6 Using Data Visualisations in a Participatory Approach to Multilingualism: 'I Feel What You Don't Feel'

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1 Introduction

This chapter can be read as a double story. On the one hand, it is an account of the use of interactive digital visualisations designed to make students reflect on multilingualism based on data they had previously helped generate (Storto, 2022). On the other, it attempts to show how the use of images can be incorporated into a larger research project to address issues related to ethics, knowledge production and social justice. By addressing topics of common interest to researchers, language teachers and educators, this account aims to stimulate discussions about the challenges and potentials of exploratory approaches to multilingualism in the language classroom, and the role of visual methodologies within this context.

The visualisations discussed in this chapter were implemented in the second phase of the *Ungspråk*[1] project, a three-year mixed methods study conducted in the Department of Foreign Languages at the University of Bergen, Norway. The main aim of the project was to investigate various aspects of multilingualism in Norwegian lower secondary schools (Haukås *et al*., 2021a). In the first phase of the project, 593 lower secondary students from seven schools answered the *Ungspråk* questionnaire (Haukås *et al*., 2021b), a digital tool developed to look into different aspects of multilingualism, such as the languages known and used by participants, their beliefs about and attitudes towards multilingualism and the role of language learning in developing their multilingual identities. In one of the sections of the questionnaire, participants were asked to complete the prompt 'To be multilingual means…', followed by the question 'Are you multilingual?'. Data from these two questions served as the basis for the development of the visualisations which were later used in interactive sessions with 114 students in one of the participant schools (the second

phase of the project). By adopting a participatory, exploratory approach to research in multilingualism in education (Storto, 2022; Fisher *et al.*, 2018), the interactive sessions, and the data visualisations of which they are a part, represent an innovative effort to enhance the quality of findings in academic research while allowing participants to expand their own knowledge of the phenomena being researched. The implications of this methodological move to research ethics, social justice and equity (CohenMiller & Boivin, 2021; Kubanyiova, 2008) will be discussed in Section 2.2.

Motivated in great part by the increasing linguistic and cultural diversity of contemporary societies, especially in the global north, the 'multilingual turn' in applied linguistics (May, 2014) has produced research in various fields of expertise. Within this context, the use of visual methods in language learning and teaching (Chik & Melo-Pfeifer, 2020) has come to the fore as a prominent line of research that contributes to a more refined understanding of the interplay between multiple languages, dialects, varieties and registers in educational environments and beyond. However, 'visual methodology is a very loose description for an eclectic collection of research approaches' (Chik & Melo-Pfeifer, 2020: 339) that deploy a variety of visual representations for distinct research purposes and participant groups. In their meta-analysis of 43 journal articles published in English between 2000 and 2018, Chik and Melo-Pfeifer (2020) provide an overview of research in language learning and teaching using visual methodologies. In order to better situate the reader, in what follows I focus on some of their findings which are useful for our discussions and contributions to visual methods in language research.

Among their most prominent findings are the predominance of small-scale studies, mostly below 50 participants, and the use of drawings and photos as the main visual component of the studies. In relation to the former, rather than simply claiming that our study includes a larger number of participants, one of its main contributions lies in the role of the interactive sessions and data visualisations in enhancing the quality of knowledge produced by research. These issues will be addressed in detail in Section 2.2 of this chapter.

Concerning the visual component in the studies surveyed, many authors mentioned the use of a 'drawing-only' methodology as the most common limitation of their studies, which can be partly attributed to the small sample size and the interpretative nature of the studies. In this regard, our contributions are not restricted to the fact that, incidentally, no study so far has explored the use of digital data visualisations to engage school children in discussions about multilingualism and language learning. Rather, the use of data visualisations is increasingly common in contemporary data-driven societies (Buzato, 2019; Lankshear, 2003) and, consequently, the ability to critically interpret data presented visually has become a relevant form of literacy in recent years (Bhargava & D'Ignazio, 2015;

Tønnessen, 2020; see also Introduction to this volume). As a consequence, our data visualisations were developed with the pedagogical aim of encouraging schoolchildren to interact and critically reflect on research data they helped to generate (Storto, 2022), and they were designed to be adapted to other educational settings, therefore being of potential interest to language teachers, educators and other stakeholders.

Finally, most research using visual methods in educational settings tends to focus exclusively on multilingual speakers with an immigrant background or from language minorities (see, for example, Chik & Melo-Pfeifer, 2020; Kalaja & Melo-Pfeifer, 2019). Our study broadens the profile of participants by including lower secondary school students regardless of their family or ethnic backgrounds, the languages in their repertoire or whether they learn a second foreign language at school or not.

Based on what has been discussed so far, I propose the following research questions, which will be addressed in the next sections of this chapter:

(1) How can data visualisations be integrated into a larger research project while addressing issues related to ethics, knowledge production and pedagogy?
(2) How can data visualisations be used to engage participants in discussions about multilingualism, while providing them with autonomy in interpreting research findings?

