



Original Research

Language-Related Challenges and Recommendations of Migrant Families Visiting Dutch Science Museums

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Abstract: Science museums can be a rich learning context, where visitors engage with scientific practices with few formal requirements. However, science museums can be experienced as not welcoming to migrant families due to social, economic, and cultural barriers. In this study, we asked what language-related challenges migrant families experienced in Dutch science museums and what recommendations they had for linguistic inclusion. We interviewed twelve families of Turkish, Moroccan, or Syrian backgrounds after their visit to a Dutch science museum. We discovered that (1) first-generation families found the predominance of Dutch in the museum challenging, (2) the science language used in the museum brought on additional challenges, and (3) the families saw potential emotional benefits to the presence of their mother tongue in the museum, albeit expressing a need for Dutch to remain at the center of the linguistic landscape in the museum. These findings show that language plays a role in migrant families' experiences in science museums. The findings invite science museums to engage in a dialogue with migrant communities about their needs when it comes to more inclusive museum experiences.

Keywords: Multilingualism, Language, Science Museums, Migrant Families, Inclusion

Introduction

People of minority backgrounds do not participate as much in science practices as people of majority backgrounds (Graves et al. 2022). A context where inequity in science is evident is science museums (Feinstein 2017). Research shows that children and families of migrant backgrounds, specifically, can face economic, sociocultural, and linguistic barriers that hamper their experiences in science museums (Papadimitriou et al. 2016). In science museums, migrant families may feel uninterested, or even out of place and disoriented (Archer et al. 2016). Language has been shown to play a role in migrant families' experiences in science museums, as both a hinderer and an enabler of participation (e.g., Dawson 2014b; Kwon 2019). Through this exploratory study, we aim to learn more about the challenges and recommendations of migrant families surrounding science museums in the Netherlands, with a focus on linguistic inclusion. Understanding more about families' language-related challenges in, and

recommendations based on, their science museum visits is a step toward designing multilingual strategies for greater participation of migrant families in science museums.

Science museums are cultural institutions specifically designed for engaging with and learning science (Bell et al. 2009). Since the 1980s, researchers have recognized museums as privileged sites for family learning (Ellenbogen et al. 2004). In science museums, families are invited to observe and interact with texts, media, objects (e.g., fossils, microscopes), and people (e.g., museum educators) through a broad range of activities (e.g., looking at displays, doing experiments). In science museums, families may learn about scientific ideas and processes and encounter the language and culture of science (Bell et al. 2009). This happens through joint meaning-making or inquiry, or engagement in science talk (e.g., Ash 2003; Crowley et al. 2001; Tenenbaum and Callanan 2008). As much as science museums cater to families in particular, research suggests that the families they cater to are the ones from Western, white backgrounds, pertaining to majority groups (Dawson 2014b).

Migrant families may particularly benefit from the characteristics of science museums (Rochera 2019) because of the freedom they offer in engaging with science, away from formal educational constraints like standardized assessments in a new language. However, worldwide, migrant families tend to visit science museums less frequently than nonmigrant families and have a generally lower participation in the activities offered by the museums (Dawson 2014a). For the last couple of decades, this apparent lack of inclusivity has been an ongoing challenge for science museums (Falk and Dierking 2013; Farrell and Medvedeva 2010). Although there is abundant research on family and children's learning in museums, research on the experiences of migrant families is still scarce (for an exception, see the Garibay Group's research in the US). Dawson (2014a) explains that museum research "clusters around" families of more dominant backgrounds.

Nevertheless, an important area of focus has been the challenges or barriers migrant families encounter in museums (e.g., Acevedo and Madara 2015; Weiss and Villiere 2022). These involve economic, social, cultural, and linguistic aspects. Acevedo and Madara (2015), for example, distinguish between experiential barriers (i.e., tangible challenges like the language of museum communications) and perceptual barriers (i.e., internal attitudes or beliefs that hinder participation, like the feeling that museums are not for them). Research on social inclusion/exclusion in museums has slowly come to explore the role of language in the museum experience (Maldonado 2018; Monagle 2017). First, participation in museums in general requires a certain level of literacy, given that museums convey a large amount of information through written text. This is why museums aim to make texts accessible to a broad audience (Ravelli 1996). Second, science museums rely on the language of science, with characteristic vocabulary, "lexical and grammatical patterns" (Fang 2012, 19), as well as traditions and conventions, which can be unfamiliar to some groups. Third, the choice of languages per se in museums can be challenging (Miklošević 2021; Papadimitriou et al. 2016). In a study with Hispanic mothers visiting science centers with their children in the US,

Weiland (2015) found that linguistic aspects limited the families' joint experiences. In these museums, English was the predominant language. Even though they were learning English, the mothers explained that they did not fully understand museum educators' explanations as well as museum labels and signage. Dawson (2014b) also found language to be a difficulty for migrants visiting science centers in the UK. The families reported difficulties in understanding texts, navigating the museum space, and participating in interactive games in English. They felt "out of place, anxious, unsure of what to do,...with a sense of not being sufficiently educated, linguistically deficient, and profoundly uncomfortable" (993).

