#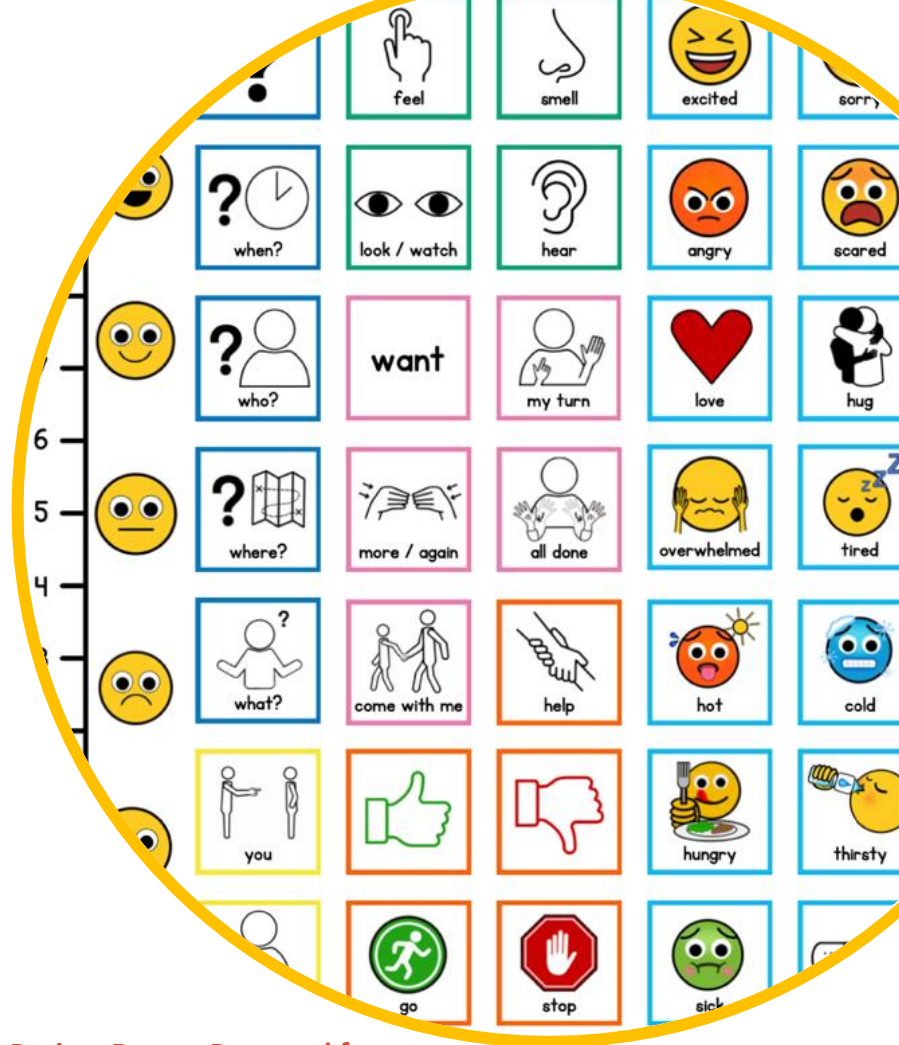 A University-Landscape Architect Collaboration to Develop an Augmentative and Alternative Communication (AAC) Board for a City Park Playground

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A Full Report of its Design

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More information can be viewed at Children's Communication Lab, University of Waterloo. https://uwaterloo.ca/childrens-communication-lab/community-outreach/playground-aac-board-eby-farm-playground

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Brief Overview of this Report

In this report, we detail the development of an AAC board for a community playground situated in a large park in the heart of Waterloo, Ontario, Canada. AAC boards for community locations have received much less attention and study than AAC tools intended for individual use at home and/or in schools, or by children on school playgrounds. This AAC board was developed through an ongoing collaboration between the landscape architect redeveloping the playground for the city and a professor of developmental psychology with expertise in children's early social pragmatic communication, along with her students at the University of Waterloo.

For this AAC board, we prioritized practical communication in a playground context by adopting an activity-focused approach. We describe the major steps taken in developing the AAC board and explain the reasoning and empirical support that guided our content and design decisions. These included choices about the vocabulary included, the symbols used and developed, and the positioning of all components on the board. We also considered symbol and border colours to support accessibility and ease of use. In this process, we sourced empirical evidence from many domains, including speech-language-pathology, AAC, and language and cognitive development within developmental psychology. We also trialled a draft version of the AAC board in the park and made revisions based on feedback from children and their parents. We considered novel factors our expertise suggested would be relevant, such as the age and height of children and the vertical position of symbols on the board, and we introduced some novel elements such as a colour wheel.

We conclude by outlining limitations and recent developments by manufacturers that may improve the design and use of playground AAC boards. We also highlight areas for further research that might be particularly helpful. We have prioritized sharing all aspects of our work openly so that it can be easily accessed, used, and shared by others without restrictions.

Introduction

In this report, we present the development process and outcome of an Augmentative and Alternative Communication (AAC) board for a new accessible playground in a large city park in Waterloo, ON in Canada. This AAC board was developed as a result of an ongoing collaboration between the landscape architect redeveloping the playground for the city and a professor of developmental psychology, with expertise in children's early social pragmatic communication, and her students at the University of Waterloo. AAC is an area of clinical intervention in which a variety of techniques and tools such as manual signs, communication boards with symbols, and speech-generating devices are used to help supplement or compensate for impairments in speech-language production (see American Speech Hearing Association, 2002 for fuller description). Albeit much larger, a playground AAC board would be most similar to aided "light tech" forms of communication boards with symbols (i.e., pictures, photographs, printed words, more abstract symbols) created for an individual child in print form.

This report will describe the major steps taken in the process of developing the AAC board and explain the basis for all content and design decisions made, such as the vocabulary contained on the board, the symbols used and its layout. We believe that in doing so, this report will provide a uniquely detailed view of the process and reasons behind content decisions made, informed by empirical evidence from the domains of speech-language pathology, AAC, and language and cognitive development within developmental psychology. Although one can find many photographs of existing playground AAC boards online, as well as information regarding how to go about getting an AAC board developed (e.g., how to fund it, decisions about size, placement, companies to order from), the process by which the specific content and the graphic display of a board came to be is not usually discussed in any systematic detail. Even for AAC graphic displays in more common classroom contexts, the discussion tends to focus more on general, and less detailed, factors considered during decision making (e.g., Thistle & Wilkinson, 2015) or on hypothetical case studies pertaining to use by a single child (Thistle & Wilkinson, 2021). Given our difficulty in finding such detailed information, the project was expanded to include as a final product not only the AAC board, but a detailed overview of how it came to have the content it did, what evidence informed this content, and the factors determining how it was organized in the final graphic display.

We also prioritized sharing this information openly with others for whom it might be helpful. More specifically, this report and the openly available symbols contained in Appendix 2, may be of particular interest to those planning an AAC board for a playground open to a community, as this has received much less attention and study than AAC tools intended for use by an individual child in a home and/or school setting. Indeed, a recent scoping review of the playground experiences of children with AAC needs (Therrien et al., 2022) found not a single study directed specifically at children with limited speech or the challenges of communicating on a playground using AAC. Nevertheless, it is clear that accessibility and inclusivity on playgrounds for children is a more frequent factor being considered for playgrounds by communities and designers (e.g., James et al., 2022; Thierrien et al., 2022). While accessibility often pertains largely to issues of physical access, an inclusive playground is one that offers

equitable access to rich play opportunities that meet a wider array of children's and families' needs, such as playing with other children, social skills practice, cognitive and sensory stimulation, and more solitary play (see James et al., 2022). Inclusivity would also encompass making it more possible for children with limited speech to be able to participate in such rich play opportunities on a playground in the same way as children without communication challenges (Thierrien et al., 2022).

Figure 1. Constructed Red Tower Playground. (Photo credit: Daniela O'Neill)

To provide a brief overview of the different stages of this project, it began when the landscape architect in charge of Waterloo Park's new Eby Farm playground, Stephanie Snow, approached Daniela O'Neill at the University of Waterloo in January of 2024 regarding the possibility of her and her students helping to develop an AAC board for the

playground. In previous years, Daniela's students had proposed redesigns for this playground as part of a course examining children's early social pragmatic language development. These redesigns were aimed at fostering greater opportunities for social interaction and communicative development on the playground. Stephanie attended the class to provide information about the new universal playground. At the time of beginning the project, one side of the playground ("The Red Tower" aimed at children ages 6 to 12) had been completed, and the second side ("The Market" aimed for younger children ages 2 to 5) had been designed and was under construction (see Figures 1 and 2). The design included one AAC board to be placed in the middle of the two sides of the playground with a two-sided metal sign preprinted with the AAC artwork. At the time of the class, the request was for an AAC board specific to each side of the playground.

In the first phase of this project focused on the vocabulary content of playground board, students began with an environmental scan of literature and empirical work related to the vocabulary content of AAC boards. and application of course content related to children's social pragmatic language development from infancy through the elementary school years (e.g., class

texts were Clark, 2003 and 2017 which summarize extensive research findings). In addition, students gathered informal observations of talk happening on the playground and participated in an in-class consultation with a local SLP who had created a school playground AAC board. The goal was for students to propose relevant vocabulary for the AAC board and a possible design layout. Symbols were not considered at this time as it was beyond the time frame possible for the 5-week class project.

Following this class, in a second phase, a small group of 4 students keen on continuing with the project, worked with Daniela and Stephanie during the following summer and fall term. During this time, they conducted a deeper search and review of relevant literature in order to revise and refine the content of the board and consider the symbols accompanying the words on the board, with a focus on using or developing openly available symbols. (See Appendix 1 for a listing of all symbols on our final AAC board and their sources.) At this time, the city also requested that both sides of the playground be incorporated into one board, necessitating editing and reducing the content to accommodate this from the original two boards. Further informal playground observations informed this process along with a greater emphasis on considering the pragmatics and practicalities of children's communication in this city playground setting as will be described in more detail below. As a final design was approached, it was reviewed with two AAC experts in the field of speech-language pathology. We also held a "feedback event" in the park to display the board and receive informal feedback from parents, caregivers and children playing in the park that day. From this feedback, further revisions were made. In December 2024, the final proposed AAC board design was presented to the City of Waterloo and the Grand River Accessibility Advisory Committee (GRAAC) and the full report detailing our final proposal was completed and provided to the City in March 2025 with some further consultations and decisions by the City beyond this as a result of further feedback from GRAAC and Reconciliation, Equity, Accessibility, Diversity and Inclusion (READI) committee. (An epilogue to this report was added in July 2025.)

A note on terminology going forward will be helpful to the reader. We use the term *tool* as an overall term to encompass various modes of AAC mediated devices (e.g., digital iPad, hardcopy binder, physical board). For individual vocabulary items on our board, we use the term *word(s)*. At times, *word(s)* may refer to a short phrase (e.g., *my turn*) or be an illustrated symbol only with no accompanying text (e.g., *thumbs-up*), as will be described when relevant. We will refer to the groupings of related words defined by different colour borders as *(word) classes*. The term *symbol* will be used for the illustration accompanying a word on the board and *cell*(s)will refer to the individual item(s) on the board consisting of a word plus its symbol. The entire grid of cells will be referred to as the *graphic display*.

No "Perfect" Approach to Developing the Content of an AAC Tool

When we set out to design this AAC playground board, we quickly learned that there are multiple approaches to deciding on what vocabulary content to include in an AAC tool, which each have their advantages and disadvantages. Binger et al. (2024) reviews three main approaches and analyzes their strengths and weaknesses, with particular consideration as to how each approach aligns with the typical variety of utterances observed in early language

acquisition. This fit very well with our own priority to consider the content through the lens of children's social pragmatic language development.

A first *noun focused* approach easily allows children to make requests for things (often nouns), which can be very helpful to ensuring that the child's needs are being met, especially for autistic individuals for whom establishing joint attention on an object via the use of gaze and gestures may be difficult. However, noun-focused approaches do not provide enough diversity with respect to word classes to appropriately support the communicative functions that even young children require, such as asking questions or telling stories.