The chapter starts by contextualising multilingualism and language learning in Norwegian society. The focus then shifts to our first research question and the integration of ethics, knowledge production and pedagogy in our project, as a means of addressing social justice in research on multilingualism and language learning. The discussions then move to the design of interactive digital data visualisations based on data participants helped generate. Particular attention is paid to the interactive features of the visuals and their role in helping answer the second research question. In the findings section of this study, two interrelated aspects of multilingualism will be explored, namely, the 'use' and 'proficiency' dimensions (Cenoz, 2013), based on novel readings of the data that emerged from participants' interactions with the visuals. The chapter concludes with some reflections on the lessons learnt from our project.

2 Background to the Study

2.1 Multilingualism in Norwegian society and education and the *Ungspråk* project

Norway is a country with an intrinsically rich linguistic and dialectal diversity. Apart from two official languages, Norwegian and Sami (a group of indigenous languages used in northern Scandinavia and parts

of Russia), the country has three minority languages (Kven, Romani, Romanes), a national sign language (Norwegian sign language) and a host of regional dialects that are commonly used in different domains of society. Norwegian has two written variants, Bokmål and Nynorsk, which are taught simultaneously from year 8 of lower secondary school.[2] In addition, most Norwegians can understand standard Swedish and Danish, due to the typological proximity between the languages (Olerud & Dybvik, 2014).

English is taught as a foreign language from the first year of primary school. At the age of 13, when students start lower secondary school (the focus of our study), they can opt for taking a second foreign language (predominantly, Spanish, French or German) or other elective subjects. According to official figures, 75% of students choose a second foreign language when starting lower secondary school (Foreign Language Centre, 2020). In the last decades, the linguistic scenario at schools has been enriched even further by a host of immigrant languages. According to Statistics Norway (2022), 18.9% of the Norwegian population is composed of immigrants and Norwegian-born to immigrant parents. Such figures imply that a significant percentage of the school population has a family language other than Norwegian. This brief outline allows us to conclude that virtually all schoolchildren in Norway can be considered multilingual, and this fact is also acknowledged in Norwegian language curricula, which portray students' 'multilingualism' (and 'flesrpråklighet', the Norwegian equivalent) as a resource (see, for example, the Norwegian curriculum for foreign languages, Norwegian Directorate for Education and Training, 2023).

It is amidst this rich linguistic scenario that the *Ungspråk* project set out to investigate various aspects of multilingualism in Norwegian lower secondary schools (Haukås *et al.*, 2021a). Following calls for research on multilingualism to be conducted multilingually (Holmes *et al.*, 2013, 2016; see also Introduction to this volume), the *Ungspråk* project was composed of a team of multilingual researchers with diverse linguistic and cultural backgrounds (Haukås *et al.*, 2021b). In order to approach such a multifaceted phenomenon as multilingualism among young learners, we opted for a mixed methods design that combines the strengths of quantitative and qualitative methodologies and research instruments to enhance the overall quality of the findings (Schoonenboom & Johnson, 2017). Table 6.1 below summarises the mixed methods design of the *Ungspråk* project and situates the data visualisations in the chronology of the research process.

In the mixed methods design of the *Ungspråk* project, the point of integration (Morse & Niehaus, 2009) provides a feedback loop in the research process in which some of the data from the questionnaire are presented back to participants as a means of making them 'reflect on their reflections'. The ethical, epistemological and pedagogical implications of such a methodological move, along with the role of the visualisations in this process, are discussed in the next section.

Table 6.1 Mixed methods design of the *Ungspråk* project[3]

The *Ungspråk* project	**Phase I (Apr./Aug. 2019)**	**Point of Integration (2019/2020)**	**Phase II[4] (Dec. 2020)**
Research instruments	*Ungspråk* online questionnaire (Quantitative component)	Design of digital visualisations based on data from the questionnaire	Interactive sessions using **data visualisations** (Qualitative component)
Number of participants	**593 students** (Year 8 lower sec. school)	Development of the interactive sessions	**114 students** (Year 10 lower sec. school)
Participant schools	**7 schools** in the city of Bergen	Piloting of visuals and sessions	**1 school** from the first phase

2.2 Data visualisations: Integrating ethics, epistemology and pedagogy in research on multilingualism

In the *Ungspråk* project as a whole, and particularly in the methodological rationale adopted in the development of the visualisations discussed in this study, there are three interrelated dimensions. They are ethics (or the nature and governing principles of human relationships and, particularly in our case, research ethics); epistemology (or the nature, purposes and scope of knowledge production, including academic research) and pedagogy (or the fundamentals and objectives of educational praxis). This section explains the role of data visualisations in the integration of these three dimensions, as a means of answering our first research question. By doing so, I hope to show readers why adopting visual methods in language research is more than simply using images in our studies.

The discussions start with research ethics and social justice. It is a common premise in research ethics that participants should somehow benefit from academic research. For instance, the Norwegian *Guidelines for Research Ethics in the Social Sciences and the Humanities* (NESH, 2022) state that participants 'are entitled to be informed about the results of the research' (NESH, 2022). Even though this is acknowledged to be the case, frequently, the demands and pressures of academic life often lead researchers to restrict themselves to general ethical procedures overseen by ethics committees (such as obtaining consent from participants, guaranteeing their anonymity and protecting their well-being), rather than 'consulting the children about their thoughts and reflections afterwards' (Pinter & Zandian, 2015: 237; see also Alderson, 2000; Christensen & Prout, 2002).

