 107 cases) when *zum*-ICs are used, the informants did not employ the complementizer *um* (29). One instance where both *um* and *zum* co-occur is presented in (30). In contrast, with *zu*-ICs, *um* is always realized (31).

(29) MI-FY i bi as toi kemma zum oawatn
I am in.the valley come to work
'I came to the valley to work/with the intention of working.'

(30) KA-MO i bin ins toi kemma um zun oawatn
I am in.the valley come for to work

(31) SL-FO i bin ins tol kemm um zu orweitn
I am in.the valley come for to work

The usage of *zu* and *zum* with preceding *um* in (30) and (31) illustrates why *zum* cannot be interpreted as a preposition in such *zum*-ICs: The complementizer *um* can govern only clauses and not prepositional phrases (see the discussion in section 2.2 and below).

For item #9, alternative constructions, mostly finite clauses with *dass*, are quite rare. This is different for item #10 and #11, in which *dass*-clauses (32) – and for item #11 also V2-clauses (33) – appear more often.

(32) GP-MY se geht am moakt dass die keasch vakaft
she goes to.the market that.she the cherries sells
'She goes to the market (in order) to sell cherries.'

(33) SL-FO de geht am moakt und vakaft die keaschn doat
she goes to.the market and sells the cherries there

However, both for items #10 and #11, informants frequently use *zum*-ICs. This variant occurs in about one-third of all cases, and for item #10, it is even the most frequent variant. In items #10 and #11, the complementizer *um* can be used (34) or omitted (35, 36, 37) in co-occurrence with *zum*-ICs. In the latter case, *zum* can precede the infinitive verb (35) or the incorporated noun phrase of the IC (36), or is doubled (37). Note that the incorporated noun phrase is in most cases indefinite (and non-specific), as in (36).

(34) ML-MO se geht aufn moakt um de keaschn zun vakafn
she goes to.the market for the cherries to sell

(35) EZ-FY sie geht am moakt die kiaschn zum vakafn
she goes to.the market the cherries to sell

(36) MI-FY se geht aufn moakt zum keaschn vakaufn
she goes to.the market to cherries sell

(37) LI-MY si got aufn mat zum krisbe zum vakofe
she goes to.the market to cherries to sell

In item #10, *um* is not realized in 36 of 60 cases, with 28 cases showing noun incorporation and only one translation by a speaker from the Alemannic region evincing *zum*-doubling. In item #11,[23] *um* is omitted in 23 of 53 cases. In all these instances, *zum* precedes the noun phrase and the adverbial and thus may act as a complementizer. In five cases, we also find *zum*-doubling. Notably, these forms are exclusively documented in the Alemannic dialects. In items #10 and #11, adverbial *zu*-ICs are used both with (38) and without *um* (39), although the latter variant appears less frequently – for item #10 it occurs in 3 out of 24 cases, for item #11 in 6 out of 19 cases.

[23] Since item #11 also contains a particle verb, there is also variation concerning the positioning of the *zum* with respect to the particle – only in 6 cases does *zum* appear left-adjacent to the particle.

(38) HO-MY sie geht aufn morkt um die kiaschn zu vakafn
she goes to.the market to the cherries to sell

(39) HO-FO sie geht aufn morkt die keaschn zu vakafn
she goes to.the market the cherries to sell

While ICs with *zu* occur with similar frequencies, there is also an interesting difference between the two items concerning the usage of adverbial ICs with clitic *z'* and bare infinitives. ICs with bare infinitives seem to be restricted to item #10 (40), while ICs with *z'* practically never occur for this item. In contrast, for item #11, we find ICs with *z'* (41) but hardly any bare infinitives.

(40) LE-FO sie geat aufm morkt keaschtn vakafm
she goes to.the market cherries sell

(41) AB-MO du bist no ned groß gnua um a floschn wei ausztringa
you are PTCL not big enough for a bottle wine out.to.drink
'You are not old enough to drink a whole bottle by yourself.'

This difference could be explained, first, by the fact that item #10 contains a prefixed verb and item #11 a particle verb. As for the use of *z'* in co-occurrence with prefixed verbs, our data confirm Weiß's (1998) observation. Second, regarding the usage of bare infinitives, the fact that the matrix clause of item #10 includes the motion verb *gehen* ('go') as predicate seems to be relevant. Even in SG, *gehen* can be used with a bare infinitive, when it is not used as a full verb but a semi-auxiliary verb (see Demske 2020 for a discussion). This restriction to the verb *gehen* could also explain why IC with bare infinitives are virtually absent from item #9, where the motion verb *kommen* ('come') is used in the matrix clause. In SG and other present-day varieties of German, *kommen* can only occur with a past participle when employed as a semi-auxiliary verb (e.g., *sie kamen gelaufen* 'they came running'; cf. Vogel 2005).