A second *core vocabulary* approach emphasizes words and word classes that are frequently used across a large number of contexts. Beyond nouns, these boards feature other word classes such as pronouns, verbs, prepositions, and other grammatical elements that allow children to convey a wider range of pragmatic functions such as rejection, asking questions, and description of objects, places, and experiences. Since this approach focuses on common vocabulary required over multiple contexts, these boards are less likely to include more context-specific symbols thus reducing semantic diversity. Although the inclusion of multiple word classes facilitates the creation of grammatically correct sentences, these sentences are often less semantically specific and sophisticated compared to those of typically developing children. As children develop more complex thoughts, their vocabulary rapidly expands such that they can specify those precise thoughts and ideas. Indeed, for very young children, core vocabulary lists for AAC have shown poor alignment with the typical spoken progression of language development (Semmler et al., 2024). When an AAC tool only features nonspecific core words, children face the cognitive burden of trying to use non-specific words to communicate specific and complex thoughts that typically emerge at their given age. We would add that this approach also involves increasingly difficult vocabulary to illustrate in a readily identifiable, context relevant manner (e.g., *same, under, want*), especially for young children (e.g., Worah et al., 2015).

The final third *activity focused* approach reviewed by Binger et al. (2024) aims to predict the specific vocabulary needed for a given context, thus incorporating more specific vocabulary from a variety of word classes. As a result, this approach facilitates practical and rapid communication about the "here and now". Typically, however, as toddler and preschool aged children acquire more words, they begin to use their expanding vocabulary for talk that is not in the here-and-now (also known as decontextualized or displaced talk), marking an important developmental advance that even predicts later academic language skills (Rowe & Snow, 2020). One main drawback of the activity-focused approach is that providing vocabulary needed for talk that is not in the here-and-now, such as talk about a future or past event, is more difficult. An activity-focused AAC tool can also require children to navigate between multiple activity displays to search for a needed word thereby increasing cognitive demands (Binger et al., 2024).

Taking these three approaches into account and our goal to create an AAC board for communication related to a very specific context – the Eby Farm playground – we decided to take primarily an activity-focused approach. Although this approach, like the core approach, usually emphasizes a fuller range of grammatical elements, we kept in mind the more informal, fast-paced interactions that would occur in playground settings where social engagement is more critical than grammatical correctness (in contrast to an AAC tool used in a school setting

for example). As a result, we did omit some grammatical elements altogether (e.g., prepositions) to prioritize other word classes such as nouns that would be particularly relevant to talk about structures and other things on the playground (sometimes referred to as fringe vocabulary because it is more context specific unlike core vocabulary, Beukelman & Light, 2020). We also prioritized vocabulary that would be commonly acquired by children in the age range of both playgrounds based on findings in child language acquisition (e.g., Clark, 2003) and in the AAC field, such as Banajee et al. (2003), who analyzed naturally occurring language in preschools during play and snack times to identify a list of frequently used core words serving various syntactic, semantic, and pragmatic functions across contexts that could be applied to functional and age appropriate AAC systems for toddlers. Furthermore, we prioritized verbs and other word classes for children to be able to talk about activities, wants and needs, and share physical and emotional states that we thought as being of most functional use or had heard frequently in our own informal observations. We recognize that our activity-based approach may limit the amount of decontextualized talk about non-playground-related topics, but we took into account that this board is not intended to serve as any child's primary AAC system. Instead, it functions as a supplementary tool for more specific communication while visiting this particular playground. Moreover, it could present opportunities for decontextualized talk about the playground visit if photographed or a pdf is made available for download and then used at home, for example, to talk about what happened on the playground with someone who was not present or plan a future visit.

In addition, when considering the symbols for the board, we also discovered that multiple symbols often exist for a word across different AAC tools and that there have been recent calls for greater consistency in AAC picture systems (Derse, 2020). When considering the symbol to be used for a word, we took a number of things into account including common symbols we saw appearing on AAC tools intended for young children from various sources (e.g., photos online of existing playground boards); empirical work in the fields of AAC, cognitive, and developmental psychology related to young neurotypical and neurodivergent children's (and adults') understanding of symbols (e.g., Hand, 2023); iconicity and transparency in symbol identification (e.g., Schlosser & Sigafoos, 2002) including accessing data from a large study of the ARASAAC pictograms (Diez et al., 2024); factors that impede or facilitate visual searches within a grid display (e.g., Wilkinson et al., 2022); and, the semantic relatedness of symbols (e.g., Clark, 1972).

Thus, overall, in choosing the content for the board we took a developmental and pragmatic language approach with an emphasis on vocabulary that would be of most use to children and others using the board with them. We also took into account that the city park setting for this board necessitated a more universal design as children of many different ages, communicative abilities, and cultural backgrounds might be using it. The City of Waterloo's population was approximately 121,436 in 2021 and it is one of three cities including neighbouring Kitchener and Cambridge that make up the Region of Waterloo, with a population of 587,847 in 2021 (Statistics Canada, 2023). The 2016 census recorded over 120 languages other than English spoken by residents. The top 5 languages after English were German, Portuguese, Mandarin, Spanish and Arabic with 1 in 8 residents speaking a language other than English in the home (Region of Waterloo, 2016). According to the 2021 census, 98% of residents of Waterloo Region (excluding institutional residents) reported themselves to have "knowledge

of" the English language (Statistics Canada, 2023). Finally, we attempted to bring to bear as much evidence-informed decision making regarding the symbols accompanying the words on the board as we could find in different related literatures, and to use or develop symbols that would be openly available to make our work as shareable to others working on playground boards as possible (see Appendix 2).

In Figure 3, you can see the final, complete playground AAC board design we developed for the Eby Farm playground. We will now discuss the process of how we came to this final design in detail.

Figure 3. Our final design for the AAC Board developed for Eby Farm playground.

Overview of Main Design Decisions Regarding Design and Layout

Grid organization of cells

Just as there are several approaches for choosing and narrowing down vocabulary on an AAC tool, there are also different approaches to organizing the cells. Two common approaches are grid-based layouts and visual scene displays (VSDs) (Beukelman & Light, 2020). We believe the hybrid use of some VSD-like elements in our overall grid layout is a more novel feature of our board.

Grid displays organize symbols and words into rows and columns of cells, typically grouping related items together by category, event, or word-class (Light et al., 2019b). Grid displays are commonly used by children with complex communication needs because they allow the flexibility to present a variety of symbols and words necessary for a child's large range of communicative functions (LIght et al., 2019b). Grid displays have been shown to result in gains in vocabulary knowledge following intervention in both toddler and school-age children with developmental disabilities (Romski & Sevcik, 1996; Romski et al., 2010).

In contrast, a VSD is an integrated scene, usually in the form of a photograph, that captures a meaningful event or location to an individual (Blackstone, 2004). Photographs can be more personally relevant, especially when they contain more contextual elements, enabling better recognition and word identification in AAC tools (McKelvey et al., 2010). Although, grid-based displays remain the most commonly used (Wilkinson et al, 2022), advances in technology and features for VSD displays such as "just-in-time" programming are showing advantages, especially among very young children first learning to use AAC tools (Drager et al., 2003, 2019; Light et al., 2019a). For example, Olin et al. (2010) found that they require less instruction than grid layouts to teach very young 2-year-old children to use. As reviewed by Blackstone (2004), advantages of VSDs can be that they place fewer cognitive demands on beginning communicators; that they allow children of a larger range of ages, complex communication needs, and skill levels to interact with a board while playing because VSDs lessen the need to learn and gesture to isolated symbols; and that they enable communication partners with less experience with AAC to more actively participate in the communication process. However, sole use of VSDs can make communication about other topics more difficult (e.g., verbs, important safety words).

Ultimately, our activity-focused approach to our AAC board employed primarily a grid display, but also included three smaller VSD-like elements where we thought these would be of most use to children by easing the burden of communication. With respect to the grid layout of the cells within the entire graphic display, we adhered to the common practice of organizing cells according to word class (e.g., pronoun, verb, noun) and following the sentence structure and word order of the language for which they are intended (see Light et al., 2019b). Therefore, on our board, symbols and words were placed in the subject-verb-object (SVO) order to reflect the syntax of English. This organization supports the natural development of sentence structure and also makes locating words and constructing phrases more efficient and intuitive for individuals using the board to communicate or model communication (Binger et al., 2024). We decided not to feature any other language on the board given that, as mentioned, English is the most commonly spoken language in Waterloo Region Region (Statistics Canada, 2022) and that

among the over 120 languages spoken within the region, the highest percentage of residents speaking any one language after English is 3% for German (Region of Waterloo, 2016).

In a hybrid manner, we integrated three VSDs in the form of larger illustrations (photographs, ideally) that extended over 2-4 cells in the grid-based layout displaying the red tower, the tractor and wagon, and the tractor panel (see Figure 4). These three playground structures were specifically chosen because they all possess multiple components and ways for children to play with or on them (e.g., the red tower has 2 different slides and several climbing elements; the tractor panel has 3 different panels with different activities). Some of these components would likely be harder for children to name or recognize on their own (e.g., climbing ladder on side of red tower) and so being able to point to these parts specifically on the photograph may ease the cognitive and linguistic demands. Incorporating these 3 larger VSD photographs also conserved space on our board that would otherwise have been needed to capture all the components. The photographs also preserve the spatial relation of elements in the setting.

Figure 4. Three VSD-like cells included.

Use of symbol + text versus symbol or text alone and font chosen

Most cells in our board contain text for the word and an accompanying symbol. For children who can read or are learning to read, the text combined with the symbol can help provide extra context for them to fully understand the meaning. Additionally, the text can help parents locate words faster when they are constructing utterances, regardless of whether their children can read the text or not. Making the board more efficient for parents and other communicative partners helps prevent frustration on their part and ensure that they are more likely to continue using it to model utterances for a child.

In a few select cases, we chose not to have any text accompany a symbol (e.g., *thumbs-up*) to allow them to be more multi-functional with respect to meaning. Symbols with no text that can express several potential meanings can also conserve space when grid display space is limited. In the single case of the verb *want,* we chose to use only text given the difficulty of finding an appropriate symbol. These cases are described further in later sections.

All text for the words is presented in a font that most reading children should recognize from school or books, namely KG Penmanship that depicts the letters "a" and "g" as single-story versus double-story (see https://kimberlygeswein.com/downloads/kg-primary/). This font was created in consultation with elementary school teachers and is available for free on the free version of Canva. As part of our due diligence its use in this application was also confirmed in writing with the owner of the font. All words, except the proper noun *Silver Lake* and the pronoun *I*, are written with lowercase letters to be consistent and easy to read. We kept verbs in the present tense to encourage conversation about the here-and-now without adding any further inflectional forms which children acquiring English tend to only master later (Binger et al., 2020; Clark, 2003) and which would compress text and symbols further on the board space-wise. Similarly, most nouns were kept in the singular form except for play

structures that are usually plural, like *swings*. Although grammatical morphemes such as the plural -s are an early appearing and important development in children's language acquisition (Brown, 1973), we did not include any individual morphemes or prefixes and affixes in the content of this board given that we chose to prioritize efficient and activity-based communication over being able to construct fully grammatical sentences. In addition, as Binger et al. (2020) note, the high-level literacy skills required to be able to use morphemes in producing utterances on an AAC board or in writing (versus in spoken language) are not within the capability of preschoolers. We also reasoned, as is commonly found during a child's early language acquisition, that parents and caregivers can repeat their utterance back to them, filling in missing words such as prepositions, morphemes and/or modelling correct verb tense (Chouinard & Clark, 2003) thereby exposing the child to the full, grammatically correct form.

Use of Modified Fitzgerald Key with colour-blind friendly palette for symbol borders

The use of colour-coded borders or backgrounds of cells is often recommended in AAC design to designate different grammatical or other important classes of words. This can provide the user with a reference to quickly locate symbols relating to different word classes (Thistle and Wilkinson, 2009). The Fitzgerald Key (Fitzgerald, 1949) was originally developed to assist deaf children in visualizing and establishing relationships within language. McDonald and Schultz (1973) modified the Fitzgerald Key and applied it to AAC usage. Their Modified Fitzgerald Key (MFK) consists of six colour-coded classes of words: orange (nouns), green (verbs), yellow (pronouns), blue (adjectives), pink (social words), and white (miscellaneous). Since then, more informally, the MFK colours have been applied to further word classes such as purple (question words) and red (important/safety words) (e.g., Zangari, 2013). The inclusion of the MFK colours is ubiquitous on AAC graphic displays and recognized to be aimed towards aiding parents and older children in the quick location of symbols more so than younger children, whose ability to understand the link between background or border colour and grammatical categorization has been found to emerge only around 5-7 years of age (Wilkinson et al., 2022).