Even though general ethical procedures are of primordial concern in any kind of research, there are always unforeseeable situations that demand researchers to be attentive to 'ethically important moments' (Guillemin & Gillam, 2004: 262) that emerge from their interactions with participants and colleagues along the research process. Kubanyova named such

situations 'microethics' to refer to 'everyday ethical dilemmas that arise from specific roles and responsibilities that researchers and research participants adopt in specific research contexts' (Kubanyiova, 2008: 504). As a side note, I believe the concept of *microethics* in research not to be very far from the ethical classroom dilemmas teachers are often confronted with. In retrospect, an 'ethically important moment' happened during my first face-to-face meeting with my research supervisor, at the beginning of the project in 2018. On that occasion, she mentioned that we should start thinking of how to give something back to participants as a way of wrapping up our activities at the end of the project. Eventually, her recommendation matured into the idea of presenting participants with findings during the research process as a means of redressing a recurrent gap, especially in research conducted with a large number of participants.

The idea of presenting participants with findings from the *Ungspråk* questionnaire also had important implications for the quality of the knowledge produced by research. For the purposes of promoting meaningful discussions on multilingualism, participants' responses to the prompt 'To be multilingual means …' can be considered as their own analytical framework (O'Kane, 2008) to the phenomenon in question. Rather than starting from pre-determined, scholarly-centred concepts and categorisations, using participants' own data is potentially more engaging and, therefore, more likely to make them 'relate the new knowledge to themselves and their lives' (Fisher *et al.*, 2018: 461). Similarly, we decided to include data from the question 'Are you multilingual?' because of their potential to make students draw inferences from the percentage of the responses (Storto, 2022). The methodological move of confronting participants with the plurality of their own voices addresses calls for research to focus on 'how they themselves make sense of various aspects of their multilingualism' (Kalaja & Pitkänen-Huhta, 2018: 158), while engaging participants in the creation and dissemination of scientific and academic knowledge (see Introduction to this volume). In the *Ungspråk* project, such a methodological move has the double benefit of enhancing both the participants' and researchers' understanding of multilingualism and the factors that contribute to the self-identification of participants as multilingual speakers, including the learning of foreign languages at school (Storto, 2022).

Finally, there was the practical question of how to accomplish all the above, and this is where the data visualisations come into play. Since the mechanics and structure of the visuals, as well as the methodological procedures adopted in their development, are discussed in detail elsewhere (Storto, 2022), the following discussion focuses on a crucial interactive feature of our visuals that requires further explanation.

As a guiding pedagogical principle, we wanted participants to have meaningful interactions with the data that stimulated critical reflection and independent action (Little, 1991; Palfreyman & Benson, 2019) in

interpreting the findings. To this end, in our data visualisations information is not apprehended solely by a 'visual' reading of the images. Rather, they require of the users the 'tactile' manipulation of the visual elements, to explore different possibilities of organising, categorising, and therefore interpreting the data. Briefly, such operation involves the testing of their affordances (or 'what the visualisations allow us to do with the data') and the elaboration of interpretations warranted by them (or 'what kind of readings are possible based on what the visualisations allow us to do with the data'). Drawing on insights from an interdisciplinary pool of studies from fields as diverse as phenomenology (Merleau-Ponty, 2002), anthropology of the senses (Howes, 2005; Pink, 2011, 2015), sociology (Paterson, 2007), cultural and media studies (Marks, 2002; McLuhan, 2013; Miller, 2014; Richardson, 2012), cognitive psychology (Gibbs, 2003, 2005; Shapiro, 2010) and multimodality (Bezemer & Kress, 2014; Hurdley & Dicks, 2011; Jewitt & Mackley, 2018), I argue that what fundamentally distinguishes any image in the digital medium from their analogical counterparts, including printed images, is the fact that they are never purely 'visual', but rather they engage users in a tactile-visual experience in which the eyes and hands coalesce (Richardson, 2012; Storto, 2021).

Based on the common underlying premise from the disciplines above that sensory engagements are vital both to 'humans' experiences of the world and to meaning-making' (Lupton, 2017: 1601), our data visualisations invite users not just to 'look at', but literally to 'manipulate' the data to obtain their own readings and interpretations. From the perspective of the use of visual methods in language research, the multisensory approach to digital images adopted in our study addresses the need to pay 'greater attention to embodiment and multimodality' (Kalaja & Melo-Pfeifer, 2019, foreword; see also Introduction to this volume), while contributing to research that works 'at the intersection of the sensory and the semiotic' (Jewitt & Mackley, 2018) to explore the role of the sense of touch in digital communication (Storto, 2021).