Comparing both age groups, we find that for all three items the share of *zum*-ICs increases considerably from older to younger speakers while the proportions of the other variants decrease accordingly in most cases. The geographical patterns (see figure A2, #9 to #11, in the Appendix) are more diverse. Interestingly, for all three items it is the Alemannic west, where *zum*-ICs are most dominant. In the neighboring Alemannic dialect areas of Eastern Switzerland, the *zum*-IC is also the dominant variant (see Glaser 2021, e.g., vol. 1:333, vol. 2:207). In eastern and central Austria alternative constructions are more frequently and for items #10 and #11, in which the ICs are extended, even predominantly used. In the western South-Bavarian locations, *zu*-ICs are frequently reported. In addition, for item #10, ICs with bare infinitives are more often used in the west, while for item #11, ICs with *z'* occur most frequently in the east.

In item #12 (*Jetzt geht er lieber ins Wirtshaus anstatt zu arbeiten*), the IC in the stimulus sentence also has an adverbial function. Unlike in the final clauses discussed before (items #9 to #11), it is introduced with the complementizer *anstatt* 'instead of', which marks a contrastive meaning of the adverbial. According to

Table 14. Results for item #12 (*Jetzt geht er lieber ins Wirtshaus anstatt zu arbeiten*)

	Bare infinitive	*z'* + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	26%	2%	7%	28%	37%
Old	34%	1%	5%	29%	31%
Young	19%	2%	9%	28%	43%

previous research, the use of ICs is not possible in this context in Bavarian dialects. Weiß (1998:264), for example, states that the IC is replaced by a *dass*-clause in Bavarian when introduced by *anstatt*. Table 14 shows the results for this item.

Our findings reveal that – while *dass*-clauses do indeed occur in more than one-third of the reported cases – *zum*-ICs are also used in this context (42), although less often than with the purposive or final adverbials. Apart from *dass*-clauses, nominalizations introduced with the preposition *statt* ('instead') (43) are frequently realized alternative constructions. Another relatively often employed variant is ICs with bare infinitives, commonly introduced with comparative particles such as *als wie* (lit. 'than as') (44). The high proportion of bare infinitives seems again (as in item #10) to be due to the fact that the matrix sentence contains the verb *gehen*, which is reanalyzed as a semi-auxiliary verb by our participants.

(42) KA-MO iatz gehta liawa ins wiatshaus anstott zun oawatn
now goes.he rather in.the pub instead.of to work

(43) ML-FO hetz geat ea liawa ins wiatshaus stott zu da oawat
now goes he rather in.the pub instead.of to the work

(44) HO-FY etz gehta liawa ins goschthaus als wia oawatn
now goes.he rather in.the pub than as work

Interestingly, item #12 is one of just two items where the younger speakers do not use *zum*-ICs more frequently than older speakers but with a similar frequency. At the same time, younger speakers use bare ICs less often and alternative constructions more often. Regarding the geographical patterns (see figure A2, #12), it is observable that ICs with bare infinitives (as in item #10) are prevalent in the west, while *zum*-ICs are frequently employed in the east and alternative constructions in the northern and central regions of Austria.

4.4. Attributive Function

In the remaining two items, #13 (*Du hast immer etwas zu jammern*) and #14 (*Habt ihr nichts zu tun?*), the IC in the stimulus sentence is used with an attributive function. The head of the IC is an indefinite pronoun (#13: *etwas* 'something', #14: *nichts* 'nothing'). Tables 15 and 16 show the results for these items.

For this context, the informants realize only ICs with either *zum*, *zu* or *z'*. ICs with *zum* are more frequently used in response to item #13 than to item #14. In contrast,

Table 15. Results for item #13 (*Du hast immer etwas zu jammern*)

	Bare infinitive	*z'* + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	0%	19%	11%	70%	0%
Old	0%	27%	9%	64%	0%
Young	0%	12%	13%	76%	0%

Table 16. Results for item #14 (*Habt ihr nichts zu tun?*)

	Bare infinitive	*z'* + infinitive	*zu* + infinitive	*zum* + infinitive	Alt. constr.
Total	0%	44%	12%	44%	0%
Old	0%	63%	12%	25%	0%
Young	0%	26%	11%	63%	0%

ICs with *z'* are frequent for item #14, but less so for item #13. While the reason for this pattern is not entirely clear, it may be due to the different head pronouns.