We applied MFK colours to our board, however, to accommodate colour-blind individuals, we applied a modification of certain colours. Okabe and Ito (2002/2008) have made a set of colours available online (along with print specifications) that is unambiguous to both colourblind and non-colourblind individuals (https://jfly.uni-koeln.de/color/ ; see Appendix 3 for extract). We noted that we could align the colours used in the MFK to close alternatives that are colourblind-friendly. Thus, following the suggestions by Okabe and Ito (2002/2008), green (verbs) was replaced by a bluish green colour that helps to distinguish it more clearly from red and brown. Purple (question words) was replaced by a dark blue. Blue (adjectives) was replaced by a lighter sky blue to enable the darker blue to be used instead of violet/purple for the question words. Pink (prepositions and social words) was replaced by the reddish-purple colour most similar to it. Red (negation and important/safety words) was replaced by vermillion (an orangy red) as it is identifiable to protanopes; people with red-green colour-blindness. Orange (nouns) and yellow (pronouns) did not need to be replaced as they are included in the colour-blind friendly palette. No further adaptations were made for the MFK colours for adverbs, determiners, or conjunctions as these word classes were not included on our board.

Internal symbol colour design decisions

Black and white symbols: Black and white symbols are often used when colour does not contribute to the overall meaning of the word (Thistle & Wilkinson, 2015). We chose black and white symbols for pronouns, question words, social words, and verbs given that internal colours would not further aid in determining their meaning and they can be more representative of all users. Where small details such as fingers or hands are important (e.g., *all done*, *help*), black and white line drawings were used. Where such details were not critical, we used figures and objects in black (e.g., *climb*, *race*).

Internal Colours: Our decision to include internal colours (apart from MFK border colours) by colouring in the line drawings or assuming colour photographs on some symbols was influenced by findings of an increased speed and accuracy in symbol identification among younger children when symbols are clustered by internal colours (for review see Light et al., 2019b). The use of colour also plays a significant role in achieving high contrast to help all individuals, including those with low-vision or cortical/cerebral visual impairment, to visually access content (Nattress et al., 2024; Russell & Willis, 202). Our decisions regarding the internal colours for the safety words, physical states, emotional states, and play structures will be described in more detail in sections to come. As noted above, the black internal colouring for the figures for (non-sensory) action verbs also serve to differentiate this word class from others.

Vertical placement of symbols within word classes

Whenever possible, we arranged symbols vertically on our AAC board to align with age of acquisition linguistically, but also considered important words that should be readily accessible to all ages and physical abilities (e.g., safety words such as *stop)*. We positioned words vertically *within word classes* in the order that they typically emerge in children's language development, with earlier acquired words nearer to the bottom of the board to ensure they were within easy reach (e.g., their placement was lower on the board because younger children are shorter in height). For example, for *wh-* question words, the symbols for *what* and *where* are placed closer to the bottom as they emerge at earlier ages than *who* and *when* which are placed higher up (Clark, 2003). Thus, words acquired typically at later ages within a class will be closer to the top of the board. Further details and examples will be provided in later sections. Important/safety words were also placed at or near the bottom to be within reach of all children.

In addition to age of acquisition, we vertically arranged words and symbols into thematic columns based on positive or negative tone. For example, affirmative words such as *more/again, thumbs-up,* and *go,* are all in the same column, adjacent to a column of negative words featuring their opposites *all done, thumbs-down,* and *stop*.

We also took into consideration the spatial layout of the physical structures on the Eby Park playground. For instance, the swings in the park are located up a hill and farther away from the AAC board's location, and so we placed the symbol for *swings* near the top of the board, along with other structures in that area. Our goal with this "map-like" organization was to help children associate the symbolic representations of playground structures with their real-world referents. In addition, when possible, we took into account the ages of children for whom the structures were intended, with cells for structures aimed at younger children (e.g., sandbox) placed lower than those for older children (e.g., red tower).

Horizontal placement of symbols within and between word classes

The horizontal placement of symbols on our AAC board was designed to emphasize meaningful relationships within and between word classes. Within individual classes, we arranged words with contrasting meanings side by side to highlight their relatedness and make navigation intuitive and efficient. For example, we placed *hot* and *cold* adjacent to each other, taking advantage of research indicating that preschool age children naturally group words with related meanings together into semantic fields, before they necessarily understand the individual meaning of those words (Clark, 1972). By taking all these considerations into account in both the vertical and horizontal grouping of items, we aimed to capitalize on findings that greater separation ("e.g., perimeter design") between different clusters of words is beneficial (Wilkinson et al., 2022), although we were not able to impose as much separation between them as might be desired given space constraints and the grid design. We also believe these considerations improve upon AAC displays in which related words are spatially separated across different areas of the board (see Figure 5), potentially making them both harder to locate and harder to comprehend in a comparative sense.
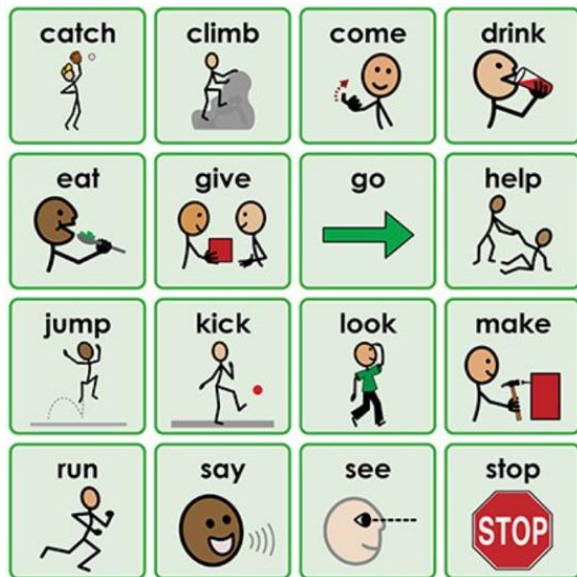
Figure 5. Example taken from a photograph of an existing AAC display on a school playground where the placement of related words 'stop' and 'go' as well as 'eat' and 'drink' are separated in space. (Source: We have chosen not to identify it given that displays with similar placements can be found on many AAC boards and we do not want to single out this particular example.)

In addition, we incorporated spatial considerations to reflect the physical layout of the playground, similar to our approach to vertical organization. This was particularly relevant for the playground-specific nouns, which we recognize would differ between playgrounds. For instance, it made sense on our board to place the spinner next to the climbing ropes, as these two structures are in the same area of the playground.

Finally, we considered relevant combinations of words across classes to further enhance efficiency. For example, the verbs *fast* and *slow* were placed next to the playground noun *spinner*, as we noticed these words are frequently used together on the playground. Similarly, we placed the social words *more* and *all done* next to the physical states (e.g., *overwhelmed, tired, hot, cold,* etc.) as these words may help a child explain to their caregiver whether they would like to continue playing or not, and why.

**Height + width of the board and grid size**

The desired height and width dimensions of the board provided to us were 150 cm (59 in) wide by 112 cm (44 in) high. The bottom row of symbols was to start at a height that could accommodate wheelchair users. By placing the title at the bottom below wheelchair height, we maximized space for cells within reach for all children. These considerations ultimately led to a graphic display that could accommodate 9 cells in width by 7 cells in height. This total of 63 cells was in the range of typical grids on handheld AAC devices (e.g., Proloquo2Go™ has grid sizes of 5x9 and 7x11) and was supported by an internet search for existing playground AAC boards and a recent 2024 survey by openAAC.org that found "60 buttons was by far the most common grid size" (https://www.openaac.org/2024/02/13/state-of-aac-2024.html). It also allowed each cell to be about 10 cm in width with about 5 cm between cells to avoid excessive visual crowding and clutter which has been shown to be detrimental to efficient use of AAC displays (Wilkinson et al., 2022). This number also left a one-cell column space for us to use to accommodate further features of a colour wheel, Smiley Face Likert scale, number line, and *hi/bye* greeting/farewell cell.

Details of words in main classes, symbols used, and placement on our board

Pronouns (Yellow border colour)
Words

When working with limited spaces on the board, it was important to select words that we felt would be the most used on the playground. Ultimately, we decided to include only two pronoun cells on our board, *I/me* and *you*. Supporting this decision, in the Banajee et al. (2003) study mentioned above, *I* and *you* were the only pronouns identified within the nine-word core vocabulary list for toddlers developed by analyzing naturally occurring language in preschools during play and snack times. We also reasoned that in the context of the playground, if a child wanted to refer to another child, or group of children, they would most likely point to them directly. Given that it is common in language acquisition for younger children to use *me* before *I*, both were included (Clark, 2003).
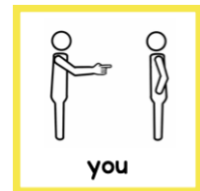
Symbols

We opted for a black and white line drawing of a torso view with a hand pointing toward self for *I/me.* Our initial depiction of *you* consisted of a similar torso view with a hand in front and one finger pointing towards the viewer. In our park feedback session, however, children struggled to understand the idea of the finger pointing out, which led us to replace this symbol with 2 figures outlined in black, with one figure pointing at the other figure in a side view.

Placement

We placed the pronouns on the far-left side of the board to concur with their subject position in sentences. Given that children often master the use of these pronouns by the age of three (Oshima-Takane et al., 1999), they were also placed in the bottom 2 rows of the board to be easily within reach of all children.

Question Words (Dark blue border colour)
Words

We included the four question words *what?, where?, who?, when?,* and a final generic question mark symbol without accompanying text to allow it to be used in a more multi-functional way to express *why?* or *how?* or even other meanings such as *I'm confused*.

Symbols

AAC boards commonly represent question words by placing a question mark inside another shape. For example, the *Picture Communication Symbols*^{TM} from Mayer-Johnson (1992) depict *who* as a question mark within a blank face, and *when* as a question mark inside a circular clock face. However, Worah et al. (2015) argue that most children do not have the metalinguistic skills necessary to extract the meaning of such representations, especially for abstract linguistic concepts like *who*, that are based on adult conceptual models. Symbols are better understood when they align with children's conceptualizations of the vocabulary item (Worah et al., 2015; see also Light et al., 2002, 2007). However, as Worah et al. (2015) argue, interrogatives such as *who* are used in a wide variety of contexts, making it very difficult to strike a balance between a developmentally appropriate representation that offers more specific contextual information and a more abstract representation that can apply to many contexts.

When drawing these symbols, we decided to separate the question mark from the object to reduce the metalinguistic skills necessary to interpret the symbol, while still using a common object (clock for *when?*, torso for *who?*, map for *where?)* that could be recognized by children and applied to the wh-question word. For *what?* we used the common body gesture with two outstretched arms. This consistency in presenting *object +?* was also employed to help signal that all these cells are related to question words.

The use of a generic question mark alone was decided upon for the interrogative *why* and related question words such as *how* given the difficulty in representing these meanings visually as they can be applied in many contexts. This more open-ended symbol thus affords greater semantic diversity and is efficient space-wise.

Placement

We arranged the interrogatives vertically largely according to their emergence in child language. *What* and *where* are usually already used by 2-year-olds and tend to emerge somewhat simultaneously (Clark, 2003) and so were placed near the bottom (accessible to shorter, younger children). *Who* and *when* are most commonly produced next and so were placed next highest on the board. Although, *why* (and *how*) may appear soon after *what* and *where*, given their more difficult representation as a symbol as mentioned, this open-ended question mark symbol was placed in the top row of the board. It is also the case, that in the production of *wh*-words, children may rely on earlier forms even when they have demonstrated comprehension of later-appearing terms (Ervin-Tripp, 1970).