3 Research Methodology

3.1 Details of the interactive sessions

The interactive sessions (see Table 6.1) happened on two consecutive days in December 2020. In total, 114 students from five different classes participated in the sessions, which took place in one of the schools from Phase I. Each session lasted for about one hour. Within our exploratory, participatory framework to research on multilingualism (Storto, 2022), the interactive sessions are conceived as actions through which researchers and participants in a study can engage with research data and each other in a dialogical manner (Haukås *et al.*, 2021b). As discussed earlier, the sessions have implications for research ethics, social justice and equity

(Piller, 2016; Storto, 2022; see also Introduction to this volume) and they are grounded on a methodological stance that seeks to increase the societal relevance of academic research and to reconcile research and scientific rigour with the needs and expectations of participants (Haukås *et al.*, 2021a; Moita Lopes, 1998; Ortega, 2005). In order to achieve these aims, the data visualisations are fundamental research tools. During the sessions, I conducted the interactions and activities with the visualisations, while a colleague from our research team took observation notes. Since the main objective was to stimulate meaningful reflections based on research data, one important feature of the sessions is that participants were encouraged to work and provide answers to all the activities in pairs (Storto, 2022).

3.2 General dynamics of the data visualisations

As stated earlier, the visualisations used in the sessions were based on data from the *Ungspråk* questionnaire, and they represent participants' textual data to the prompt 'To be multilingual means …', and numerical data for the answers to the question 'Are you multilingual?' ('Yes', 'No' or 'Not sure'). Figures 6.1 and 6.2 below are illustrative images of the data visualisations. In order to better comprehend the dynamics, affordances, and different levels of interaction of the actual visuals, readers are recommended to access them via the hyperlinks in the notes section.[5]

The visualisation in Figure 6.1 is a bubble graph structured in four layers (Storto, 2022). The visual was designed to facilitate cognitive engagement and exploration of the data via manual, oral and written activities that allow different paths of interpretation (Bhargava & D'Ignazio, 2015). The visualisations in Figure 6.2 are an ensemble of more

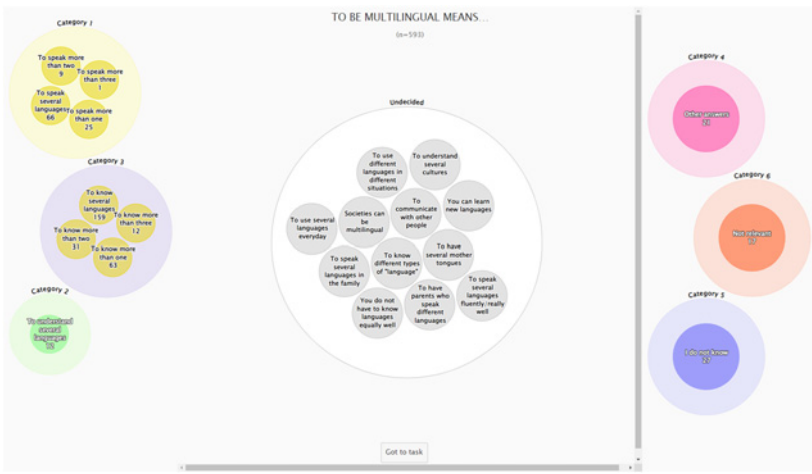

Figure 6.1 First layer of the visualisation 'To be multilingual means …'[6]

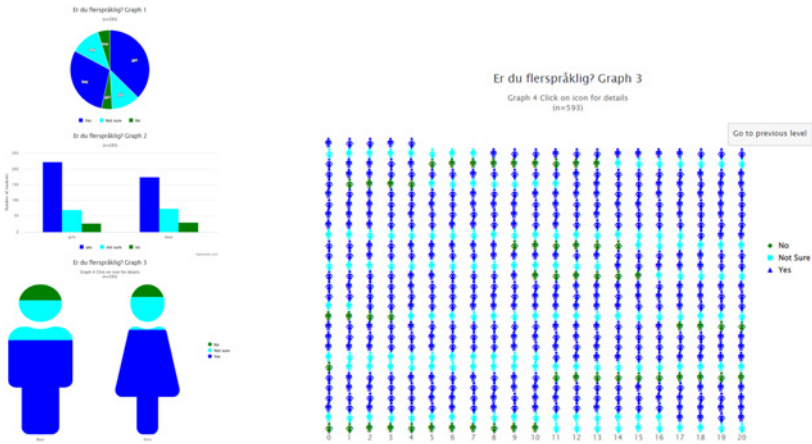

Figure 6.2 Different visual representations of participants' answers to the question 'Are you multilingual?'

conventional forms of representation (such as a pie chart, a bar graph and an 'icon crowd') that encourage participants to explore different aspects of the same dataset by drawing on the specific affordances of each visual (Storto, 2022). In what follows, we focus our analysis on the data obtained from participants' interactions with the bubble graph (Figure 6.1), which are related to two interrelated dimensions of multilingualism that have been explored in academia: the 'proficiency' and the 'use' dimensions of multilingualism (Cenoz, 2013).

3.3 Data collection

In the interactive sessions, participants were asked to group the categories in the middle of the bubble graph according to what they thought they had in common (as in the example in Figure 6.3).

Visual data of their groupings were stored in a server for later analysis. When the task was completed, participants were encouraged to share and explain the reason for some of their groupings with the whole class. Afterwards, they were invited to contrast their own groupings with those done by the researchers (see Figure 6.4). Rather than presenting participants with the 'right' responses, the purpose of this task was to explain how we had made sense of the data they had helped to generate, thus providing extra input to stimulate the discussions (Storto, 2022).