Interestingly, for both items the frequency of *zum*-ICs is again higher for younger speakers when compared with older speakers. In turn, older speakers use more ICs with *z'*. This effect is particularly pronounced for item #14. Geographically (see figure A2), the most noticeable pattern is again the prevalence of *zu*-ICs in western South Bavarian. In addition, for item #14, ICs with *z'* are more or less restricted to western Austria. In the Alemannic region of Vorarlberg, the *zum*-IC seems to be used about as frequently as the *z'*-IC. This distribution appears to correspond to the usage of these two variants in the neighboring Alemannic dialect areas in the east of Switzerland (see Glaser 2021, vol. 2:153).[24]

4.5. General Patterns, Constraints, and Tendencies

In this section, we aim to summarize the general trends identified from the previous item-by-item analyses. Initially, we will focus on geographical patterns, followed by linguistic factors and lastly, we will examine age-related differences to determine language change.

Geographical variation: Our findings reveal that there are clear geographical differences in Austria for the dialect variants used for SG ICs with *zu*. Importantly, the geographical patterns for these syntactic phenomena only partially coincide with traditional dialect areas, which are essentially classified according to phonetic criteria (see section 3.1). This finding corroborates previous and ongoing research on dialect syntax in Austria, where east–west differences are found to be more important than north–west differences (Bülow et al. 2021, Vergeiner et al. forthcoming). Although the

[24] Note that the map in the Swiss Dialect Atlas (Glaser 2021, vol. 2:153) focuses on the form of the gerund but does not differentiate between the *zu*- and the *z'*-variant so that, as far as the complementizer is concerned, a distinction is only made between *zu* and *zum*. However, as can be seen from the examples given for the *zu*-variant, they predominantly consist of clitic *z'*-forms (see Glaser 2021, vol. 1:268–269).

distribution of the different IC-variants depends on the items (and thus on the linguistic context, see below), a clear overall picture emerges (see figures A1 and A2 in the Appendix):

- *zum*-ICs are predominant in Central and South-Central Bavarian, and also in the eastern parts of South Bavarian. In about half of the items, *zum*-ICs also occur frequently in the Alemannic dialect region. Interestingly, in Austria *zum*-ICs appear more frequently in Bavarian when the IC in the item is an object of a phase verb, while they are more often used in Alemannic when the IC in the item has an adverbial function (as can be confirmed by the evidence in Schallert 2010:143–145). This finding is consistent with the results for the neighboring Alemannic areas in Switzerland, where, for example, the *zum*-IC is the dominant variant for the adverbial function (Glaser 2021).
- A clear exception is the South Bavarian area in Tyrol and in western Carinthia. Here, *zum*-ICs are rarely used, which may be explained by the prevalence of another variant, namely, ICs with *zu* + infinitive. This result dovetails with the findings of Scheutz (2016) on the South Bavarian dialects in neighboring South Tyrol in Northern Italy. He shows that the *zu*-IC has been grammaticalized in these dialects, and it appears that this is also true for the geographically adjacent western South Bavarian region in Austria, which is considered a particularly conservative dialect area. Note that the *zu*-IC formally corresponds to SG *zu*-IC but is considered a genuine dialectal structure in these regions. Accordingly, ICs with *zu* + infinitive are rarely used in dialects outside western South Bavarian. In fact, the instances of *zu*-IC reported in research locations outside of South Bavarian may be explained by a methodological effect, namely, that some informants mirror the structure of the stimulus sentence presented in SG.
- Clear geographical differences are also visible for bare infinitival constructions. This variant tends to occur in the west, that is, in the Alemannic dialect region and in the Bavarian-Alemannic transition zone, but also in western South Bavarian and South-Central Bavarian. This finding amends the picture provided by other studies, which similarly located bare ICs in the southwest of the German-speaking area but considered them to be predominantly a feature of Alemannic dialects (Brandner 2006, 2020; but see Schallert 2013).
- Finally, for the clitic form *z'* there are less clear-cut geographical differences as the variant occurs throughout Austria – except South Bavarian, which in its western part is a stronghold of the *zu*-IC. This finding seems to support Weiß's assumption that *z'* is to be regarded as a reduced form of *zum* and not of *zu* in the investigated dialects (see the discussion in section 2.2).

Linguistic factors: Our results show that the use of ICs in the Bavarian and Alemannic dialects in Austria varies greatly according to linguistic factors, such as the syntactic function of the IC, the matrix verb, the morphological complexity of the infinitive verb, the internal complexity of the IC, etc. Our analyses have revealed that the observable microvariation in and between the investigated dialects may be attributable to differences in these linguistic factors. Our results confirm some of the findings in the research literature and aid in both clarifying or even amending

statements from other studies which are based on comparatively small amounts of data – and some of which claim to be generalizable to other Upper German dialects.