Theoretical Framework

In an overarching manner, this study draws from a sociocultural lens (Vygotsky 1978; Lave and Wenger 1991) that puts the focus on interactions as the vehicle for significant learning experiences, in both formal and informal contexts such as the museum (Jakobsson and Davidsson 2012). From such a lens, both interactions between people and between people and artifacts are relevant. That is, the science museum experiences of parents and children can be seen as made up of a combination of elements of their personal contexts (motivations, expectations, prior experiences) and the social and physical contexts of the museum (museum guides, objects, museum texts) (Dierking and Falk 1992). A sociocultural lens posits language as a tool and mediator for people–artifact interactions (Halliday 1984). This lens supports a body of research that considers dialogue as central in driving thought and action in the museum context (Jakobsson and Davidsson 2012). Following this theoretical reasoning, this study acknowledges and addresses the role of language in families' museum experiences (Falk and Dierking 2013). Additionally, we build on the view that language is "a system of resources for making meanings" in science (Lemke 1990, 9). Using language as a medium for interaction in a science-learning context includes using the specialized language register of science (Gibbons 1998). This view emphasizes the need for considering the role of language in the science museum experience, as a context where the function, format, and level of the texts are built in relation to the language of the scientific disciplines (Afonso et al. 2019).

This study also draws on the concepts of social and cultural inclusion/exclusion in museums. Museums can function as institutions where the participation, access, and representation of certain groups of people are restricted (Kinsley 2016; Sandell 1998). In this study, we focus on the linguistic aspects that can challenge migrant families' participation in museums as institutions and in the science practice that takes place in those museums. Specifically, we recognize "the monolingual bias of institutions as agents in the exclusion of linguistically diverse populations and argues for linguistic recognition and multilingual provision as ways to promote social inclusion" (Piller and Takahashi 2011, 374). Museums present the public with particular linguistic landscapes (the languages that are displayed in the museum and how they are displayed). Linguistic landscapes convey and reproduce

language hierarchies where one language is portrayed as having a higher status than another (e.g., Robinson-Jones 2022). As put by Maldonado and Nguyen (2020), “Language plays a large role in being able to participate and navigate a space, as well as in making people feel welcome and included” (614).

The aforementioned can be considered a “deficit perspective” as it focuses mainly on the different challenges that migrant families experience in the museum (in relation to language in particular) (Dawson 2014a). We also recognize, from a more critical perspective, that families bring their own linguistic repertoires to the museum and have language policies of their own that become apparent in their language practices in the public sphere (Lanza 2021). Research shows how, in the case of multilingual families, interactions take place in more than one language (e.g., Choi 2022; Kwon 2019). In a comparable manner, it is useful to consider families’ “skills of maneuvering through social institutions” in which they do not necessarily feel welcome (Yosso 2005, 80). This critical perspective highlights the need to seek families’ voices as to what they believe can be done to best include them in the museum. Through interviews, this study seeks migrant children and families’ own voices, since

it is essential to understand the perceptions, attitudes, paradigms, values, needs and interests from an internal or “emic” perspective (that is, from the viewpoints of those belonging to that group) in order to build foundations for meaningful, relevant experiences—rather than to impose external or “etic” definitions of what a community may need or value. (Stein et al. 2008, 180)

By seeking the families’ voices, the needs and wishes of children and their families can be uncovered and effective strategies for participation can be devised (Canning et al. 2006). As such, this study can inform the design of multilingual strategies that advance the equity agenda of science museums.

In this study, the following two research questions were, thus, leading:

- What language-related challenges do migrant families experience during their visit to a Dutch science museum?
- What language-related recommendations do migrant families have to make Dutch science museums more welcoming for themselves and other migrant families?

Context

Migrant Families in the Netherlands

Migrants in the Netherlands constitute a heterogeneous group, with variations in origin, cultural identity, motivations for migrating, acculturation, and language skills. Motives for immigration can be work, family reunification, asylum, or education (Statistics Netherlands, n.d.). In 2022, 15% of the population in the Netherlands was born in a foreign country (first-

generation migrants), and 12% had at least one foreign parent (second-generation migrants). The places of origin of most second- and third-generation migrants (children of individuals who migrated to the Netherlands in the 1960s and 1970s) are Turkey, Morocco, Suriname, the Dutch Caribbean, and Indonesia (Statistics Netherlands, n.d.). In more recent years, there has been a large influx of migrants from the Ukraine, Bulgaria, Romania, Poland, Syria, and Turkey.

Inclusivity in Science Museums in the Netherlands

Many museums in the Netherlands are working toward becoming more inclusive, as seen in the museums' vision and mission statements as well as in concrete programs and activities aimed at a broader audience (e.g., Museum Vereniging, n.d.; Vereniging van Wetenschapsmusea en Science Centers, n.d.). While more data is needed on social inclusion/exclusion in the Dutch cultural sector (Rana and Koning 2022), the existing reports suggest that Dutch museums still mostly cater to visitors from white, Western European, and highly educated backgrounds (Boekmanstichting 2023; Van den Bosch 2020; Vereniging van Wetenschapsmusea en Science Centers, n.d.).