After comparing their own groupings with the researchers', participants were presented with textual prompts that invited them to reflect on further aspects of multilingualism implied by each grouping (as an example, see Figure 6.5). Finally, participants chose a prompt they wanted to interact with and wrote their reflections in an online mini survey, which were also saved for later analysis.

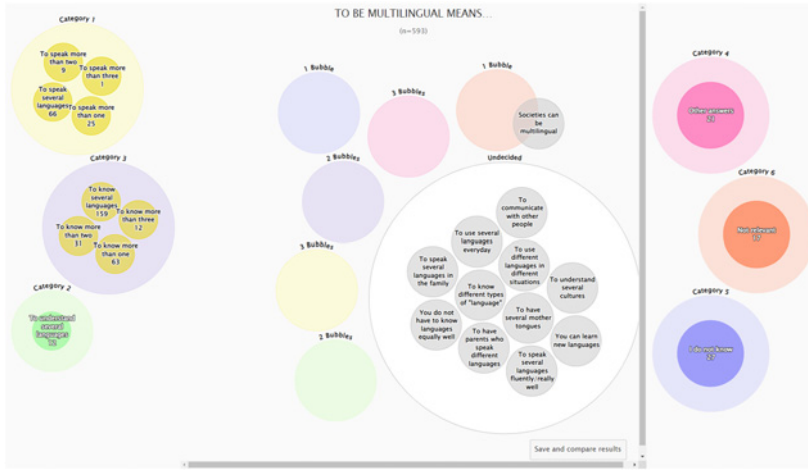

Figure 6.3 Categories being grouped together using the 'drag and drop' functionality of the visualisation

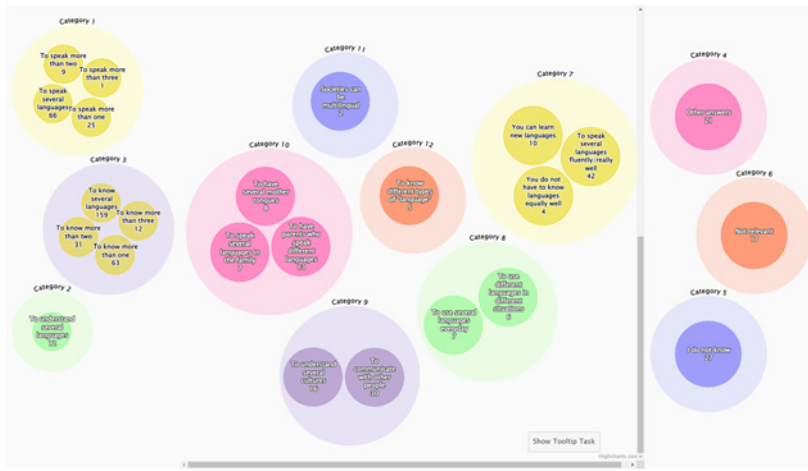

Figure 6.4 Layer of the visualisation showing the grouping of the categories done by the researchers[7]

3.4 Data analysis

In order to provide input to answer the second research question, in this section I narrow down the focus of the analysis to participants' interactions and reflections with the categories 'to use different languages in different situations' and 'to use several languages everyday'[8] (see Figure 6.6). These two categories were grouped together by researchers because they address two interrelated, commonly mentioned aspects of multilingualism in individuals, namely, frequency and contexts of use of languages. For example,

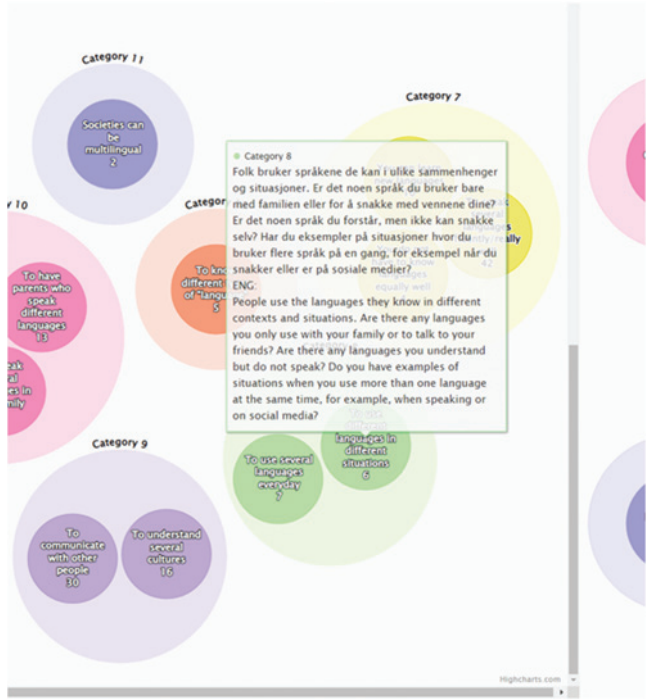

Figure 6.5 Example of a textual prompt for the categories 'to use different languages in different situations' and 'to use several languages everyday'