16

Important/Safety Words (Vermillion border colour)
Words

To maximize opportunities for communication across a range of settings and activities, it is important to include words on an AAC device that can be used to mediate and regulate activities with other people (Binger et al., 2020, 2024; Light, 1997). Such words can allow children to control/direct activities, assert boundaries, initiate and terminate conversation, and express their needs, likes, and dislikes. This class of words, which relates to children's growing social pragmatic communicative skills, also appears early in toddlerhood in the typical course of language acquisition (Clark, 2003; O'Neill, 2007). The safety and social words we included are intended to fulfill such communicative functions, and were therefore placed close together on the board. They will now be discussed in turn.

We included 5 important/safety words that included two related pairs — *go* and *stop* and *thumbs-up* and *thumbs-down* — and *help*. We included *help* as it is generally recognized as a universally important safety word (e.g., Johnson et al., 2016) and therefore often included in AAC graphic displays such as *LAMP Words For Life*™, *TouchChat*™, and more. It was placed next to the symbol for *come with me* in the social class due to their similar intention to have someone come and similar illustrations of hands interlocking. *Go* and *stop* allow children to assert themselves and express boundaries. *Thumbs-up* and *thumbs-down* can be used to express various things such as indicating likes and dislikes, communicating yes and no, and acknowledging understanding.

Symbols

Go and *stop* are accompanied by illustrations representing typical traffic signs that children encounter in their day-to-day lives. In our feedback session, three-year-olds were able to identify *stop*, with one child even expressing that he saw a stop sign on the way to the park. *Go* was also correctly identified. We chose not to accompany the symbols for *thumbs-up* and *thumbs-down* with any text/words to allow for a greater variety of uses and meanings (e.g., *yes/okay/good/like* for *thumbs-up*) which is an important consideration for increasing semantic diversity and alignment with children's typical language development (e.g., Binger et al., 2024). We did colour them green and red to be consistent with *go* and *stop* below them and therefore aid in identifying their similar meaning.

Placement

The important/safety words are placed at the bottom of the board for easy access to children of all ages. *Go* and *stop* are placed lowest and *thumbs-up/thumbs-down* are above. The affirmative versions of each pair are placed to the left, with the negative placed right (e.g., *thumbs-up* above *go* and *thumbs-down* above *stop*).

Social Words (Reddish-purple border colour similar to pink)
Words

We included six social words: *hi/bye*, *my turn*, *more/again*, *all done*, *come with me,* and *want*. *Hi/bye* could be argued to be unnecessary given their possible communication via a handwave. However, our literature review revealed several findings supporting their inclusion to facilitate initiation and termination of communication. Individuals with communication disorders often struggle to gain the attention of others through speech (Midtlin et al., 2014). Additionally, AAC users often have passive communication styles, engaging in fewer attempts to communicate, and resulting in adults initiating most of the communication (Light et al., 1985). Therefore, the inclusion of *hi/bye* has been argued to be essential for AAC users to be able to meet the demands of attracting others' attention (Midtlin et al., 2014).

More/again and three short word phrases *my turn*, *come with me*, and *all done* were included both for their relevance and frequent observation on the playground with peers and/or adults and on other playground board examples located online. From a developmental viewpoint, they are common examples of short, more "telegraphic" utterances used by children as young as 2 years of age to regulate social interactions with others to achieve or express desired outcomes (Clark, 2003). The inclusion of *my turn* allows children to discuss play opportunities and indicate that they want a turn. In addition, this phrase can be used for children to express to their communication partner that they are not done speaking. Midtlin et al. (2014) found that many AAC-using children expressed frustration when their communication partners did not wait for them to finish talking and needed a way to communicate to their partner that they needed more time to finish their point.

We also included the word *want*, in text only, which is different from all other cells on the board. The inclusion of *want* was decided after discussion with two SLP experts in AAC who relayed the importance of adult modelling and therefore the need for the word *want* given the frequency with which adults might construct questions to a child requiring *want* (see also Binger & Light, 2007; Romski et al., 2010; Wandin et al., 2023). Thus, its inclusion was influenced more by its value to adults or older children more accustomed to producing and modelling full sentences.

We did consider quite extensively the inclusion of two further phrases, namely *watch me/look at me* and *can I play?*. *Watch me/look at me* was frequently heard during playground observations. However, given space constraints, the difficulty finding an easily understood symbol, and the possibility of expressing its meaning via the use of the *look* symbol discussed in the next section, it was not included. We also noted that *watch me* was often used while a child was on a structure and so its inclusion on the board might be less useful as a child would have to disengage from their activity to get the attention of someone once more before returning to

the activity. We also considered a phrase such as *can I play*? to indicate the desire to join a group of children in play. We ultimately did not include it for several reasons such as the fact that research has shown that such direct requests to play are generally not very effective (Köngas et al, 2022) and it is also something that children would most likely want to communicate to a group of children who are already on a certain structure on the playground and not at the communication board. A more likely scenario appeared to be that a child would want to communicate to a parent that they'd like to play with a group children already somewhere on the playground, such as on the spinner, and would thus use the board to communicate they want to go on the spinner. An accompanying parent would then immediately be aware of the need to communicate to the children on the spinner that their child would like to join and could help with this on the playground itself. We also decided that including a *friend/s* symbol would be of less use in a city playground than a school playground.

Symbols

As mentioned*, hi/bye* is represented by a single symbol of a hand waving, as this is a common greeting or farewell with which even a young child would be familiar. *More/again* and *all done* are both illustrated with American Sign Language (ASL) signs. These words are both challenging to represent pictorially, so we felt that using an ASL representation would be the best option. In our feedback session, we found that children who were familiar with ASL were easily able to identify these two symbols. *My turn* is represented by a black and white line drawing of person pointing to themselves with their hand raised (and similar to the *I/me* symbol). *Come with me* is depicted by a child leading an adult, holding hands. At first, this symbol was represented by just two hands, with one holding the other. We changed this after our feedback session, as children commonly mistook the symbol to represent washing hands.
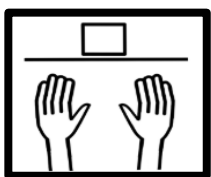
Figure 6. *Common symbol for 'want'*

The cell for *want* is unique compared to others on the board, as we opted not to include a symbol. *Want* is a cognitively complex word, as it represents a relation between a person and an object (and a mental state with no obvious facial expression) and it is difficult to represent pictorially (Worah et al., 2015). One symbol commonly used for *want* depicts two hands reaching for a box (see Figure 6). Worah et al. (2015) found that college students struggled to identify *want* using this symbol. In discussion with two SLP experts in AAC, we decided to opt solely for using text.

Placement

Hi/bye is placed furthest left on the board, outside of the main graphic display where it can be quickly found, highlighting its function to initiate or terminate communication. The other 5 social words are grouped together. *More/again* is placed beside *all done* because these words are conceptual opposites and are both illustrated with ASL signs. This is helpful because children are able to more quickly identify words when paired with their semantic opposites (Clark, 1972). *Come with me* is placed next to *help* (one of the safety words) because both function as a request for attention and an action on the part of the communicative partner and have a similar symbol as mentioned above. *Want* is placed highest in the social words as it is intended to be used primarily by adults and older children. All the social and safety words are placed in the next-most left-hand 2nd and 3rd columns given their importance (safety words) and their usual place in English sentence structure or their use as single word utterances or complete phrases ('telegraphic speech') by very young children (Clark, 2017).

Four senses (Green border colour)
Words

We decided to include words for 4 senses – *look/watch, hear, feel, smell* – as they are relevant to children's sensorimotor explorations of their environment from very early on. The inclusion of these sense words allows children to describe their surroundings to others, which is especially relevant to the setting of an outside playground in a city park. In our feedback session, we noted that the eyes were most often named as "*look*" supporting our use of *look* rather than *see*. Aligned with both the aim of more core- or activity-focused approaches to AAC, the inclusion of these sense words allows children and their communicative partners to communicate thoughts and impressions beyond simple requests, benefitting their language development (Binger et al., 2024). Learning about how our senses can help us to explore and learn more about the world is also a very common topic in early childhood education (Ontario Ministry of Education, 2014). We chose not to include *taste* as this sense is less likely to be used in a playground setting (versus at home, for example). For reasons mentioned above, we felt *look/watch* could be used to express the commonly heard phrase *watch me*.
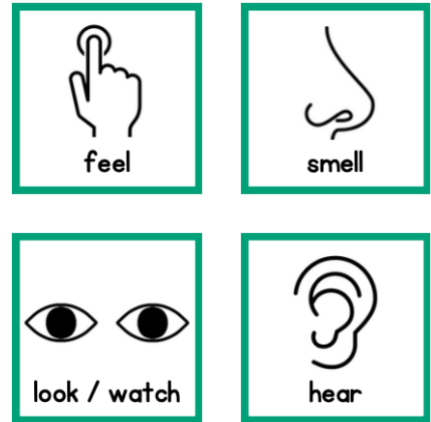
Symbols

When choosing the symbols, we decided to represent each sense using only an easily recognizable primary body part involved in that sense. Showing solely one feature makes it easier to recognize what is being depicted at first glance. We noticed that many AAC boards use symbols with arrows or lines to represent sound waves or smells travelling through the air (e.g., *ARASAAC*; also see Figure 7).

However, interpretation of these arrows and lines likely requires more conceptual understanding of the senses than preschool age children have been shown to possess (e.g., O'Neill & Chong, 2001) and a level of abstract symbol understanding (e.g., wavy lines representing sound waves) that is not typically covered in a school curriculum until at least

Figure 7. A depiction of AAC symbols for smell and look/see/watch with arrows and lines.

Grade 4 (e.g., Ontario Ministry of Education 2022 Science and Technology Curriculum retrieved from https://www.dcp.edu.gov.on.ca/en/curriculum/science-technology/grades/grade-4/strands). Thus, extra lines and arrows were not included in these illustrations. The illustrations were presented as black and white line drawings to be more universally applicable and to reflect that no particular colours are associated with any of the senses in contrast to colours that are associated with certain physical and emotional states, which will be discussed in later sections.

Placement

Our decision was to separate the four sense verbs from the action verbs, although all maintained the green border used for verbs. Given that children's communication is likely to focus on the here-and-now, placing the sense words further to the left allows a user to more quickly construct utterances such as "I feel hot" rather than "hot" or "I hot". The left-side placement also positioned these verbs closer to the Smiley Face Likert scale, allowing sentences such as "You look sad" to be easily constructed. Their placement in the same columns as *thumbs-up* and *thumbs-down* symbols can also allow easier communication of preferences, such as "smell bad." Their placement near to *I/me* and *you* can also help to construct the commonly observed request of children to "watch me". Research has not shown a consistent trend with respect to when preschool-age children come to understand information provided by each of the five senses (O'Neill & Chong, 2001), and so placement of *look/watch* and *hear* below *feel* and *smell* was determined by their potential greater use (placed lower) or lesser use (placed higher) in a playground setting.

Physical States (Sky blue border colour)
Words

We dedicated a relatively large portion of our board to words describing both physical and emotional states. (We recognize that some of these terms might be viewed as representing physiological, rather than physical, states, but we will use the more common term physical.) As previously discussed, there is no one correct approach for deciding which types of words to feature. However, noun-focused boards tend to limit communication to basic requests, despite children developing pragmatic function beyond requesting very early (Binger et al., 2024; Clark, 2017). Therefore, it was important to us that our board met children's needs to comment, label, and describe themselves. A child's ability to accurately describe their physical state to a caregiver is crucial to ensuring that their needs are met. Without the necessary vocabulary, a behaviour such as crying at the playground is open to many interpretations, such as the child being hungry, tired, hot, injured, or angry at another child for not giving them a turn.