The current study is part of the larger project Multi-STEM (science, technology, engineering, and mathematics). Multi-STEM is a project being conducted by a consortium of higher education institutions (Utrecht University, Utrecht University of Applied Sciences, and iPABO Amsterdam) in partnership with societal institutions such as science museums (for more information on the project, see www.multi-stem.net). The project aims to design and develop multilingual strategies that promote the participation of children and families of migrant and multilingual backgrounds in STEM in different contexts. One such context is the science museum.

Methods

The study involved twelve families of Turkish, Syrian, and Moroccan backgrounds currently living in the Netherlands. We invited the families to visit one of our partner science museums and afterwards participate in an interview, where the consultation took place. We asked the families to report on their experiences in the science museums, with a focus on language-related challenges, and gathered their recommendations as to how these science museums could become more welcoming for them and other migrant families (cf. Head 2011).

Science Museums

Museon-Omniversum and NEMO Science Museum are large science museums located in two cities in the Netherlands receiving Dutch and international visitors and offering programs for general visitors as well as educational programs (school visits, teacher trainings). Museon-Omniversum has sustainability and citizenship as its central themes, while NEMO Science Museum keeps a more general focus on the workings of science. Both museums focus on

interactivity with science and portray science in action while offering visitors wonder and experience (Amodio 2013, cited by Pedretti and Iannini 2020).

Dutch and English were the predominant named languages in the museums' linguistic landscapes at the time of this study. Museon-Omniversum featured exhibit labels, maps, signs, and videos in both Dutch and English in the newer exhibitions, while English was present in smaller size or in summarized texts in the older exhibitions. All text in NEMO Science Museum was in Dutch and English; additionally, the museum offered family workshops in Ukrainian, Italian, Spanish, French, and German. The last four had been added for being the languages of the largest tourist groups that visited the museum, while Ukrainian was added as a response to the recent influx of Ukrainian refugees (museum colleague, personal communication).

Recruitment and Participants

Recruitment of the families was done through social media and within our network. Four criteria were used to recruit the participants: (1) they resided in the Netherlands; (2) they had a migrant background, regardless of migration generation; (3) they were multilingual families, defined here as speaking one or more languages other than Dutch at home; and (4) they had children aged 8 to 12. In this study, first-generation families are the ones in which parents and children have been born abroad, whereas in second-generation families, the children have been born in the Netherlands, and in third-generation families, both parents and children have been born in the Netherlands.

Table 1 summarizes the participant families' background information. Each family consisted of one or more parents and one or more children between the ages of 8 and 12. The families reported to speak Dutch, Turkish, Moroccan-Berber, Syrian-Arabic, and/or Aramaic. Most of the first-generation families in this study reported speaking exclusively the language of their home country at home (Turkish or Syrian-Arabic), except for the Younan family, in which the siblings spoke Dutch between each other at home (in addition to Aramaic). In these first-generation families, the children were becoming proficient in Dutch more quickly than their parents, Dutch being the language of schooling (cf. Kaveh and Lenz 2022). Second-generation families in this study reported speaking both Dutch and a language from the country they migrated from (Turkish or Moroccan-Berber) at home. The language practices in the home reported by these families are congruent with the idea of a language shift among migrant families, through which migrant families from the first generation speak their mother tongue at home, whereas older generations increasingly speak the majority language (in this case, Dutch) in this environment (Saltarelli and Gonzo 1977).

Table 1: Background Information of the Participating Families

<i>Family Pseudonym</i>	<i>Family Composition</i>	<i>Country of Birth</i>	<i>Languages Spoken at Home</i>	<i>Migration Background</i>	<i>Visited the Museum Before?</i>	<i>Museum</i>
Demir	Mother and son	Turkey	Turkish	First generation	Yes	Museon-Omniversum
Yilmaz	Mother, father, and daughter	Turkey	Turkish	First generation	No	Museon-Omniversum
Kaya	Mother, father, and daughter	Turkey	Turkish	First generation	No	Museon-Omniversum
Claasen	Mother, father, son, and two daughters	Turkey (mother), the Netherlands (father and children)	Turkish and Dutch	First generation (mother), second generation (children), no migration background (father)	Yes	NEMO Science Museum
Yildirim	Mother, father, two sons, and daughter	the Netherlands	Turkish and Dutch	Second generation (parents), third generation (children)	No	NEMO Science Museum
Celik	Mother and three daughters	the Netherlands	Turkish and Dutch	Second generation (parents), third generation (children)	No	NEMO Science Museum
Younan	Mother, father, son, and daughter	Syria	Syrian-Arabic, Aramaic, and Dutch	First generation	Yes	NEMO Science Museum
Ali	Mother and son	Syria	Syrian-Arabic	First generation	Yes	NEMO Science Museum
Mounir	Mother, father, two daughters, and two sons	Morocco, the Netherlands	Moroccan-Berber and Dutch	First generation (father), second/third generation (mother and children)	No	Museon-Omniversum
Chaoui	Mother father, two daughters, and son	Morocco, the Netherlands	Moroccan-Berber and Dutch	First generation (parents), second generation (children)	No	Museon-Omniversum
Ahmad	Mother, son, and daughter	Syria	Syrian-Arabic	First generation	No	NEMO Science Museum
Bensaid	Mother, father, and two sons	Morocco, the Netherlands	Moroccan-Berber and Dutch	First generation (parents), second generation (children)	No	NEMO Science Museum