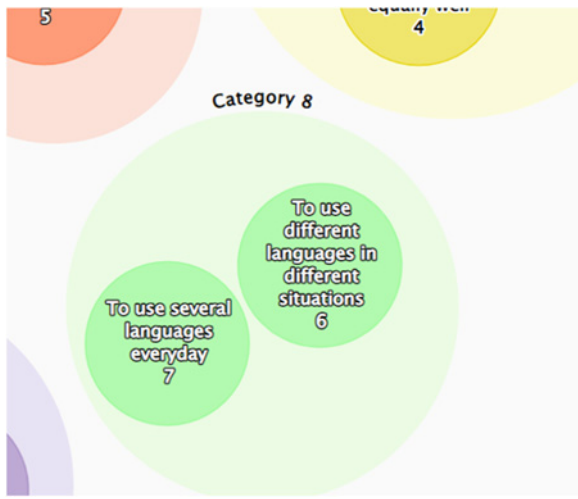

Figure 6.6 Detail from Figure 6.4 showing the two categories discussed in this section

the European Commission defines multilingualism as 'the ability of societies, institutions, groups and individuals to engage, *on a regular basis*, with more than one language *in their day-to-day lives*' (European Commission, 2017, italics added). The practical, 'use dimension' (Cenoz, 2013) of multilingualism mentioned by some of the respondents to our questionnaire is also seen among scholars as one of the main defining characteristics of bi- and multilingual individuals (Cenoz, 2013; Grosjean, 2010).

In relation to the engagement of participants with the data, an outstanding finding from the interactive sessions is the high co-occurrence of the two categories: out of a dataset comprising 31 groupings[9] done by participants in pairs, 20 (64.5% of the total) combined the two categories together. Out of the 20 groupings, seven paired up the two categories alone, in the same way done by researchers (Figure 6.6) and the remainder ($n = 13$) added a third category to the pair. Considering that the groupings were the result of participants' experimentations with the data and discussions with peers, it seems reasonable to claim that a significant number of participants consider that frequently using different languages in different situations are two interrelated aspects that define multilingual individuals. However, this general assertion does not account for the rationale adopted for grouping the two categories together in each individual case, and should therefore be approached with caution.

In the next section, we explore some of the findings from the groupings of these categories done by participants. The discussions are complemented by participants' responses to the textual prompt for the categories 'to use different languages in different situations' and 'to use several languages everyday' (Figure 6.5).

4 Findings

As argued earlier, a prominent design feature of our data visualisations is that they facilitate novel readings of the data emerging from categorisations conducted by participants. In relation to our second research question, the 13 groupings that added a third category to the pair in Figure 6.6 offer a glimpse into unexpected readings of the data that do not conform with the ones done by researchers. An example is five groupings that joined the two categories above with the category 'to speak several languages fluently/really well' (see Figure 6.7).

From a theoretical perspective, such groupings are interesting because they conflate the practical, 'use' dimension with the 'proficiency' dimension of multilingualism (Cenoz, 2013). The level of proficiency required in the different languages in order to characterise individuals as multilingual has been the object of long discussions in the academia (for example, Baker, 2011; Bassetti & Cook, 2011; Cenoz, 2013). Following Bassetti and Cook (2011), Cenoz argues that most academic definitions of multilingualism focusing on proficiency tend to fall into two groups: 'One

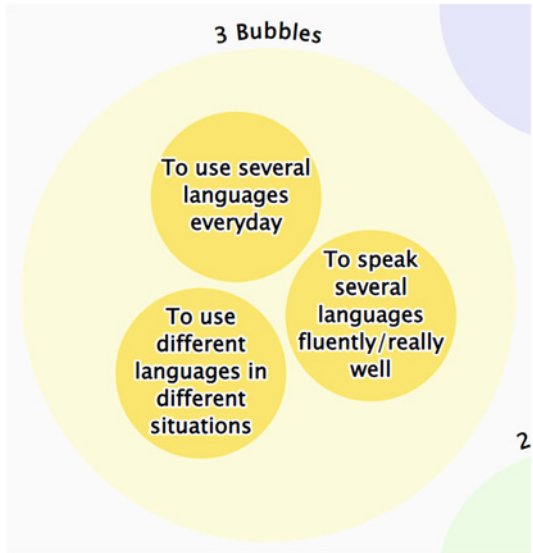

Figure 6.7 Illustrative image of five groupings in the dataset including the category 'to speak several languages fluently/really well'

considers maximal proficiency to be necessary, while the other accepts minimal proficiency' (Cenoz, 2013: 6). In recent years, claims have been made for a practice-oriented, usage-based view of language knowledge and proficiency (Canagarajah, 2013; Hall *et al*., 2006) that sees contexts of use both shaping and shaped by the language practices of multilingual speakers (Pennycook, 2010).

Based on these observations, the groupings represented in Figure 6.7 can be interpreted as readings of the data that conflate the three categories in a spectrum between the incremental and co-occurrent ('To be multilingual means to speak several languages really well AND use them regularly in different contexts') and the causational-inferential ('To be multilingual means to speak several languages really well BECAUSE they are used regularly in different contexts').