As part of our activity focused approach, we tried to consider the most common and important physical states that would arise in a playground setting, ultimately narrowing down the physical state words to *sick, hurt, hungry, thirsty, hot, cold, overwhelmed,* and *tired. Hurt* has been documented to be a universal pain-related word used by all ages (Johnson et al., 2016). The inclusion of *overwhelmed* was motivated largely by discussions pertaining to the need for quieter spaces in playgrounds for neurodivergent children who may become overwhelmed by
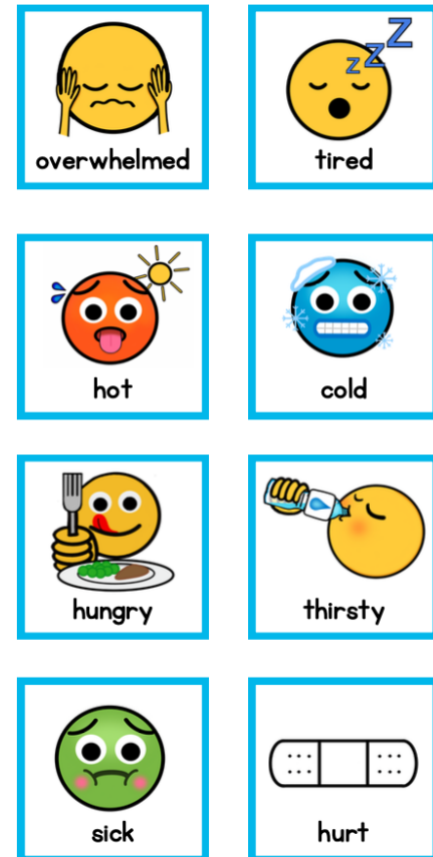
sounds or number of children and need to communicate that they are feeling overwhelmed and/or want to go to a quieter space (James et al., 2022). Despite the lengthier word, our feedback session revealed that parents liked this term and its open-ended meaning and preferred it to other alternatives (e.g., overstimulated, too noisy). We grouped these physical state terms (and emotional state terms described next) under the MFK word class of "adjectives" for purposes of assigning a colour border to them.

Symbols

After selecting the words, the question became how to visually represent these state-words in an accessible and inclusive way. We noticed that many existing AAC tools depict these words using different expressions on human faces. At times, these faces are depicted with one consistent gender, complexion, and physical appearance. This may be appropriate when an AAC tool is being used by a single child where the face can be customized to reflect the physical features of the sole user, similar to avatars commonly used on electronic devices. However, in a diverse setting like a city playground, using one set of physical characteristics is not inclusive. To address, some AAC graphic displays feature multiple faces with different features and complexions. However, this approach requires one to decide which features and complexions to use with each state term, which can be problematic, especially for the related domain of emotion state words. As a result, we decided to employ a solution that we believe is somewhat novel to AAC boards (we could not locate one in our searches), namely to use *emoji-style* symbols with their typical colourings that do not represent any particular human complexion (e.g., yellow, green, blue). For instance, in the style of classic emojis, *hot* was depicted by an emoji with a typical red/orange face colouring and *cold* featured an emoji with blue face colouring, reflecting conventional associations with hot and cold temperature. Similarly, *sick* was depicted by an emoji with green face colouring, commonly associated with nausea. Other states used the classic yellow emoji colouring.

Not only are emojis an inclusive option, but they are also ubiquitous in our world today given their presence on tablets, phones, games, and in pop culture (Hand et al., 2023). In fact, we were inspired to further investigate the use of emojis after encountering them in the children's charades game, *Dizzy Donkey*™*,* from Orchard Toys. Hand et al. (2023) found that many emojis are understood by a wide range of users, including autistic individuals. To enhance familiarity, we based our emoji designs on universally recognized classic emojis with respect to the facial expressions and internal colouring. Having multiple cells with these familiar and brightly coloured symbols clustered together should also make finding these two classes of symbols faster. Both neurotypical and neurodivergent children (autistic, Down syndrome) have been shown to be faster and more accurate at locating symbols, and less likely to become distracted by words in other classes, when symbols were clustered together based on internal colour (for reviews see Light at al., 2019b; Wilkinson et al., 2022). The bright internal colouring is also appealing to children and should be an advantage for younger children who have been found to rely more on internal colours on AAC symbols than background or border colours (Thistle & Wilkinson, 2017).

Whenever possible, we used emoji designs consistent with universally recognized classic emojis to ensure familiarity. However, for some words, such as *hungry, thirsty,* and *overwhelmed,* different versions of emojis were found and so we created custom designs drawing from the different versions and other symbols commonly found on AAC graphic

displays. For *hungry,* we designed the emoji to feature a character holding a fork over a plate of food. Initially, the character also held a knife, but we removed this detail to respect cultural practices where knives are not commonly used for eating. The food on the plate was intentionally designed to be ambiguous, using colours and shapes that could represent a variety of cuisines from different cultures.

Our feedback session (see Figures 8a and 8b) led to a few refinements to our designs such as making the beads of sweat and the sun more prominent in *hot* to be more similar to the snowflakes for *cold* and avoid misinterpretation as *sad.* Children in the feedback session were able to recognize most of the other emojis, except for some of the youngest children, who struggled to understand *overwhelmed.* However, older children and parents were able to recognize this state and even created sentences using it.

For *hurt,* we opted not to use an emoji face, but rather a simple drawing of a bandage. This more ambiguous symbol can better represent various types of injuries compared to a facial expression of pain, which can be easily misunderstood even by adults. We observed that this symbol was well understood by children as young as three years of age during our feedback session.

Placement

We arranged the physical states such that related or contrasting words were adjacent to each other. For example, *hungry* and *thirsty* are placed side-by-side to show the contrast between the words. We observed this arrangement to be quite beneficial during our feedback session. For example, children who first identified *cold* were more easily able to recognize that the adjacent symbol must represent *hot,* even though the latter's design was subsequently improved, once again demonstrating the value in grouping related words.

Consistent with our vertical approach overall, we positioned potentially more important or urgent words for health and safety such as *sick* and *hurt* near the bottom to be accessible for all ages and heights. We placed the words *overwhelmed* and *tired* further up on the board, and also in lateral proximity to the social word *all done* in case this would be helpful for children wanting to communicate that they need a break from playing.

Figure 8a. A parent and child exploring our board during the feedback session. (Photo Credit: Snow Larc)

Figure 8b. Daniela talking with children exploring our board during our feedback event. (Photo credit: Snow Larc)

Emotional States (Sky blue border colour)
Words

As with the physical state terms we included, our goal was to include emotion words that would be the most relevant on the playground to give children the vocabulary to express what they are feeling in that specific context. Indeed, investigation of the factors considered by practitioners in building AAC displays for children found that 93% of more experienced practitioners included emotion words most or all of the time (Thistle & Wilkinson, 2015). The emotion words we included are *excited, sorry, angry, scared,* and we additionally included *love* and *hug* given their thematic relatedness, despite being verbs. One unique decision we made was to not include the words *happy* and *sad* and to instead create a Smiley Face Likert scale on the left side of the board that can serve to represent *happy* and *sad* by the faces at either end of the scale (this scale is described further below).
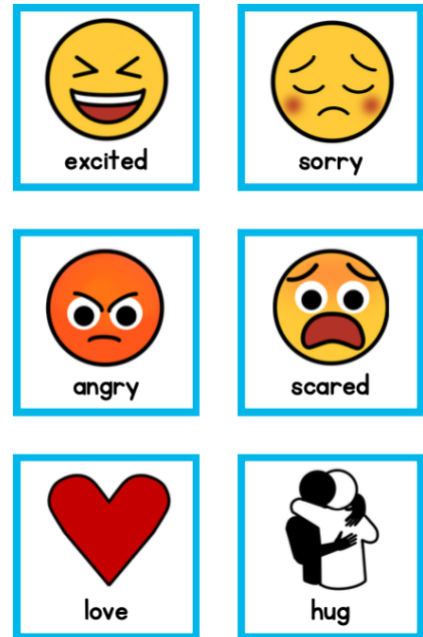
By about 10 years of age, children's ability to recognize and label most emotional states and expressions has been found to be similar to that of adults, especially for less subtle and more intense emotions (Mondloch et al., 2003) but may pose more difficulties for neurodivergent children (e.g., autistic children; Rump et al., 2009). Difficulties communicating about emotions when using AAC tools, can lead to confusion on the part of a communication partner and perhaps an unhelpful response towards this child, leading them to feel misunderstood and frustrated (Midtlin et al., 2014). The ability to express emotions, and have others recognize your emotions, is important for socioemotional wellbeing and to foster a safe space for all children (Gilmore et al., 2018). Moreover, it has been shown that children who have a larger vocabulary of emotion words to use to talk about their own and others' emotional states were more liked by peers (Fabes et al., 2001). Thus, we prioritized the inclusion of as many emotion words as possible, both for the child to use or a communication partner to model, given that exposure to emotion language at a young age predicts a child's ability to understand and discuss emotions (Ogren & Sandhofer, 2021).

The playground is an ideal context for children to learn and express their emotions, as there are many opportunities during physical play to cope with challenges such as getting hurt or feeling scared. It also provides an environment for practicing peer interaction skills, such as navigating social conflicts and communicating about the strong emotions that can arise within them (Vaiga et al., 2022). Thus, having access to emotion words is crucial as children learn to express their feelings and needs while engaging with others. Children also often engage in pretend play on playgrounds and may use emotion words to establish social roles or even tell stories about characters (Clark, 2017). As Clark (2017) states, "play allows children not only practice in using language, but also practice in both taking and tracking different viewpoints" (p. 111). As the Eby Farm playground features structures that provide children with challenges

(e.g., very high tube slide that may be scary), opportunities to work and negotiate together (e.g., spinner), and engage in pretend play (e.g., vegetable and flower stands), the inclusion of emotion words was deemed very relevant.

Symbols

For the same reasons as discussed for the physical state words, we used emoji-like symbols to represent the emotional states. Our symbols for *excited, sorry, angry,* and *scared,* resemble the classic emojis for these facial expressions with the typical emoji yellow internal colour. A red heart depicts *love* and the symbol for *hug* is similar to the grey/blue emoji version of a hug for support and comfort (rather than the more smiling emoji hug to share joy).

Placement

We placed the emotion words above the physical state words given that children's ability to use language to describe their feelings and emotions emerges later in development than their ability to describe physical/physiological states (Bretherton & Beeghly, 1982). It was not possible to align the height of symbols with age of emergence as clearly as within other classes given that this would have necessitated intermixing words for physical and emotion states (e.g., both *hungry* and *hug* would be early appearing words as opposed to *overwhelmed* and *excited*). We felt that it was clearer and easier to locate words overall if they were kept in these two separate classes. Within the emotion words, we tried to place related or contrasting words beside each other (e.g., *love, hug*), but most of the words have fairly different meanings that do not lie on a continuum.

Action Verbs and Adverbs (Green border colour)

Words

Our final board had to combine both areas of the playground and their structures, along with other actions and games possible on the playground, and so space for action verbs and adverbs was very limited. As a result, we immediately eliminated any verb that could be expressed via pointing to the playground structure symbol itself, such as the verb *slide* which could be communicated via pointing at the symbol for the slide structure. That is, *I want to slide* could be communicated using the cells *I want slide* and similarly the symbol *spinner* could be used to communicate the verb *spin.* Some symbols for structures could also be used to convey the action afforded by them, such as using the word *bench* to convey the meaning that you would like to *sit*.

This word class ultimately included the two adverbs *fast* and *slow* and the four verbs *climb*, *drive*, *race,* and *hide.* The adverbs *fast* and *slow* were included as they were often mentioned at the playground, particularly when using the spinner, but also when playing on the slide and when racing. *Climb* and *drive* were included because they were also observed to be used in many contexts and ways on the playground. For example, children not only climbed on the climbing ropes and ladders, but on top of the tube slide, playhouse and pigs in the sandbox. *Drive* was also a verb
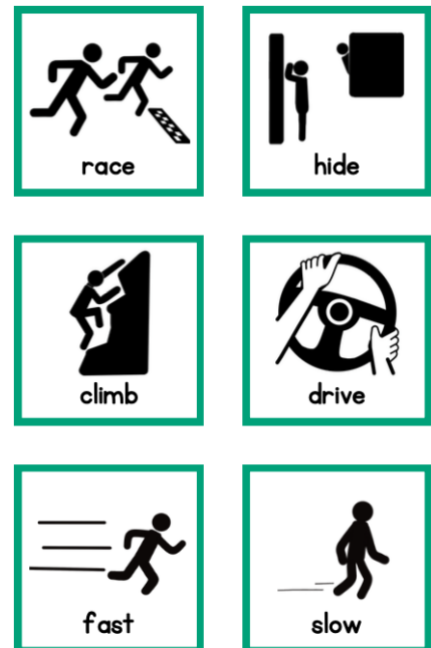
that could be used with respect to several structures on the playground and, in addition, could be combined with *home* to indicate the desire to drive home.