Data Collection

The data collection consisted of a first group of family interviews conducted by the first author in May and June 2022 with eight of the twelve participating families (except for the first interview, more than one family participated in each interview). The second group of interviews was conducted in March and April 2023 with four of the twelve participating families

individually by four bachelor's students. The interviews were conducted in English or Dutch, depending on the families' preferences. The interviews were audio recorded and transcribed verbatim. In both groups, before the interviews, we explained the main ethical and privacy aspects of the study and gave the families written information on how the data would be managed securely and pseudonymously. The families agreed to the research, and the parents signed informed consents. The research protocol was approved by the Ethics Review Board of the Faculty of Social and Behavioural Sciences of Utrecht University (#23-0080).

The first group of interviews took the form of a reflection conducted immediately after the visit. The first author guided the families through a placemat that showed three questions: What did you enjoy? What did you enjoy less? What can the museum do to be more welcoming to migrant families? The families were invited to write, draw, or provide their responses out loud. The families were invited to speak in the language they were most comfortable with, with the interpreter being instructed to translate for the first author when families spoke in their home languages. The first author asked clarification questions throughout the process. The second group of interviews consisted of a semi-structured interview conducted by the bachelor's students with each family a few days after the visit. The interview included questions on how the families had experienced the museum visit, what they had enjoyed more and what they had enjoyed less, and what their thoughts were on what science museums could do to become more welcoming for migrant families in the Netherlands. In this second group, due to budget limitations, an interpreter was not present.

Data Analysis

In this study, we used thematic analysis (Braun and Clarke 2006) to identify patterns in the data from the family interviews. Thematic analysis allowed us to flexibly generate codes and themes within and across interviews. The emphasis was on exploration and identification of the language-related challenges experienced by these families in the science museum and their recommendations on linguistic inclusion in the museums. We sought to make an inventory of the challenges, however big or small, to provide proof of existence that could advance the problem of linguistic inclusion in science museums. In the same way, we gathered and report on all recommendations of the families, to reach a fuller picture that could be informative for us as researchers and for science museums.

As a first step, we read the interview transcriptions once to familiarize ourselves with the data. We then selected all the relevant fragments of the interviews. After fragment selection, we assigned one or more descriptive codes to each fragment in all the interviews. The codes were meant to indicate what brought about the language-related challenge or what the main idea was behind a particular suggestion on linguistic inclusion. For example, the fragment "... The language there, I think it's too difficult for children. It's not easy to understand, like percentages, or workers" was assigned the code "difficult words/concepts." This resulted in a total of thirty-eight descriptive codes that indicated challenges or recommendations.

The codes, together with their fragments, were classified according to language—Dutch/English, Science language, and Mother tongue/s—and two themes—Language-related challenges and Recommendations on linguistic inclusion. A third theme—Background/Context—grouped codes that served as context for families’ reported challenges and recommendations (“language practices at home,” “language practices in the museum,” “interests/prior museum experiences,” and “other aspects of the museum experience”).

Table 2: Analytical Themes Found in the Interviews with Migrant Multilingual Families

<i>Theme</i>	<i>Language</i>	<i>Examples of Fragments</i>
Language-related challenges	Science language	Some specific words, I do not know them. Because my Dutch is normal Dutch. My vocabulary is very big for house-related things. But I do not know how to say “gravity” in Dutch. (Mother, Claasen family, Turkish speakers, second generation)
Suggestions on linguistic inclusion	Dutch/English	Here [in the museum] there is also the English translation, I think it’s enough for most people. But if they don’t know English, it’s another situation, then maybe, pictures can help everybody. (Mother, Demir family, Turkish speakers, first generation)
Background/Context	Language practices in the museum	In the museum, sometimes I translated from English to Arabic. For my son, but also for myself. (Mother, Ali family, Syrian-Arabic speakers, first generation)

Positionality

The first author of this study, who conducted the data collection and analysis, has Spanish as her mother tongue and, at the time of the study, spoke English (advanced level) and Dutch (intermediate level). The first author has a personal history of migration as an expat. Her experience with learning Dutch, as well as her migration history, helped in building a rapport with the participants. However, aspects of the participants’ experiences that were unfamiliar were discussed with the research team, who, in different ways, were more acquainted with the experiences of Turkish, Moroccan, Berber, and Syrian migrants in the Netherlands. For example, we discussed the differences in the Turkish language spoken by second- or third-generation migrants and first-generation migrants. We acknowledge that, despite our efforts, the reliability of the findings may be less due to the first author not belonging to the communities under study.

Results

In this section, we provide a description of the language-related challenges and recommendations reported by the migrant families after their visit to a Dutch science museum. We first present the language-related challenges, followed by recommendations on linguistic inclusion, in relation to each of the three languages and the one specialized register: Dutch, English, science language, and mother tongue/s. We use the information under the

theme “Background/Context” to contextualize the findings. The quotes from participants presented here, when in Dutch, were translated to English by the first author.