- ICs with *zum* are frequently used as verbal complements. While their usage is very common in sentences with a phase verb or a causative verb as matrix verb (section 4.2), there are particular constraints with propositional verbs as matrix verbs (item #2) or with ICs in subject function (see section 4.1, item #1). In addition, *zum*-ICs can be used as adverbials or attributes. Notably, when used as a purposive or final adverbial, the complementizer *um* is frequently – but not always – omitted. In such contexts, the doubling of *zum* and its usage as a complementizer are restricted to Alemannic dialects. ICs with *zum* frequently allow the incorporation of simple noun phrases, at least if they are indefinite and non-specific, both in Alemannic and in Bavarian dialects. In contrast, *zum*-ICs tend not to license an incorporation of pronouns (see section 4.1 on item #1 and section 4.2 on item #2). In general, *zum*-ICs seem to occur less often the more the IC has been expanded.
- ICs with *zu* are autochthonous variants primarily in the western parts of South Bavarian. In these dialects, the use of *zu*-ICs seems to be licensed in a wide range of contexts and functions. Although they may be restricted in a few contexts (for example, in object function with propositional verbs as matrix verbs; see section 4.2 on item #2), their functions more closely resemble *zu*-ICs in SG than *zum*-ICs in Austrian dialects.
- ICs with *z'* is a lesser used variant in most contexts, and their usage is even more restricted (for example, with prefixed infinitive verbs, as opposed to particle verbs; see section 4.3 on items #10 and #11). These ICs are most frequently used when they have an attributive function with an indefinite pronoun as syntactical head (section 4.5).
- ICs with bare infinitives are restricted to verbal complements in object function with a phase verb or a causative verb as matrix verb (see section 4.2, items #3 to #8) and to ICs with adverbial function when the matrix clauses contains the verb *gehen* ('go') as a (grammaticalized) semi-auxiliary verb (Demske 2020; see section 4.4 on items #10 and #12). In contrast, bare infinitives are obviously not possible when the IC has an attributive function (section 4.4) or a subject function (section 4.1) – even in the Alemannic dialects of Austria, where they are predominantly used. This constraint regarding the subject function is remarkable in that Alemannic dialects in Switzerland license the use of bare infinitives in this function (see Brandner 2006).

Language change: Previous research indicates that the infinitive syntax in Bavarian dialects in Germany is prone to change, resulting in an increased use of ICs, for example, with *zum* (Donhauser 1989, Weiß 1998; see section 2.2). Our findings can clearly confirm this assumption for Austrian dialects as, in general, younger speakers use *zum*-ICs more often, while older speakers tend to employ more ICs with *z'* and bare infinitives and also alternative constructions. This trend can be observed in 12 of 14 items,[25] although not equally pronounced in all of these 12 items. Younger speakers

[25] The only exceptions are item #2, where the IC is an object of the propositional verb *glauben* 'believe', and item #12, where the IC is a contrastive adverbial.

use considerably more *zum*-variants in cases where older speakers seem to avoid them, for example in the function of a subject (item #1), an object with the causative matrix verb *helfen* 'help' (item #3) or an attributive with the head *nichts* 'nothing' (item #14). At the same time, younger informants increase their use of the *zum*-variant in contexts where older informants already employ it frequently, namely, in ICs with the matrix verb *anfangen* 'begin' when the IC is not extended (items #5 to #7) and in an attributive IC with the head *etwas* 'something' (item #13).

In sum, these apparent-time findings indicate ongoing change, resulting in the spread of *zum*-ICs at the expense of the other variants. We see here a form of syntactic leveling that is unusual in that it is not a standard form that is spreading, but a nonstandard variant. However, the *zum*-variant is also the predominantly used ICs in colloquial language in most of the Upper German language areas (see AdA, www.atlas-alltagssprache.de/runde-7/f13b-d/ [retrieved 01.08.2023]). Moreover, there is reason to believe that this change does not constitute a formal, but a functional advergence to SG (see the discussion in section 5 below).

In order to illustrate geographical differences in change, figure 2 maps the total usage frequency of *zum*-ICs for older and younger speakers separately.

Our findings indicate that *zum*-ICs have become more frequent in most research locations (in 32 of the 40 locations). Moreover, this increase affects both Alemannic and Bavarian dialects. However, the change seems to be much stronger in the Alemannic dialects where *zum*-ICs are overall only a minority variant for older speakers but the majority variant for younger speakers. It is possible that this sharp increase of *zum*-ICs in Alemannic can be attributed to dialect contact with Bavarian, to which most Austrian dialects belong.