Two verbs not related to any structure, *race* and *hide* (as in hide-and-go-seek), were included due to hearing children mention these games. Children would take part in races on and to different structures or parts of structures. Wanting to race is not easy to communicate via the use of gestures or actions, nor is wanting to play hide-and-seek. Thus, these two game related verbs were included. For the opposite reason, *tag* was not included as a child simply tapping the person they wish to tag and running away appears to be readily understood and a successful way of initiating a game of tag.

Symbols

We based the design of these action verb symbols on Isotype symbols which depict people doing things via simplistic black and white drawings (Nemeth & Stadler, 1996). A gender-neutral style was used for the human figures.

Our symbol for *climb* had to encompass many different types of climbing observed on different playground features. One more general AAC symbol we observed for *climb* is a rock face associated with rock climbing, and this symbol was correctly identified by children as *climb* in our feedback session. For *drive*, the Isotype-based style was not quite ideal, and instead a black wheel with line-drawn arms was created.

Fast and *slow* are often (surprisingly) represented on AAC boards by an illustration of a rabbit in a running pose and a tortoise, respectively, reminiscent of the fable *The Tortoise and the Hare* by Aesop (https://en.wikipedia.org/wiki/The_Tortoise_and_the_Hare). In addition, these two words were often separated from each other on the board, likely making their meaning even more difficult to decipher. Thus, beyond requiring potentially culturally-specific knowledge of a fable to interpret the meaning of these symbols, the level of abstraction and lack of contextual relevance of a rabbit and turtle to the playground led us to look for alternatives. We therefore based our symbols for *fast* and *slow* on the Isotype symbol designs and created two related symbols, one depicting a figure in a walking pose and the other in a running pose. To represent speed, we did use lines trailing behind the figure. Although these lines are more abstract, they are often seen in popular animations to depict running and we therefore thought they would be more easily interpreted by children.

As for the colouring within the symbols, we made them fully black to fit with the Isotype theme. Colour was not thought to provide any additional value with respect to interpretation. This black isotype style also served to group these words and differentiate them on the board.

Placement

When deciding the placement of the verbs, age of acquisition contributed to their location higher on the board as, in English, verbs are typically acquired at a later age than nouns due to their complexity (Bornstein et al., 2004). Conceptual and thematic groupings were also taken into account, with *fast* and *slow* being placed next to each other and beside the noun *spinner*. As *race* and *hide* are both games that do not relate to any particular playground structure, they were placed at the top of the board.

Nouns (Orange border colour)
Words

In our attempt to capture the main structures within the two playgrounds, nouns represent the largest class of words on our board and are the most customized to this particular playground (i.e., as mentioned previously, in the AAC literature, they might be referred to as fringe words; Beukelman & Light, 2020). It would have been ideal to create a single custom board for each playground, but the City of Waterloo's request was to have one board. We view this class of more customized words as one that would be unique to every playground to highlight its specific structures and features. The constrained space led to some decisions that we felt were not ideal, which will be mentioned here, coupled with the ideal solutions that we would propose with two separate boards.

In total, we included 10 of the play structures across both playgrounds: *playhouse, sandbox, tunnel, spring rider, red tower* (a VSD-like larger image using space of 4 cells), *tractor and wagon* and *tractor panel* (both VSD-like larger images using space of 2 cells), *spinner, climbing ropes, hill slide*, and *bench* (see full display in Figure 3). Although *bench* does not represent a play structure, it allows children to be able to express the need for a rest or break as mentioned earlier, or possibly for parents to indicate where they will be while the child is playing. The playground actually has three different playhouses, and had we had greater space available, we would have liked to include all three (house, flower stand, vegetable stand) given that children may have wanted to refer specifically to one of them. In addition, had we been able to include all three, we would have included the verbs *buy* and *sell* to encourage and promote pretend play afforded by the market playhouses that have symbols such as money on them.

Five further nouns representing locations or things away from the main playground area were included: *swings, Silver Lake, picnic table, dog, toilet* and *home*. Waterloo Park is a large park with many other features for families and children. Nearby the Eby Farm playground were two in particular that we heard children ask about during observations – the large swings at the top of a nearby hill and Silver Lake with its ducks, boardwalk and sandy beach area. A nearby ice cream/snack shop was also considered but ultimately left out for space reasons, its more limited summer opening, and the potential to convey a similar meaning via *hungry*. The Eby Farm playground also contains different types of tables: snack tables and a large picnic table area. Ideally, we would have included a cell for both types, but space constraints prevented this and so the more iconic *picnic table* was chosen.

Dog was chosen because it was observed being used in two main ways on the playground – both to signal interest (usually to pet) or because a child felt uneasy or scared. It was therefore deemed to be an important word outside of the play structures to include given the large park setting and frequent sightings of dogs by children. The final two words *toilet* and *home* were chosen to allow children to indicate these important needs and wants (e.g., *I want to go home*).

Symbols

Ideally, we would suggest photographs for all playground structures given that they would be the most iconic representations possible and because photograph symbols have been shown to be easier to learn for those with intellectual disabilities compared to line drawings (Mirenda & Locke, 1989). As the Market playground was still under construction at the time of

this project, our graphic display has a combination of photographs where possible and coloured line drawings standing in lieu of photographs for structures not yet in the playground. Ideally the photographs would also be edited to remove background material that may obscure clarity of the structure. As discussed, we included three VSD-type larger symbols for the structures with multiple play features – the *red tower, tractor + wagon, and tractor panel*. Silver Lake was a hand-drawn illustration as it is large and its main features are not easily captured in a photograph.

Very generic and common black and white line-drawings were used as the symbols for *dog, toilet* and *home.* Although we recognized that our drawings of a dog and house are not inclusive of all different types of dogs or homes (e.g., apartments), they are both commonly used symbols to convey these words in AAC systems (e.g., ARASAAC pictograms). Indeed, a Spanish study of the transparency of the ARASAAC pictograms found similar symbols were identified as a dog by 95% of participants and as a house by 98% (Diez et al., 2024).

Placement

Given the need to combine both areas of the playground onto one board, the placement of the play structures was influenced by the age for which they were intended, in addition to their location in space relative to each other and the position of the board. Thus, structures on the Market playground aimed at younger children were placed towards the bottom of the board, with structures of the Red Tower playground aimed at older children slightly higher up. The elements away from the playground (*swings, picnic tables, Silver Lake*) were placed at the top. As previously mentioned, we also tried to place these verbs and adverb symbols as close to their relevant playground structure symbols as possible.

A final decision made was to place *bench* and the three symbols *dog*, *toilet,* and *home* in the bottom right-most rows with home at the very "end" of the board. These all represent non-playground structures and important needs for children to communicate about (e.g., toilet, fear of a dog, wanting a break or to go home) and so their placement in the lowest row on the board makes them accessible to all. *Dog*, *toilet*, and *home* are easily distinguished and located by their black-and-white colouring, which was used to be more inclusive of, for example, different dogs or homes (Wilkinson et al., 2022).

Smiley Face (Likert) Scale

A Smiley Face Likert (SFL) scale is a well-known scale using five faces (and thus a form of pictorial Likert type continuum scale) with a range of expressions. Likert scales are often used with children to allow them to respond more easily to questions about how they feel about something, such as in pediatric medical settings where they have long been used to help children rate how they are feeling with facial expressions ranging from very negative to very positive (Tatla, 2015). SFL scales have been shown to increase children's engagement with questionnaires (Hall et al., 2016). A Likert 5-point scale can allow for a wider range of descriptors compared to a single symbol.

Our inclusion of an SFL scale provides children and communicative partners a fun and unique way to communicate their own emotional state (e.g., really happy, a bit scared, very upset), opinions, preferences or desire states (e.g., like a lot, don't find it fun, want to do it again, so-so about playing longer) and feelings (e.g., feeling bad or good). Based on our feedback session, many children recognized these multiple functions of the SFL scale and were

able, for example, to assign descriptors to the full range of 5 expressions (e.g., super happy, a little bit happy, not happy or sad, a little bit sad, really sad).

We again used emoji-like designs for the five symbols on the SFL scale, with the typical yellow colouring and more exaggerated expressions. SFL scales utilizing more exaggerated emoji-like symbols over simple line drawings have been found to lead children to use a greater range of options on the scale (Hall et al., 2016). Its inclusion on our board led us to leave out cells for *happy* or *sad*, which could be replaced by the use of this SFL scale (and conserve space). We positioned the SFL scale left-most on our board for two main reasons: first, it represents a scale of bi-polar adjectives, which precede nouns in English word order (Clark, 2017). Second, it can serve as a means of quick, single responses to many different questions and so its left-most placement makes these response options quick and easy for a child to locate (e.g., Did you like playing on the playground? Do you want to come again?)

Number Line

We included a number line alongside the Smiley Face Likert scale to offer children the opportunity to answer questions such as "how many?" and "how old are you?" as well as initiate communication with a numerical element. For example, in our feedback session, we saw children use this number scale to compare how tall they were. The number line can also be used to indicate plurality in a simpler manner than including individual morphemes like the plural –s. Indeed, this aligned with findings that, even before 2 years of age, children often attach a numeral to a bare noun as a plural marker (e.g., two dog), and only later learn to attach suffixes such as the morpheme -s (Clark, 2017). These types of early plural constructions and its potential use in single replies to many different questions supported its placement on the left-most end of the board similar to the SFL scale.
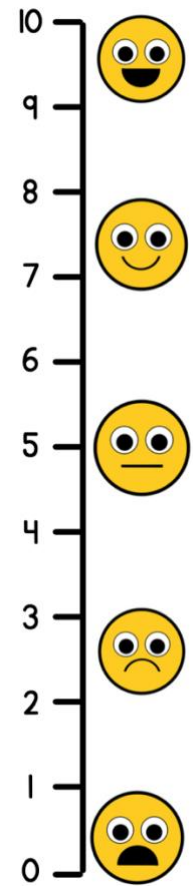
Colour Wheel

In the top left corner of our board, we included one further unique element that we developed – a colour wheel. Children can discriminate and categorize colours as young as four months of age, but often cannot accurately use language to describe colours in their environment until preschool age (Bornstein, 1985). Thus, including colours on our AAC board enables children to communicate about them before they can accurately label them. We chose a circular colour wheel as the most space-efficient way to include a range of colours while aligning with commonly seen colour wheels associated with colour theory. However, the colours in our wheel depart from those from traditional colour theory designs because we prioritized colours most relevant to a playground setting and how children might want to communicate about colour. For example, a child might tell a parent about a new friend on the playground by describing their clothing, in which case colours like black, brown, and white would likely be common, but do not appear on

colour theory wheels. We decided to base the colours on our wheel on those included in a pack of 10 Classic Colours Crayola™ Markers (red, orange, yellow, green, blue, purple, pink, brown, grey, and black), as we assumed most children would already be familiar with and comfortable using these colours. We also added white as a further 11th colour on the wheel.

Instructions and pdf copy of AAC board

AAC boards vary as to whether they include any instructions or not. When they do, the instructions are generally aimed at the communication partners of AAC users (e.g., parents, siblings). In addition to the name of board featuring the term "Augmentative Alternative Communication", we decided to add a very short line of instructional text to accompany this that reads "*Say the words out loud that you or your child points to, and leave time for a response!*" The inclusion of these instructions is supported on several grounds. First and foremost, the instructions provide some context about the board, especially to individuals who may have never heard of AAC or seen a communication board, which we observed during our feedback session. The AAC name and instructions help playground visitors understand that this is a communication tool used by individuals who benefit from having an alternative means of communication to spoken language. This is particularly relevant to the Eby Farm playground which is the first playground constructed in the City of Waterloo with a universal design featuring accessible structures (e.g., the spinner is wheel-chair accessible). Additionally, these instructions prompt aided AAC modelling from a communication partner, which has been shown to support children's language comprehension and development (Wandin et al., 2023). Furthermore, the instructions contain the important reminder to communication partners to allow plenty of time for the AAC user to respond. Without sufficient time, it can be difficult for AAC users to plan a response and then locate the correct vocabulary to express their thoughts, which can lead to an interrupted conversation flow or imbalanced turn-taking where the AAC user is only responding to simple questions (Midtlin et al., 2014). One of the most important things a communication partner can do to avoid a frustrating communication breakdown is to patiently wait for a response and take the time to clarify misunderstandings as they arise (Midtlin et al., 2014). We decided against very detailed instructions to leave a lot of flexibility in how people interact and who interacts with it. For example, in our feedback session we observed pairs of children who were very interested in the board read out loud many of the symbols, comment to their parent that a classmate used a board like this, and parents explaining to children why a child might use an AAC board. We observed that simply having a board at the playground generated interest in learning and talking about what it is and who might need to use it, thereby promoting inclusion and raising awareness of complex communication needs and AAC, as has been argued with respect to the installation of other boards in community playgrounds (e.g., Haliburton County, https://www.haliburtoncounty.ca/en/county-office/communication-boards.aspx).