First-generation families with a single child reported to mostly have spoken their mother tongue during the visit. In the Younan family, Dutch was also sometimes spoken between the siblings. Second-generation families spoke Dutch or a mix of Dutch and the mother tongue in the museum visit. As for the choice of languages from the museum, the participant families encountered two languages in their museum visit: Dutch and English. While parents of first-generation families who were recent migrants reported choosing the English option, others who had spent more time in the Netherlands tried the Dutch one. First-generation children usually preferred the Dutch option (“My brain for sciences is in Dutch,” child Ahmad). Second-generation families chose Dutch.

Language-Related Challenges

Predominance of Dutch and English

The predominance of Dutch especially presented a challenge for the parents of first-generation families. The father of the Kaya family (Turkish speakers, first generation) explained it this way: “Everything seems to be in Dutch to me. Maybe I should read the small things... [laughs]. So it’s difficult for me, because I don’t speak Dutch.”

This was confirmed by the mother and daughter in the family, who affectionately teased the father on the level of his Dutch proficiency (“He always has no idea about the Dutch”). In all the first-generation families, the children were already being exposed to Dutch in the school setting, sometimes preferring Dutch to English. Parents often remarked about their children learning Dutch much faster than they were able to. However, the children’s Dutch proficiency, although often higher than that of their parents, was not always sufficient to meet the language-related challenges. For example, the mother from the Demir family (Turkish speakers, first generation) explained that her son did not understand everything, which led her to read the English version, so that she could translate for him. During a demonstration of a chain reaction in the museum, this child had raised his hand to provide an answer to a museum guide’s question, but upon being given the microphone, could not give the answer in Dutch. The mother remarked that, when one is learning a new language, sometimes “the words do not come.”

From the museums’ perspective, the English in the museum texts was intended as an additional linguistic resource for visitors, but, for some of these families, that was also experienced as challenging. Having watched a video with no sound and English subtitles, one of the children of the Claasen family (Turkish/Dutch speakers, second generation) complained that she did not fully understand the language and had therefore opted to watch only a part of the video and without really seeking to understand it. In the cases where English was indeed experienced as a linguistic resource (a welcome alternative to Dutch), the lack of

accessibility and visibility of English in the museums could bring difficulties. The father of the Kaya family remarked as follows:

If there is a language choice in the digital screens, it's always difficult to find out how to get the English one from the Dutch one, and sometimes I feel like, I can't find it, and then I just let go, I don't check it at all. (Father Kaya family, Turkish speakers, first generation)

When discussing linguistic inclusion in the museum, both parents and children from first-generation and second-generation families were aware of the fact that other first-generation families, certain family members from second-generation families, and international visitors may also experience Dutch and/or English as a challenge in their visit to the science museum. The mother from the Ali family (Syrian-Arabic speakers, first generation) said that once they had come to the museum with some friends whose daughter spoke little Dutch. She remarked that, while her friend and mother of the child translated from English for her, the visit seemed to be less enjoyable for the daughter. Bluntly put, "Families who do not understand Dutch or English would not understand anything" (child Claasen family, Turkish/Dutch speakers, second generation). It was also mentioned that visiting grandparents may understand neither Dutch nor English: "If my parents would be here, you know they are old, then Turkish would definitely be the first choice" (Father Kaya family, Turkish speakers, first generation).

Science Language in a New Language

Both first-generation and second-generation families said that scientific terms in a new language could be challenging to understand for children and, often, also for parents. The father of the Kaya family explained as follows:

For instance, the [exhibit part] that was talking about the textile industry, on this floor. The language there, I think it's too difficult for children. It's not easy to understand, like "percentages," or "workers," information about those kinds of things, it's not easy for the children. Even for me, most of the questions I answered wrong. So I think it's not really a good way to give the information. (Father Kaya family, Turkish speakers, first generation)

This referred to a part of the exhibition where visitors were invited to answer multiple-choice questions, using a tactile projection on the floor, about the sustainability of work and employment in our current world. Animal names and terms like "research question" were also among the terms that parents and children named as particularly difficult.

A second challenge referred to the length of scientific texts present in the museums. Families reported that children had often refrained from reading the museum text due to the texts being too long or too difficult or finding reading unattractive or boring. This was also the case for some parents. The mother from the Ahmad family (Syrian-Arabic speakers, first generation) explained that she would rather listen to a museum guide giving explanations than having to read so much information. These experiences highlight how three features of science language (emphasis on textuality, technical vocabulary, and text length) can be challenging for these families in museum visits. The child of the Demir family expressed the challenge of science language in a stronger way:

They should build another museum next to this one, but for children, so that children can understand. Sometimes they use words that children do not understand ... so children ask [what the words mean], but they also do not want to come [to the museum]. (Child Demir family, Turkish speakers, first generation)

The data in this study shows that multilingual families in the science museums not only experienced the challenge of science language, but, in fact, a double challenge, which arose from encountering science language in Dutch or English. In other words, they encountered a combination of science language and a new language for them, as opposed to encountering science language in a language that they already knew well (Turkish, Moroccan-Berber, or Arabic). This double challenge appeared in families' reports of their experiences in different ways. The mother of the Claasen family explained that the scientific register in Dutch made it difficult for her to act as a mediator between the children and the museum content, although she was competent in Dutch:

The kids don't get most explanations, so they ask it to the parents, the parents discover it, and then they tell it to the kids. So I feel, here, the barrier is probably the parents' language other than the kids' language. Most of the kids understand Dutch very well or in a few years they come to that point where they understand it very well. But you always need a human to teach you. The museum can't teach a kid. It's the parent that teaches the kid ... My Dutch is normal Dutch.... My vocabulary is very big for house stuff. But I do not know what gravity is in Dutch. (Mother Claasen family, Turkish speakers, second generation)

An additional aspect of the double challenge came up in children's translation of Dutch for the parents. The child of the Kaya family (Turkish speakers, first generation) explained that, when her father asked what something in Dutch meant, she "could read it, but could not understand it enough to explain it to him." The Claasen family (Turkish speakers, second generation) went on to explain that, in these situations, children found translating "boring" or "difficult."

A similar challenge was reported surrounding the mother tongues. The mother from the Claasen family (Turkish speakers, second generation) explained that she noticed that, when her children wanted to ask her questions, they did not know enough Turkish to ask the question in that language. For second-generation families, this could also happen to the parents: the mother from the Ahmad family (Syrian-Arabic speakers, second generation) explained that she had already been in the Netherlands for a long time, so she did not know these scientific words in Arabic anymore.

Feelings Around, and Proficiency in, the Mother Tongues

Despite the absence of the mother tongues in the physical context of the museum, the parents and children did report using their own mother tongue during the visit. In the case of one family (Claasen family, Turkish/Dutch speakers, second generation), this situation seemed to lead to feelings of discomfort. The mother (born in Turkey) raised the issue of her children feeling uncomfortable speaking Turkish with her in the museum due to what other people may think of them upon hearing “that strange language.” The youngest child confirmed this, and when asked what the museum could do to prevent this, she replied, “There is nothing that can be done, because it is about what other people think, and you cannot change what other people think.” The mother subsequently explained that her main reason for participating in this research was to show her children how valuable mother tongues are and to hopefully make them feel prouder to be Turkish speakers. This issue was not brought up by other first-generation families in the sample.

Some children were said to have difficulties understanding the mother tongue, either because they were second-generation children whose language of schooling was Dutch or, in the case of the Younan family (Aramaic speakers, first generation), because the children had never learned to read Aramaic due to Arabic being the language of schooling in Syria (Aramaic was then a mother tongue mainly used in the speaking and listening modalities). According to his mother, the child of the Ali family (Syrian-Arabic speakers, first generation) was currently “suffering a bit, and there is a bit delay in language ... now the focus on his mind is on Dutch, so he’s losing Arabic.”

Recommendations for Linguistic Inclusion

Accessibility of Language Options and Addition of Languages

Improving the accessibility and visibility of English in the science museum was a suggestion made by some of the families in the interviews. Furthermore, both first-generation and second-generation families suggested that museums add more languages to their linguistic landscapes. A distinction was made between the languages that are spoken by migrant minorities in the Netherlands (migrant community languages like Moroccan, Turkish, etc.)

and the so-called tourist languages (such as Chinese and Italian), with families mentioning the relative advantages of adding both. For the mother of the Kaya family (Turkish speakers, first generation), the addition of migrant languages could also help in attracting more migrant families to the museums if they were to learn, by word of mouth, that their language was present.

Mother Tongues and Dutch in the Linguistic Landscape of the Museum

In our interviews, we asked the families how they would feel if their mother tongues were present in the museum. This was generally received with a positive attitude. The parents of the Younan family (Aramaic speakers, first generation) explained that, if they found their language in the museum, they would “feel at home.... You hear your language, you feel like you are a part of this place. You belong to this place more [and] you get the feeling that you are important for the museum.” Similarly, the mother of the Ali family (Syrian-Arabic speakers, first generation) added, “You feel more, I’m not calling integrated, but you feel there is something, on a systematic level, the government, they are doing something that meets our needs. It’s more inclusiveness towards refugees, newcomers, respect for all diversities.”

An additional perspective was brought up by parents of the first-generation families (Younan, Yilmaz, and Kaya) in relation to the presence of Dutch in the museum. These parents pointed out the need for the predominant language of the museum to remain Dutch, despite the challenges, for two main reasons. First, as part of the process of integration, the parents expressed a desire to learn Dutch. In this sense, a visit to a Dutch science museum provided an opportunity for them to learn the language, which could prove difficult elsewhere: “In the Netherlands people are speaking English everywhere, so it makes us a little lazy, or sometimes we think that we do not have to learn Dutch, we can communicate with people easily” (mother Yilmaz family, Turkish speakers, first generation). Second, as the father of the Kaya family (Turkish speakers, first generation) explained, “Language means culture, and culture needs to be protected.” According to this father, public places like museums and monuments should protect the Dutch language, and the first generation should aim to learn it. This idea was confirmed by the father of the Bensaid family (Moroccan-Berber/Dutch speakers, second generation), who had been in the Netherlands for a longer time: “Dutch is the main language of the country, and the mother tongues are for the private sphere.” This subtheme contributes to the idea that linguistic inclusion poses a poignant issue for migrant families: the families find the majority language challenging, recognize it as a possible tool for exclusion, and are, thus, all the more aware of the need to learn it.