Within Bavarian, *zum*-ICs are quite widespread among older speakers, although it is notable the *zum*-ICs are increasing among younger speakers here. As can be seen from figure 2, this change affects the dialects in the (south)east more strongly than those in the (north)west of the Central and Central South Bavarian dialect area. Interestingly, the dialects in western South Bavarian are most stable because they retain the dialect variant *zu* + infinitive, while *zum*-ICs are uncommon among both older and younger speakers. This unusual retention of a syntactic variant with only a small areal distribution can probably be attributed to the fact that the dialectal *zu*-IC happens to be the sole IC variant in SG so that its status as standard variant exerts a stabilizing influence on the dialect.

5. Discussion and Conclusion

In this article, we presented and discussed results of the first study analyzing the variation and change of infinitival constructions (IC) in the Upper German dialects of Austria, based on data collected in a large-scale survey and with a standardized method across the country. In light of previous indications that the infinitive syntax in Upper German differs substantially from Standard German (SG) (see, for example., Bayer 1993, Brandner 2006, Schallert 2010, 2013), and considering that research into areal linguistics and linguistic typology has highlighted the importance of infinitival prominence for the study of comparative typology (see, for example, Mayerthaler et al. 1995:17, Schallert 2013), it is remarkable that there have been only a few comprehensive empirical studies and none in Austria on this phenomenon so far. To address this desideratum, we

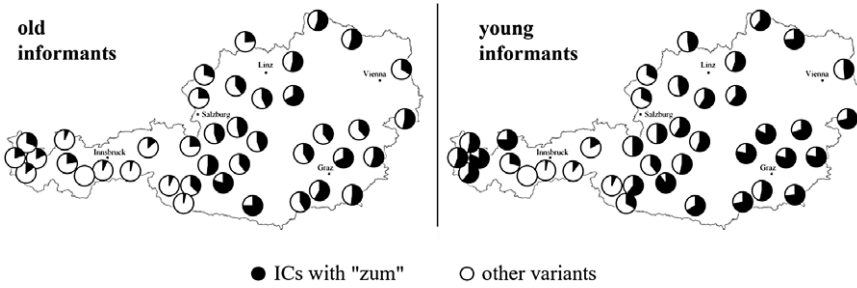

Figure 2. Apparent-time results, geographical differences for the usage of *zum*-IC.

examined 2,213 tokens, drawing on translations of 14 SG *zu*-ICs by 163 speakers from 40 locations in Austria. In the following, we summarize and discuss our findings against the backdrop of our four research questions (see section 1).

Research question 1 asked which variants of the SG infinitival construction with *zu* are used in which Austrian dialects and in which contexts. Our informants use seven main variants to translate the SG *zu*-ICs into their respective dialects (see table 2 in section 4). Most frequent are ICs with *zum* + infinitive. Additionally, we found evidence of ICs with bare infinitives ('1. Status' infinitives according to Bech 1955) as well as ICs with clitic *z'* and *zu* + infinitive. The most important alternative construction for ICs are subordinate clauses with *dass*. Other – but less frequent – variants include V2-clauses and nominalisations. On the whole, we demonstrate that the use of these variants is constrained by an interplay of geographical, linguistic, and social factors.

Research question 2 addressed the geographical patterns of these variants We identified clear patterns for three of the four IC variants (see figures A1 and A2 in the Appendix). The most strongly pronounced pattern is found in western South Bavarian, where *zu*-ICs are predominant (see also Mayerthaler et al. 1995, Scheutz 2016). This result runs counter to the claim by Bayer (1993:50) that Bavarian "lacks the *zu*-infinitive." In light of our current findings, this claim does not appear to hold true for all Bavarian dialects, but rather exclusively for the Central and South-Central Bavarian dialect area, where *zu*-ICs are only rarely used.

The other two obvious areal patterns pertain to differences between dialects in the western and dialects in the eastern parts of Austria. The IC with *zum* is the most frequently used variant overall and also the most widespread variant – *zum*-ICs are predominant in Central and South-Central Bavarian, and also in the eastern parts of South Bavarian. In ICs with adverbial function, however, the *zum*-variant is more widespread in Alemannic. The third areal pattern that we identified concerns the use of ICs with bare infinitives. Again, our findings can add to and, in part, also amend the previous body of research. ICs with bare infinitives were previously known primarily as a feature of Alemannic dialects (see, for example, Brandner 2006). However, they also occur in (western) Bavarian dialects (see also Schallert 2013: 120). Consequently, we see only a few categorical differences in the infinitive syntax between Alemannic and Bavarian – a finding which is very much in line with the assumption that syntactical variation is not only "in many cases a matter of statistical frequency," but

Table 17. IC variants and their constraints with regard to syntactic function

Syntactic function		Bare infinitive	*z'* infinitive	*zu* infinitive	*zum* infinitive
subject		*	(✓)	(✓)	(✓)
object	propositional verb	*	(✓)	(✓)	(✓)
	causative verb	✓	(✓)	✓	✓
	phase verb	✓	(✓)	✓	✓
adverbial		(✓)	(✓)	✓	✓
attributive		*	✓	✓	✓

also that it often "has a wider areal reach than phonological and lexical variation" (Kortmann 2010:846).