Another relevant aspect of multilingualism that brings together the dimensions of proficiency and use emerged in the participants' reflections based on the textual prompts to the category (see Figure 6.5). Out of 52 written reflections collected during the sessions, six replied to the prompt for the grouping of the two categories we have been discussing.[10] The prompt in the visualisation is the following:

> *People use the languages they know in different contexts and situations. Are there any languages you only use with your family or to talk to your friends? Are there any languages you understand but do not speak? Do you have examples of situations when you use more than one language at the same time, for example, when speaking or on social media?*

To the prompt above, one participant provided the following reflection:[11]

> It's not necessary at all to use a language almost every day to call yourself multilingual. I know speak (*sic*) English fluently, yet I don't need to use it every day to be considered as multilingual. Some students also answered that if you're able to understand more than one language you're multilingual. I understand both Swedish and Danish, but I rarely use that (*sic*). Still, that would make me multilingual even though I rarely hear both of them.

A striking feature of the segment above is the fact that the participant does not start by addressing any of the questions in the prompt but instead chooses to challenge the idea of frequency in the use of languages implied by the category 'to use several languages everyday'. Only later, as a development of the reflections, does the participant indirectly answer the second question ('Are there any languages you understand but do not speak?'), by stating the ability to understand Swedish and Danish. Curiously, Scandinavia is often mentioned in the literature as a paradigmatic example of 'receptive multilingualism' (Zeevaert & Ten Thije, 2007), or the phenomenon of inter-comprehension among speakers of typologically related languages, and partial knowledge of Swedish and Danish was often mentioned in the *Ungspråk* questionnaire and in the interactive sessions as a component of the participants' multilingualism, and not just in the example above.

Receptive multilingualism brings together the 'proficiency' and 'use' dimensions of multilingualism (Cenoz, 2013) while factually challenging the notion of maximal proficiency in and active use of all the languages in the repertoire of multilingual speakers. In the case of the participant above, these aspects of receptive multilingualism could be paraphrased thus: 'I am multilingual also because I understand both Swedish and Danish, even though I rarely use these languages'. In relation to the aim posed by our second research question, namely, the development of data visualisations that facilitate autonomy in interpreting the findings, the passage above is noteworthy because it shows how the participant's own interpretation of the information in the visualisation ('Some students also answered that if you're able to understand more than one language you're multilingual'[12]) led to the conclusion that the receptive knowledge of Swedish and Danish would qualify her/him as a multilingual speaker, in spite of the lack of frequency in using the languages.

5 Lessons Learnt

In relation to our second research question, the discussions above served as a brief example of the potential of using data visualisations in research on multilingualism and language learning. Our analysis attempted to show how, via their engagement with the data visualisations,

their peers and researchers, participants questioned the data and provided novel readings that have the potential to enhance their knowledge of what it means to know and learn several languages. Following calls from proponents of visual methods to go 'beyond words to access the lives and worlds of these multilinguals through visual medium' (Kramsch, 2019, foreword), the data analysis also combined visual elements (groupings of the categories) and textual ones (participants' written reflections) to enhance research knowledge on multilingualism. In addition, just as 'going beyond words' does not mean 'leaving them behind' in our analyses, I argue that adopting a theoretical and methodological stance that goes beyond the purely 'visual' aspects of digital images can be a fruitful route to understand how sight and touch, 'eyes' and 'hands' are integrated into the meaning-making and learning processes in digital media (Storto, 2021). To this end, this chapter provides evidence that the 'visual-haptic' interaction of the participants with the data facilitated the emergence of novel readings and reflections.

The use of data visualisations poses a theoretical question about the status of our exploratory approach to multilingualism. To a certain extent, it can be argued that the visuals presented in this chapter are a powerful tool for 'objectifying', not just a complex and nuanced phenomenon such as multilingualism, but more importantly, the participants themselves and their subjective, lived experiences of language (Busch, 2015; Kramsch, 2009; see also Introduction to this volume). Such claims move our discussions beyond the design process of our data visualisations, or their 'content history', to their 'material and rematerializing history' (Iedema, 2003), or the account of the visualisations as abstract 'objects of thought' produced by researchers with their own agendas and interests. From such a perspective, the value of the visualisations as research and pedagogical 'objects' can only be assessed according to the extent to which they 'affect (enable and constrain) interaction and the formation of subjectivity' (Kress & Van Leeuwen, 1996: 39 quoted in Iedema, 2003). Only then would the visualisations cease to be simply 'objects of thought' and become 'objects for thinking' about multilingualism and language learning; objects whose meaning-making potentials are constantly changing as they are used 'from context to context, from practice to practice, or from one stage of a practice to the next' (Iedema, 2003: 41).

Even though the visualisations can be seen as an objectification of a complex phenomenon (especially because of the nature of the data they represent), they are an important component of a subjective approach to multilingualism (Kalaja & Melo-Pfeifer, 2019; Kramsch, 2009) that attempts to explore how schoolchildren themselves 'feel about becoming or being multilinguals, or what the different languages and their uses might mean to them personally' (Kalaja & Melo-Pfeifer, 2019: 3). In relation to answering our first research question, this chapter also provided an account of how our exploratory, participatory approach involved the

design of interactive data visualisations (pedagogical dimension of research) aimed at enhancing both the researchers' and participants' knowledge of multilingualism (epistemological dimension of research), while simultaneously engaging participants in the research process (ethical dimension of research).