As to how new languages should be included, families suggested different methods. It was suggested that having museum guides who spoke these languages, adding audio guides or QR codes that led to audios in those languages, bilingual texts in the museum or even having only a few keywords in these languages could make a difference. Finally, a mother

and a child from two different families (Chaoui and Mounir families, Moroccan-Berber speakers, second generation) suggested the incorporation of staff who spoke the mother tongues of the migrant communities, as both a linguistic resource and a way of increasing the representation of these communities in the museums.

Simpler Language, Shorter Texts, and Pictures and Symbols

In relation to the science language, the families suggested that museums should use simpler, more “child-friendly” language. The child of the Ahmad family (Syrian-Arabic speakers, second generation) proposed that difficult words be accompanied by an explanation within parentheses. Creating shorter texts was also a suggestion: “The texts are sometimes too long, and that for adults is OK, but for children, you have to make shorter texts” (mother Demir family, Turkish speakers, first generation). One suggestion around language simplification was the use of pictures or symbols. Visual information was called “the common language” (mother Yilmaz family, Turkish speakers, first generation) and could be incorporated in videos or signs next to texts. A child (Younan family, Aramaic speakers, first generation) also suggested using other modes of conveying information, like sounds or smells.

The topic of play being universal and independent of language came up in discussions with three different families. The mother of the Demir family (Turkish speakers, first generation) explained that play is international and any child can engage in it without needing to understand the language in the museum: “No need to understand everything ... [play is the first step] and the second step is learning. When they want to know more.” The children of the families Celik (Turkish/Dutch speakers, second generation) and Ahmad (Syrian-Arabic speakers, second generation) explained that families that did not understand Dutch or English could still enjoy the museums by “playing and looking.”

Discussion

The findings of this study suggest that language can act as a hinderer or an enabler of an inclusive science museum experience for these and other migrant families and should therefore be considered when taking steps toward a more equitable participation of migrants in science museums. Our findings can be understood in the specific sociocultural and historical context in which this study was conducted. As explained next, this context has specific characteristics in terms of, for example, societal norms and values surrounding the existing languages.

The predominance of the majority languages in the linguistic landscape of museums has been suggested by previous theoretical and empirical research to potentially lead to the social exclusion of specific groups (Dawson 2014b). In this sense, these groups may rely on additional languages (i.e., English) that are offered by the museum in an accessible manner. The results of the present study put forward a more nuanced picture. The first-generation parents of this study said that they acted as mediators between the museum content and their children. In these first-

generation families, however, the parents had a lower level of proficiency in Dutch than the children. Hence, parents asked the children to translate for them, a request that was not always met with success: the children did not understand the museum texts well enough to translate them or gave up due to the texts being too long or “boring.” This finding shows how parents’ and children’s different language proficiencies can shape their interaction during the visit. Other studies have also shown how children take on translating roles when parents are not experts in the museum’s predominant language (Archer et al. 2016), a situation that adds complexity to the ongoing research on role-taking and expertise distribution in parent–child interactions in museums (e.g., Joy et al. 2021; Miklošević 2021). Research on science museum experiences of multilingual migrant families should take patterns of language into account when examining patterns of parent–child interactions.

While we did not specifically study the language practices of the families during the visits, first-generation families reported to have primarily used their mother tongues to communicate with each other during the museum visit, and siblings in first-generation families and second-generation families used a mix of Dutch and their mother tongue. This adds to the research evidence that families flexibly use their linguistic repertoires in science museums (Kwon 2019). The finding that the children of the family with a Dutch father and a Turkish mother felt uncomfortable speaking Turkish in the museum suggests that language practices in the museum, however, can be influenced by what families, the institution, and other visitors consider as “normal” behavior in the museum (Archer et al. 2016). In this sense, the families in our study confirmed that the presence of their mother tongues in the museum could contribute to their sense of belonging, which highlights the idea that language can play a role in promoting inclusion in the science museum.

The science language in the museum (also known in research as science jargon, subject-specific genres, or disciplinary or specialized language) proved challenging for all participating families in this study. Understanding science language is a crucial requirement for engaging with science practices (Lemke 1990). The fact that this language is used in science museums requires visitors to possess specific linguistic and cultural capital (Dawson 2014b). In migrant multilingual families, however, the challenge is doubled by the science language being in a language that is new to them, particularly in the case of first-generation families. In the aforementioned example, first-generation parents and children have some knowledge of basic Dutch that aids in the comprehension of the museum text, but they may still lack genre or language proficiency for engaging in science activities. Furthermore, the families in this study reported that lack of knowledge of science vocabulary in the mother tongue can bring about challenges, as children seek explanations from their parents in the mother tongue during their visit to the science museum. It is likely that the challenge extends beyond vocabulary, as comprehending science language involves not only understanding isolated science words but also being able to interpret them along with structure features (grammar, line of reasoning, ordering of arguments etc.) and language features (wordings,

formulations) (Ravelli 1996). To make museum texts more accessible to multilingual families, more research is needed to understand in detail the specific challenges posed by science language for migrant families during their museum visit.