Research question 3: Equally relevant to the typological perspective are our results on linguistic factors of the variation. We could identify several structural constraints on the occurrence of the variants. Of particular importance is the syntactical function and the governing element (for example, the matrix verb). Table 17 summarizes our findings schematically – "*" indicates that the IC in question does not occur at all in the respective syntactic function, "✓" means that it fully does, and "(✓)" signifies that it does, but relatively rarely when compared to other syntactic contexts. In general, our results show that the use of IC variants in Austrian dialects is restricted mainly in object function with a propositional verb as matrix verb – as opposed to causative verbs and phase verbs – and in subject function. These findings correspond to the hypothesis that in modern (Upper) German dialects, the functions of ICs – and the functions of ICs with *zum*, in particular – have been extended to their use as complements in incoherent ICs, and that this process has affected certain verb classes and contexts first (see below and Weiß 1998:265–272, Donhauser 1989:297).

Regarding the use of different IC variants, we find that ICs with *zu* (in western South Bavarian) and ICs with *zum* (in all other dialects) have the fewest constraints, compared to ICs with bare infinitives and ICs with clitic *z'*. Our findings suggest that the use of ICs with bare infinitives is not only constrained in subject function and as the complement of a propositional verb but also in attributive function (the latter constraint also exists in Swiss German dialects; Brandner 2006: 215). In an adverbial function, the use of ICs with bare infinitives is apparently restricted to the use with the matrix predicate *gehen* ('go'), which can be employed as a grammaticalized semi-auxiliary verb in German (Demske 2020).

ICs with *z'*, in contrast, are realized across all contexts, though with comparatively low frequencies. Only in attributive function with indefinite quantifiers as head nouns is this variant more prevalent (for similar findings see Bayer & Brandner 2004 and Donhauser 1989:296). Consequently, ICs with *z'* are (synchronically) not just an "abbreviated" form of ICs with *zu* or *zum* (Weiß 1998:235–239), but rather a separate variant with its own usage patterns (irrespective of the historical development of this form, which cannot be discussed here).

Other linguistic constraints relate to the morphological make-up of the infinitive verb or the internal complexity of the IC. For example, the usage of ICs – in particular

those with *zum* – may be constrained when there are additional elements governed by the infinitive verb (as in extended infinitival constructions). This is the case even though most Austrian dialects allow the incorporation of simple indefinite nouns in such cases. Other elements (such as pronouns), however, cannot be incorporated in ICs in Bavarian. In general, when the IC is more complex, other structures (in particular *dass*-clauses) are preferred. Only in adverbial ICs in Alemannic may *zum* potentially precede even more complex embedded phrases (thus acting like a complementizer), or even be doubled (Brandner 2006:215–219).

Research question 4: With respect to ongoing language change and the direction of change, we focused on age-related differences. We found that younger speakers use *zum*-ICs more often than do older speakers in all but two of the 14 stimulus sentences with SG *zu*-ICs. While this is true for most of the research area (except for South Bavarian, see below), the age-related differences are most pronounced in the Alemannic dialect region of Austria (see figure 2 in section 4.5). These results "in apparent time" point to an ongoing change, consisting of the spread of *zum*-ICs at the expense of the other variants. What causes this change is not entirely clear. In line with Donhauser (1989) and Weiß (1998), there is reason to assume that the change is due to dialect–standard contact, and that the dialects change according to the model of the standard language. However, *zum* + Infinitive is a nonstandard variant. As the *zum*-IC is the most frequently used and the areally most widespread IC variant, it could be argued that we are observing a case of dialect leveling. But this does not appear to substantially affect western South Bavarian, a remote and linguistically conservative area, which seems to preserve its traditional *zu*-IC variant. We suggest a third scenario that accounts for the other two hypotheses in the spirit of the "two dimensions of levelling" (Hinskens 1998). In line with other dialect contact scenarios, we can assume a leveling process in which the most dominant variant – here: the *zum*-IC – spreads at the cost of smaller-scale variants. As we argued above (section 4.3), this process could also be interpreted as advergence to SG in that most younger Austrian dialect speakers perceive *zum*-ICs as norm of usage in spoken German in Austrian,[26] thus link SG *zu* with colloquial *zum* and transfer syntactical patterns from the former to the latter (for example, the use of extended ICs or the use of ICs with subject function). Importantly, however – and this supports the third scenario – this change process does not extend to western South Bavarian with the *zu*-IC variant, as this dialect variant happens to be identical to the SG variant.