We would also propose a link or QR code to be provided on the board which would lead to a website where a pdf copy of the board can be downloaded for use while visiting the playground or talking about the playground at home. Perhaps a copy could even be integrated into a child's existing AAC tool (although we made no assumptions that children would come to the playground with their own AAC devices). QR codes are becoming more common with city playground boards (e.g., https://aaccommunity.net/recreationboards/). In lieu of this, a

photograph could be taken by playground visitors. Accompanying this pdf on the website, would be further information about the board helpful to users, such as an explanation of the Modified Fitzgerald Key colours and examples of how to construct utterances (see Appendix 1 for a sample text).

Word classes we did not include

There are three main grammatical classes of words that we did not include on our board: prepositions (e.g., *on, in, off*), conjunctions (e.g., *and, next*), and determiners (e.g., *a, the*). All of these are classes of function words in linguistics that help establish grammatical relationships between other words in a sentence (along with other word classes we have included such as pronouns). However, as explained, we prioritized the production of quick, efficient conversational utterances more suitable for an informal playground context over the construction of fully grammatical sentences. As the meaning of function words is often hard to define, finding an easily understood symbol can also be challenging. We ultimately decided that these three word classes would not expand children's communication on the playground as much as the other classes included and would impede quick and efficient communication. We did debate the inclusion of some of these words more extensively, such as the prepositions *on/off*, we did debate their inclusion more extensively because they heard frequently on the playground (especially in connection with the spinner). Ultimately, they were not included because they were largely heard while the children were already on the spinner and access to the playground board would not have been possible (see Limitations and Further Research below for further discussion of this under Type of AAC board for a Playground).

A final feature we did not include was an alphabet. Including the alphabet requires a considerable amount of space, and its inclusion would mean a trade-off in terms of reducing content elsewhere. Thus, there should be strong evidence of its utility over and above other content. We could not locate in existing research literature any evidence or reasons to support either its inclusion or not on a playground AAC board. We then considered the pragmatics of communication on the playground and possible scenarios in which it would be helpful. One obvious use would be the spelling of one's name. However, given that children would likely be at the playground with an adult, their name could be provided by the adult. Moreover, the act of spelling out word(s) using an alphabet could pose problems for both the user, who may be at an age where spelling is still somewhat imperfect especially given the difficulty of English spelling, and also for the communicative partner who would have to retain in memory the string of letters and successfully blend them into a word, which is a skill only acquired in the early Elementary school age years. For these reasons, we did not include the alphabet.

Limitations of our Playground Board and Possible Areas of Further Research

Overall, we found there was relatively little information and empirical work to guide us that specifically addressed the vocabulary and symbols to include on an AAC board intended for public use on a playground, also noted by others (e.g., Tucker, 2021). Despite increasing numbers of installations, the information we found was almost always geared more to advice

regarding the process of getting a board in a park or school playground (e.g., how to secure funding). This became a major motivating factor for us to write this detailed report on our process of developing the content for the Eby Farm playground AAC board and the evidence we found to support our decisions, as well as our own thinking, discussion with AAC experts, and feedback gained from a trial day. In this final section of this report, we outline gaps in knowledge we encountered in the hopes that this may inspire further research regarding the development and design of AAC boards for public playgrounds (that, in some cases, may also be relevant to designs for AAC tools more broadly). Moreover, we hope that more research on children's AAC use on playgrounds is also undertaken given that no such studies were found in a recent scoping review (Therrien et al., 2020).

Type of AAC board for a playground

We were given the task of developing the content for an AAC playground board that would be situated in the middle between the Red Tower and Market areas of the Eby Farm playground. As we have mentioned, at minimum, we would have liked to see a separate board for each side of the playground. However, even if two boards had been possible, there were many questions for which we could find few, or no, detailed answers in the research literature or other sources. First, are AAC boards in playgrounds well used by children and/or parents and do they find them helpful if studied over a longer time period? Do they foster social interaction and enable longer peer interactions or new friendships to develop? (for scoping review of friendship and AAC, see Finke et al., 2025). That is, most of the reports of playground AAC boards pertain to the initial installation (e.g., a news story) and the excitement around this. However, whether and how they continue to be used as intended over the long term is an area in need of further study.

Second, what type of board might actually work best on a playground and how might this differ depending on whether one focuses on communication "on the ground" versus while children are "on the structure"? For boards located at ground level on a playground, are one or two big boards the best solution or should there be multiple smaller sized boards closer to more of the structures? The consideration of boards "on the structures" themselves also merits more study (see first mention of this by the creator of the first playground AAC board in Derse, 2008). When observing a playground, a lot of communication between children happens while they are on the structure. Less often, this is communication between an adult and child unless the adult is accompanying a young child on the structure. In our environmental scans, we uncovered some unique new designs by playground manufacturers in which small AAC boards were affixed to individual playground structures (see Figure 9 for two examples). These smaller boards generally provided a small grid (e.g., 7x5 cell) or just a few key words related to the structure. For example, for a slide, the words *my turn*, *up*, *down*, *done,* and *thumbs-up* were provided. This type of solution obviously rests more on a playground manufacturer deciding to make these boards and offer this option, as affixing such smaller boards to structures already in

Figure 9. *Examples of small AAC boards affixed to individual playground structures. Retrieved from https://arasaac.org/materials/en/3402*

place would likely raise several concerns (e.g., safety, durability, etc.). Investigating different options for AAC use on a playground, and their strengths and weaknesses, would expand our knowledge of children's AAC use in real-world community contexts where many challenges for AAC users remain (e.g., Light & McNaughton, 2015; Light et al., 2019a; Thierrien et al., 2022).

A third consideration related to the provision of AAC boards on playgrounds pertains to pdf copies being provided via a QR code. Some City of Waterloo staff expressed concern that QR codes can be compromised. If access to a pdf can be provided safely however, greater information on their use pre-, during, or post-visit would be interesting to have, especially from the point of view of communicative development. Given the important developmental significance of advancing to talk beyond the here-and-now, might the availability of a personal copy of the playground AAC board help foster such decontextualized talk at home? Finally, it would be helpful to know whether AAC in various community locations could be integrated technology-wise with a child's personal AAC device as their world expands to more places and more AAC boards appear very context-specific community locations (e.g., a local swimming pool). Indeed, it would be interesting to explore the possibility of providing cost-effective downloadable versions of community AAC boards with audio features for individuals whose personal AAC device(s) support this. .

Organization and placement of symbols on a playground board

In the future, we believe further research is merited around design features that were evidence-informed, but at times from domains outside the AAC field. For example, our decisions on the organization and placement of content in and across cells carefully took into account similar conceptual (e.g., *fast*, *slow*) and thematic relatedness (*fast* and *slow* near the spinner). Further studies could determine whether factors do indeed help children to learn, locate and/or use the symbols on an AAC board more quickly and efficiently.

From our discussion with AAC experts, our decision to take into account a child's physical height as a result of age, and age trends in the acquisition of vocabulary, when vertically organizing vocabulary on the board was a novel one. Clearly this is a factor that has

specific relevance to large, physical mounted boards (and not handheld tools). Whether placing early acquired vocabulary terms lower on a physical board, and later acquired terms higher on a physical board is indeed helpful, especially to younger children, remains an empirical question.

Figure 10. Children of different ages exploring our board during the informal feedback session at the park. (Photo credit: Snow Larc)

Relatedly, considering physical height meant that the position of certain vocabulary differed from typical handheld boards. For example, *hi/bye* tends to be placed at the top left part of handheld boards, but was placed near the bottom left on our board to be easily accessible to very young (shorter) children given that the use of such gestures appears already by 18 months of age (Bates et al., 1989). More research is needed to determine whether this approach is indeed beneficial when considering the much greater age range of children who would use a public playground AAC board, or if any confusion arises for

children more familiar to using handheld boards. On the other hand, it may be possible that these children are already accustomed to encountering boards in different settings with slightly different symbol placement and so it does not significantly impede their ease of use.

Vocabulary and content of a playground board

As we have discussed, we chose an activity-based approach for our playground AAC board and made the decision to prioritize quick and efficient communication (e.g., *go slide*) over grammatically well-formed utterances (e.g., *I want to go on the slide*) given the playground context, which was supported in our conversations with three speech-language pathologists with expertise in AAC use. This decision, based on taking pragmatic factors into account, is one that despite its intuitive appeal, would have benefited from research to support it. The decision receives partial support from the fact that, developmentally, early utterances typically progress from more "telegraphic" utterances to ones that include the smaller function words and morphological components (Clark, 2017). However, would this also be the case for older, more experienced AAC-using children, who have demonstrated the ability to form fully grammatically correct utterances? That is, would they also opt for shorter and more "telegraphic" utterances, prioritizing playtime over communication time when in a quick moving playground context?

We are also curious whether some of the more novel features we included – the colour wheel, Smiley-Face Likert scale, number line – would be supported as being used in children's communication and perhaps lead spontaneously to talk beyond just the playground structures. We saw some examples of this in our feedback session when two children used the number line to compare their heights. Given consensus on the importance of AAC tools to allow for as much breadth as possible in what children may wish to communicate to best approximate typical language acquisition (e.g., Binger et al., 2020, 2024; Light, 1997), the inclusion of these features may be a space-efficient way to expand what can be talked about by children. In addition, the use of a colour-blind friendly palette for the MFK colours also merits more investigation.

Finally, as would be the case with any playground AAC board, decisions had to be made as to what to omit given space constraints. The evidence guiding us was minimal and led to long discussions. For example, it could be argued that on a playground, terms for structures and features should take priority over everything else, which would heavily favour the noun word class. Our view, influenced by our own playground observations and a large environmental scan of images of playground boards available online, was that further word classes were important so as to capture more of what children would want to talk about. However, we would stress that this decision was also context-specific. That is, in observing and thinking about how children would use and discuss playground structures, we could not find many reasons why certain words such as different prepositions would be needed (apart from *on/off* discussed above). Thus, when deciding on vocabulary to include, it is important to carefully consider what the particular playground affords and pragmatically, what words, utterances, and word classes are therefore likely to be of most use to children rather than simply adding whole sets of words. For example, prepositions can take up a lot of space on an AAC board and are also commonly depicted by symbols that do not correspond to playground scenarios such as *in,* represented by an arrow directing a circle into a box.

Figure 11. Completing the (almost) final vocabulary content in Summer term. Left to right are Olivia, Maia, Aimee, and Catelyn and Daniela. (Photo credit: Snow Larc)

Symbols used for content on a playground board

Throughout the process of deciding on symbols to accompany vocabulary (or to use text alone), we wondered about the interpretability of certain symbols even among adults, not to mention children. From a cognitive-developmental psychology perspective, we were surprised by the dearth of empirical work and/or openly available databases providing information about the transparency or interpretability of specific, common AAC symbols, given the long existence in cognitive psychology of such databases and accompanying data relating to illustrations of common items used in memory studies (see Brodeur, 2010). Indeed, this issue of the cognitive accessibility of symbols to children is one that we found mentioned quite often in the broader AAC literature (e.g., Schlosser & Sigafoos, 2002) with findings supporting difficulties interpreting some common AAC symbols both among neurotypical children (Worah et al., 2015), and neurodivergent children (Hand et al., 2023). A very recent study has taken a step in this direction, although the data is only from neurotypical adults at present. Diez et al. (2024) investigated the transparency of 1,525 openly available Spanish ARASAAC pictograms intended for use in AAC tools. Indeed, this database allowed us at times to check the transparency rating for some of our symbols when it overlapped with those in the ARASAAC database (e.g., *fast*, *house*) which was very informative and reassuring when it scored high.