Our study suggests several avenues for future research. Research on the museum experiences of migrants should include the aspect of language. This could be done, at the empirical level, by using methods that allow for the consideration of language reception and production during, and even before and after, the museum experience. At the theoretical level, models of the museum experience, such as Falk and Dierking's (2013), could explicitly incorporate language and its interdependent relationships with other factors belonging to the personal context of the families and the social and physical context of the museum.

In the present study, we did not consider families' ethnic and socioeconomic backgrounds or gender and family history and composition in our analysis of challenges and recommendations. Indeed, research suggests (e.g., Archer et al. 2016; Dawson 2014b) that migration background and language proficiency are not the only aspects that influence migrant families' museum experiences; rather, it is the intersection among multiple aspects that plays a decisive role in how specific groups experience museums. Future research could attempt a more comprehensive description of families' backgrounds and their relations to their museum experiences, with language as one element. The concept of intersectionality (Crenshaw 1989) may be useful in this attempt.

At a more practical level, we raise the question of how a more linguistically inclusive science museum experience could and should be created for multilingual migrant families. We found a pattern where the children have relatively more proficiency in Dutch than their parents in the first-generation group, while high language proficiency was present in parents and children of the second-generation group (as also reported by Acevedo and Madara 2015). At the same time, in the second-generation group, proficiency in the mother tongue was sometimes reported as decreasing. This is congruent with the so-called language shift, which suggests that first-generation families show a stronger dominance of the mother tongue, which decreases in favor of the majority language with the passing of generations (Saltarelli and Gonzo 1977). A key to promoting participation of first-generation groups could then be, for example, empowering children to act as translators in their family. In both first-generation and second-generation groups, the mother tongue could play a role in parent-child bonding through a resource shared by both (Acevedo and Madara 2015).

The picture may not be so simple, though. Sevinç (2016) highlights the complexity of families' language practices against the background of their own values and societal norms (which can take the form of socioemotional pressures to maintain the mother tongue or shift to the majority language, or of power imbalances between the two). The "language tension" can be found in the families' recommendations to protect the Dutch language while still valuing the presence of the mother tongue. The emotional reaction of the Turkish mother at her children's turndown of Turkish in the museum shows the impact of societal norms

(dominance of Dutch in the public sphere) on families' language choices and practices (Kaveh and Lenz 2022). Moreover, it seems that different migrant communities may show different experiences when it comes to mother tongue maintenance, a fact that is certainly true in the context of the Netherlands (Laghzaoui 2006). One recommendation that, thus, emerges from this study is to examine the values and needs within each migrant community surrounding the science museum experience in all its complexity and, preferably, from their own perspective (Maldonado 2018). Accommodating such complexity may require going beyond the lowering of specific barriers and investing in the design of multilingual strategies that optimize participation (Dawson 2014b).

A final recommendation is for museums to examine their participation goals. Such an examination may reveal what changes are indeed desirable and in which context of place and time. Some of the families participating in this study recommended that simpler language be used in the museum for better understanding and participation. Some families also brought up the need for non-language alternatives, that is, using pictures, symbols, smells, and sounds to convey museum content. Another perspective brought forward the idea that play is universal and that children can enjoy playing in the museum regardless of language. Here, we would like to make a distinction between language simplification and the addition of multimodal representations to the content showcased in science museums. As for language simplification, we are aware that our partner museums have consciously decided to try to "bring down" the level of Dutch, or the majority language, to one that Dutch learners can understand more easily (museum colleagues, personal communications, 2023). This could certainly aid in tackling the double challenge of being exposed to the language of science in a new language and make the museum experience more enjoyable. However, one may ask whether such strategy is indeed desirable from the point of view of participation in subject-specific discourse. Archer et al. (2016) highlight that fun and enjoyable experiences may not necessarily lead to social benefits like science learning. Having written content with other types of representations, such as graphs and diagrams, on the other hand, could be congruent with effective practices in science education (Yeo and Nielsen 2020) and more akin to science practices (due to the nature of science) (Pierson and Grapin 2021). It may be worthwhile for museums to examine their own goals in relation to those of the visitors, with the awareness that these may differ (Simon 2010; Stein et al. 2008). For example, by engaging in dialogue with surrounding migrant communities (Monagle 2017), science museums may find out what families look for in the museum experience and contrast them with their own. This could lead to the creation of an "equitable ecology" (Soto Huerta 2015) where the participation goals of the institutions and the families are acknowledged and reconciled.

Conclusion

In this study, we sought to unearth the language-related challenges experienced by multilingual migrant families visiting a Dutch science museum and the families' recommendations for

linguistic inclusion. First, we found that first-generation families, which did not have a high proficiency in Dutch, experienced challenges in accessing the museum content. Improvement of the range and accessibility of the language choices was the main suggestion in relation to these challenges. Second, the language of science used in the museum posed an additional challenge for both parents and children. Simplifying such language and offering visual support were some recommendations given. Third, mother tongues played a role in these families' sense-making during the museum visit, and according to the families, presence of the mother tongue may promote families' sense of belonging in the museum. However, some families advocated that Dutch be protected and remain a characteristic of the science museum environment.

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Informed Consent

The authors obtained informed consent from all participants.

Conflict of Interest

The authors declare that there is no conflict of interest.

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