Finally, despite the limitations of the number of items studied and the linguistic variables they offer, it is possible to go beyond the individual results and discuss the findings with a view to the typology and the grammaticalization of ICs but also regarding sociolinguistic implications:

- With regard to typological aspects, the finding of similar variant spectra in the Alemannic area (Vorarlberg and Eastern Switzerland with regard to bare infinitives and *zum*-ICs) and in the South Bavarian area (Tyrol/Western Carinthia and South Tyrol with regard to *zu*-ICs) corroborates Schallert's (2013:108–109)

[26] Recall that *zum*-ICs is also the prevailing variant in colloquial language in most of the Upper German language areas (see section 4.3).

assumption that "genetically" similar varieties in neighboring areas behave similarly in terms of infinitive embedding.

- As far as grammaticalization tendencies are concerned, our focus was on *zum*-ICs and *zu*-ICs. Our results on the spread of the *zum*-variant and the expansion of its grammatical functions are supported by statements in the literature which find such an expansion particularly pronounced among younger speakers (for example, Schallert 2013:121). In spite of the constraints identified here, *zum*-IC appears to be the most grammaticalized of all IC variants discussed here for the Central Bavarian dialect areas in Austria, while for the South Bavarian area this is *zu*-IC – just as in neighboring South Tyrol.
- In sociolinguistic terms, we saw an interesting case of the "two dimensions of levelling" (Hinskens 1998), which in the case of *zum*-IC offers a plausible explanation for the propagation of a syntactic variant, but in the case of *zu*-IC precisely for its stability.

On the whole, the present contribution illustrated how a large-scale empirical, systematic study of dialectal syntax can facilitate a broad diameter of descriptive potential concerning language variation, so paving the way to novel insights relating to its structure, multifaceted constraints, and the change of phenomena characteristic of ICs in natural languages. The example of ICs has demonstrated what potential still lies dormant in the further study of syntactic variables. In particular, our findings revealed that there are still some deep-rooted differences between the infinitive syntax in SG and (Austrian) dialects, which broadly corroborates the notion that the study of dialect syntax is an indispensable field of research on areal typology (Kortmann 2010:855).

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Appendix

Table A1. List of locations (the abbreviations refer to figure 1 in section 3.1)

	Location	State		Location	State
LI	Lingenau	Vorarlberg	AD	Adlwang	Upper Austria
LA	Laterns	Vorarlberg	UW	Unterweissenbach	Upper Austria
FO	Fontanella	Vorarlberg	AB	Allhartsberg	Lower Austria
TS	Tschagguns	Vorarlberg	KA	Kautzen	Lower Austria
NW	Nesselwängle	Tyrol	PU	Pulkau	Lower Austria
SW	Schönwies	Tyrol	WE	Weikendorf	Lower Austria
HB	Huben	Tyrol	KB	Kirchberg	Lower Austria
NS	Neustift	Tyrol	AP	Apetlon	Burgenland
GI	Ginzling	Tyrol	EZ	Eisenzicken	Burgenland
KS	Kelchsau	Tyrol	TU	Turnau	Styria
HO	Hopfgarten	Tyrol	FA	Feistritz	Styria
MA	Maria Alm	Salzburg	ST	Straden	Styria
HU	Hüttschlag	Salzburg	SS	St. Stefan	Styria
LE	Lessach	Salzburg	RA	Rassach	Styria
RB	Russbach	Salzburg	DB	Donnersbach	Styria
BD	Berndorf	Salzburg	SG	St. Georgen	Carinthia
MI	Mining	Upper Austria	PE	Pernegg	Carinthia
UB	Ulrichsberg	Upper Austria	ML	Malta	Carinthia
GP	Gaspoltshofen	Upper Austria	MO	Mörtschach	Carinthia
LS	Lasern	Upper Austria	SL	St. Lorenzen	Carinthia