From the perspective of visual methods in language learning, the interactive sessions, and the visuals of which they are a part, contribute to broadening the repertoire of research methodologies, while addressing issues related to ethics, knowledge production and social justice in research on multilingualism and language learning, which were posed by our first research question. In relation to the pedagogical challenges involved in the development of digital visual tools, I argued for the need to consider the potential of visual-haptic interaction with the data, as a means of engaging participants with the findings and facilitating novel and unexpected readings. In addition, the sessions and the visuals represent an effort towards more structured pedagogical interventions aimed at enhancing participants' awareness of multilingualism, which ultimately might have a positive influence on their future language learning trajectories (Fisher *et al*., 2018; Storto, 2022). Such an effort also addresses calls in current Norwegian curricula[13] for harnessing pupils' previous linguistic knowledge and learning experiences as a resource in the language classroom.

Like in most lessons learnt, the visuals and the sessions were also useful for determining the gaps and limitations of our exploratory approach. In retrospect, the sessions could have profited from a closer collaboration between the researchers and the language teachers at schools. Unfortunately, due to the busy agendas of all involved and the broader context of a global pandemic in which the sessions took place, such a goal was not achievable. In relation to practical aspects of the visuals, the grouping of the categories in the bubble graph (Figure 6.1) proved to be a bit challenging to participants, especially because of the number of categories they were asked to sort. During the sessions, this limitation was remediated by providing them with practical examples of sorting the categories. As for the aims posed by our second research question, the visuals and the sessions proved to be effective in engaging participants with the data and generating meaningful discussions. Even though participation in the sessions was voluntary, due to the large number of students involved, not all of them were equally interested (nor were they supposed to be) in the topics proposed by the sessions and the visuals. After all, multilingualism is not an uncontested value (Blackledge & Creese, 2010; Fisher *et al*., 2018).

The modular design of the visuals, along with their interactive features, make them promising pedagogical tools that have been tested in real classroom contexts and that can be adapted to other learning environments with different language backgrounds, therefore facilitating

potentially different learning outcomes. In addition, the visualisations presented in this chapter are a step towards visual methodologies that draw on the potential of digital tools in exploring multilingualism and language learning. In this respect, one possible future direction for research would be the design of digital tools that model the language practices of individuals and groups and that allow stakeholders to input their own data (Storto *et al.*, 2023).

The agentive role of teachers in language learning processes cannot be overstated. In relation to the development of multilingual pedagogies that draw on the linguistic repertoire of students as a resource for language learning (for example, Council of Europe, 2020; García & Flores, 2012), such a crucial role quite often overburdens teachers with high expectations about their own transformative power, without much material and methodological support from language policy planners, academic researchers and other stakeholders. From this perspective, this report aimed to contribute by offering some tangible 'objects for learning' that can be adapted and used by teachers to promote discussions about multilingualism and language learning in their classrooms. Regarding methodological issues, the discussions in this chapter can be read as an attempt to foster a productive dialogue between practitioners and researchers. After all, it does not take much empirical evidence to realise that, prior to being researchers, the vast majority of academics working on language research are (or have been) language teachers themselves, and as a consequence, theoretical advancements in the field emanate primarily from classroom practice. Ultimately, I see such dialogue as a fundamental component of research practices that would broaden the scope of social justice beyond parity of participation in cultural, economic and political domains (see Introduction to this volume) to include parity of participation in knowledge production and academic research.

Notes

(1) The coined term *Ungspråk* is made of the words *ung* ('young'), and *språk* ('language'), both in the singular and plural forms. The ambivalence of the term alludes to the linguistic diversity of the learners and the possibility of their self-identification as monolingual or multilingual individuals.
(2) The Norwegian educational system is structured as follows: primary school (years 1 to 7, age group 6–13). Lower secondary school (years 8 to 10, age group 13–16) and upper secondary school (years 11 to 13, age group 16–19).
(3) Adapted from Storto (2022).
(4) Phase II of the project has another strand that comprises interviews with language teachers based on some of the findings from the questionnaire.
(5) https://org.uib.no/multilingual/Engelsk/Betyr.html
https://org.uib.no/multilingual/ErDu/ErDu.html
(6) For easier comprehension, a translated version in English of the bubble graph is provided. During the interactive sessions, the wording in the visuals was in Norwegian.

(7) The figures in each category represent the number of the participants' answers from the *Ungspråk* questionnaire ($n = 593$).
(8) In Norwegian, the wording for the categories is the following, respectively: 'å bruke ulike språk i ulike situasjoner' and 'å bruke flere språk i hverdagen'.
(9) Due to technical problems during data collection, only data related to the groupings from the second day of the interactive sessions are available.
(10) Importantly, the participants' choices for a textual prompt are independent of their category groupings. In the case of the example provided, just because the participant chose to respond to the prompt, it does not necessarily mean that s/he had previously grouped these categories together when experimenting with the data.
(11) The answer was originally in English. Minor spelling, punctuation and capitalisation adjustments have been made by the author.
(12) The participant is referring to the category 'to understand several languages', located at the bottom left of the visualisation in Figure 6.4.
(13) See for example, the Norwegian Curriculum for Foreign Languages – FSP01-03 (Norwegian Directorate for Education and Training, 2023).

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