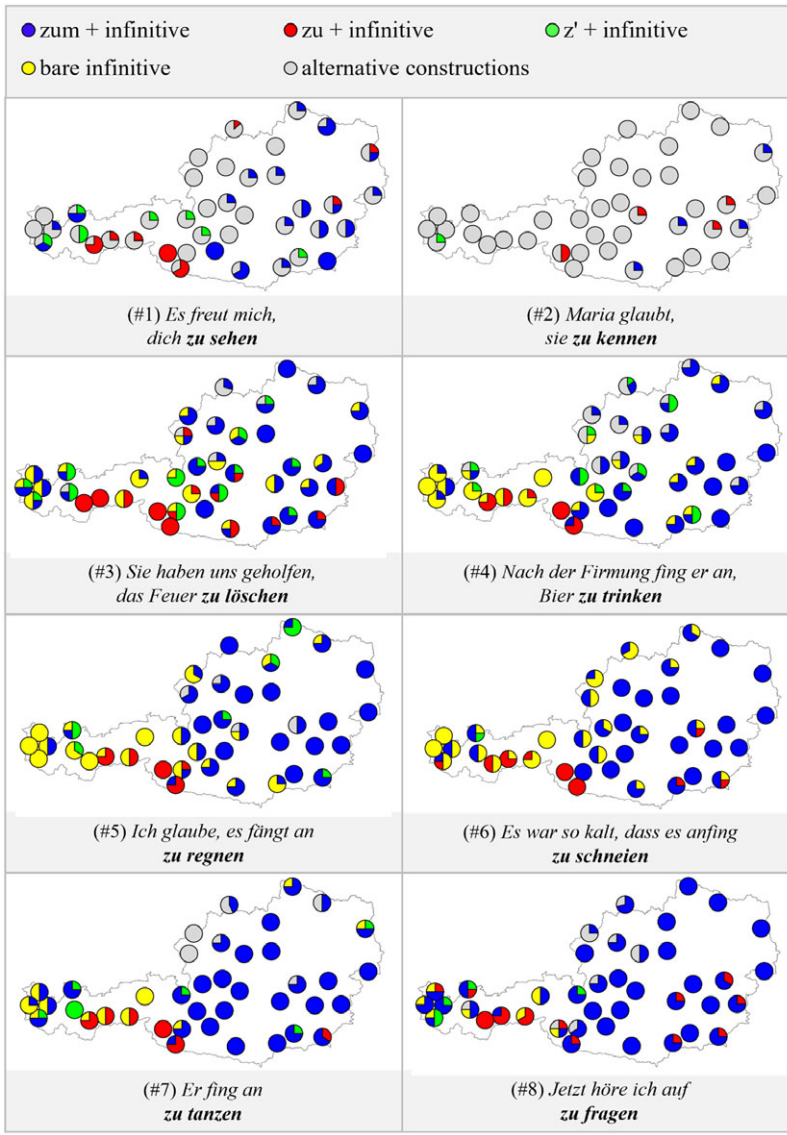

Figure A1. Geographical patterns for items #1, #2, #3, #4, #5, #6, #7, and #8.

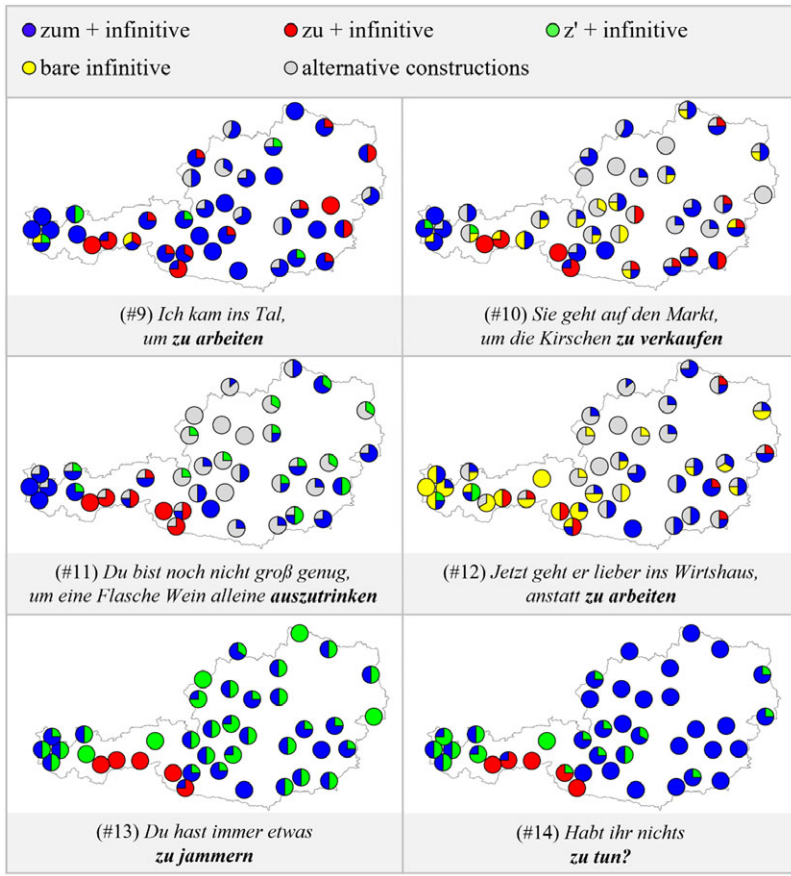

Figure A2. Geographical patterns for items #9, #10, #11, #12, #13, and #14.

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