Another issue with choosing symbols for vocabulary terms is that quite often many symbols exist for one term and there is little consistency between symbols across AAC boards. This is an issue that has been highlighted in a recent call to action for more consistency in AAC

picture systems (Derse, 2020). The lack of standardization of symbols, especially for more abstract words such as *want,* raises questions regarding which symbols are most easily understood and identifiable among children with diverse backgrounds. We often wondered whether and when children understand aspects of certain common symbols such as arrows to indicate motion and/or direction, squiggly lines to indicate smells or sound waves, or the depictions of ASL signs (e.g., *more*). We found almost no research to guide us when deciding whether to include such elements within a symbol. Further research on the cognitive accessibility, transparency, and interpretability of AAC symbols, inclusive of neurotypical and neurodivergent children as well as children of different ages and cultural backgrounds, would likely be very helpful in guiding speech-language pathologists, clinicians, and others as to what symbols are best for new AAC users. This type of data would be especially helpful when the AAC tool is intended for use in a public setting by a wide variety of users.

Our use of some symbols in a VSD-like fashion (e.g., *red tower*), especially when structures contained multiple components that might not be as identifiable if shown separately, is another feature for which more user data could be collected. It would be helpful to see whether this type of symbol does allow for more efficient recognition and/or communication about these structures and facilitate social interaction (see also Light et al., 2019a).

A few final, more general, limitations relate to the fact that this applied project and its completion had to accommodate schedules, plans, and priorities beyond our control with respect to the City of Waterloo's redevelopment of the Eby Farm Playground. For example, the design of the AAC board had to be decided upon prior to installation of the second Market area of the playground to keep on schedule. Thus, while images of these structures were presented on our board during the feedback session, we could not observe how children played on these structures or what they talked about during such play. We were also limited to only one day of trialling the board in a park feedback session, and we would have liked to collect substantially more feedback from children currently using AAC tools.

Figure 13. Day of our informal feedback session attended by students, Daniela, and Stephanie (left to right) and staff from Snow Larc and the City of Waterloo (not pictured). (Photo credit: Snow Larc).

General need for more information about AAC boards in community spaces.

Overall, however, we are reminded of what we learned very early on in the process of developing this AAC playground board – it is not possible to design a perfect board. We were able to learn and apply many things from relevant research in the AAC field in the process, but nevertheless, felt that we would have benefitted from more accessible documentation of design considerations for vocabulary, symbols, and other related content such as instructions. Indeed, this led to our goal of writing this detailed report which we hope will prove useful in guiding others tackling the challenge of developing a playground AAC board. Some features of our board that we think are novel, and gaps in empirical literature that we uncovered in the

process, also raise many possible avenues for further study that we hope some readers may be able to take on and offer more empirically-supported answers in the future.

Providing access to communication supports to community members with complex communication needs is a fundamental component in making community experiences accessible to all ages (Batorowicz et al., 2006; Raghavendra et al., 2007). As others have found, making such supports available may benefit community members beyond those for whom it was originally intended (e.g., individuals with hearing loss or limited English proficiency) and foster an environment where communicative differences are recognized and accepted (Tucker, 2021). Although research on AAC boards in non-school community spaces is growing, there are many contexts that remain unexplored. Near the end of this project, we became aware of three articles that provide a more detailed overview of an AAC board design process for different community locations; namely, a dental office (Naidoo and Singh, 2020), libraries in London, Ontario (Shepherd & McDougal, 2008), and a non-profit theatre (Tucker, 2021). In line with what we have tried to present here, they also provide further detailed descriptions of how context-specific vocabulary was chosen, reviewed with SLP, AAC and/or other relevant experts, and further evaluated and refined with input of the community partner and community members (e.g., Tucker, 2021; Naidoo & Singh, 2020). In these settings, training of staff was also a component, which is not as applicable to playground boards, although we did consider further information the City of Waterloo could provide to community members via a website.

Figure 14. *Nearing completion in Fall term 2024. (Photo credit: Daniela O'Neill)*

Finally, this project underscores the value of community-university partnerships and applied community experiential learning opportunities for students. We found two examples of students in pre-service programs (speech-language pathology Reynolds, 2023; special education, Tucker, 2021) helping in the development of AAC boards intended for community locations. Here, undergraduate students interested in developmental psychology and children's language development also found the process of developing the Eby Farm playground AAC board to be a very rich and unique applied and experiential learning opportunity (See Figures 10-14), leading to a very successful university-community collaboration that was enjoyed and valued by all involved.

Epilogue July 2025: In the intervening months between the final report's completion and its installation, some further decisions were made by the City including the addition of an alphabet and inclusion of a *friends* symbol as a fringe word placed together with *dog*, *toilet*, and *home*. In order to retain the open-access nature of all the symbols used, we designed this extra *friends* symbol and have included it in the Appendix 2 as it may be particularly helpful for playground boards located in schools. Regarding the inclusion of the alphabet, we recommended that capital letters be used and that it be placed to the far right of the board in a vertical column or along the bottom using the KG Penmanship font used throughout the board (see p. 10).

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The Eby Farm Playground Augmentative and Alternative Communication (AAC) Board

Welcome to the Augmentative and Alternative Communication (AAC) Board at Eby Farm playground! This AAC board is designed to support communication for a diverse population of children and families, helping to foster an inclusive community where everyone can communicate and connect. This custom AAC board aims to provide children with complex communication needs the ability, autonomy, and confidence to communicate with family members, caregivers and peers while they play.

How to Use

We encourage caregivers and communicative partners to initiate and model how to use the AAC board with a child. While you speak out loud, point to the corresponding symbols on the board and encourage the child to do the same. After speaking and pointing, pause to give the child plenty of time to respond. This AAC board also includes words to help children begin conversations, such as greetings (*hi/bye*), question words, pronouns (*I/me),* and *want*.

Download a PDF Copy

A PDF version of the Eby Farm playground AAC board is available for download here. We encourage you to use this copy on your phone or tablet during playground visits or for communication about the playground at home.

Features of the Eby Farm playground AAC Board

- **Organized for Sentence Structure:** Different types of words are arranged similarly to how we form sentences in English. For example, pronouns and question words (*who*, *what*, *when*, etc.) are on the left side because they usually begin sentences, whereas verbs and nouns are on the right because they usually come later in a sentence.

- **Colour-Coded Word Types:** The border of each cell is colour-coded based on the type of word. All colours are distinct and colour-blind friendly:

  - Yellow →   Pronouns (*I/me*, *you*)
  - Dark Blue →   Question Words (e.g., *what? where?*)
  - Vermilion   Important/Safety Words
  - Fushia →   Social Words
  - Sky Blue →   Physical and Emotional States

- ○ Green   Verbs and Adverbs
- ○ Orange →   Nouns

- **Opposites Placed Together:** Words like *fast* and *slow, go and stop,* or *hungry* and *thirsty* are positioned side by side to support understanding.

- **Accessible Key Words:** Important words such as *stop, hurt, sick, toilet* and *home* are placed lower on the board so children of all ages can reach them. *Hi/bye* is positioned first on the board to help children initiate greetings.

- **Engaging Symbols:** Emoji-like symbols help children express physical and emotional states in a more engaging way.

- **Smiley Face Scale:** Located on the left side, this feature helps children talk about their feelings, preferences, opinions and more.

Example Messages

Here are some examples of how you can incorporate the AAC board into playtime. Try pointing to some of the **bolded** words as you say different phrases and sentences out loud.
- Do **you want** to go **fast** or **slow** on the **spinner**?
- **I** am too **hot**. Let's take a break on the **bench**.
- **Watch me go** down the **slide**!
- **Who** did you **see**? The girl in the **blue** shirt?
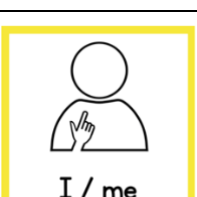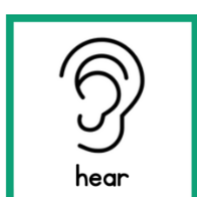
How This AAC Board Came to Eby Farm Playground

   The Eby Farm Playground AAC board was developed through a collaboration between the landscape architect for the playground, Stephanie Snow ([Snow Larc Landscape Architecture Ltd](#).), and Professor and developmental psychologist Daniela O'Neill and her students from her [Children's Communication Lab](#) in the Department of Psychology at the University of Waterloo. A developmental lens was taken in designing this board to ensure the content is inclusive and linguistically, cognitively, and physically accessible to children of all ages and abilities who may be visiting the Eby Farm Playground. A full report about the design of this board can be found at [provide locations]
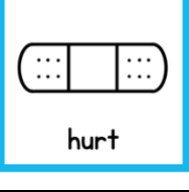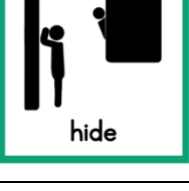
Appendix 2
Inventory of all cells and source for symbol used
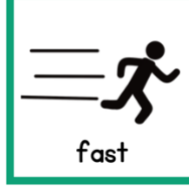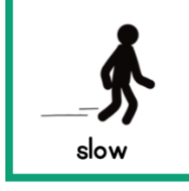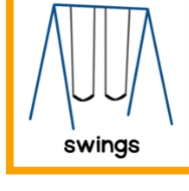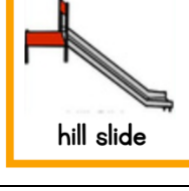
Symbol	Source	Type	Symbol	Source	Type
?	Microsoft Clipart	Question Word	feel	Microsoft Clipart	Sensing Verb
when?	Designed by us	Question Word	smell	Microsoft Clipart	Sensing Verb
who?	Designed by us	Question Word	look / watch	Designed by us	Sensing Verb
where?	Designed by us	Question Word	hear	Microsoft Clipart	Sensing Verb
what?	Designed by us	Question Word	hi / bye	Designed by us	Social Word
you	Designed by us	Pronoun	want	Designed by us	Social Word
I / me	Designed by us	Pronoun	my turn	Designed by us	Social Word
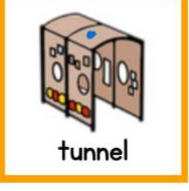
more / again	Designed by us	Social Word	excited	Designed by us	Emotional State
all done	Designed by us	Social Word	sorry	Designed by us	Emotional State
come with me	Designed by us	Social Word	angry	Designed by us	Emotional State
help	Designed by us	Important (Safety) Word	scared	Designed by us	Emotional State
(thumbs up)	Designed by us	Important (Safety) Word	love	Designed by us	Emotional State
(thumbs down)	Designed by us	Important (Safety) Word	hug	Designed by us	Emotional State
go	Designed by us	Important (Safety) Word	overwhelmed	Designed by us	Physical State
stop	Designed by us	Important (Safety) Word	tired	Designed by us	Physical State

hot	Designed by us	Physical State	climb	Designed by us	Action Verb
cold	Designed by us	Physical State	drive	Designed by us	Action Verb
hungry	Designed by us	Physical State	fast	Designed by us	Adverb
thirsty	Designed by us	Physical State	slow	Designed by us	Adverb
sick	Designed by us	Physical State	swings	Designed by us	Noun
hurt	Designed by us	Physical State	Silver Lake	Designed by us	Noun
race	Designed by us	Action Verb	hill slide	Designed by us	Noun
hide	Designed by us	Action Verb	picnic table	Designed by us	Noun

|		
spinner	Designed by us from photograph	Noun
climbing ropes	Designed by us from photograph	Noun
red tower	Sourced from the playground equipment manufacturer	Noun
tractor panel	Provided by Snow Larc and coloured by us	Noun
tractor + wagon	Provided by Snow Larc and coloured by us	Noun
play house	Provided by Snow Larc and coloured by us	Noun
sandbox	Designed by us	Noun
tunnel	Provided by Snow Larc and coloured by us	Noun

spring rider	Provided by Snow Larc and coloured by us	Noun
bench	Designed by us from photograph	Noun
dog	Microsoft Clipart	Noun
toilet	Microsoft Clipart	Noun
home	Microsoft Clipart	Noun
	Designed by us	Colour Wheel
	Additional symbol requested by City and designed by us	Noun

	Designed by us	Smiley Face Likert Scale & Number Line
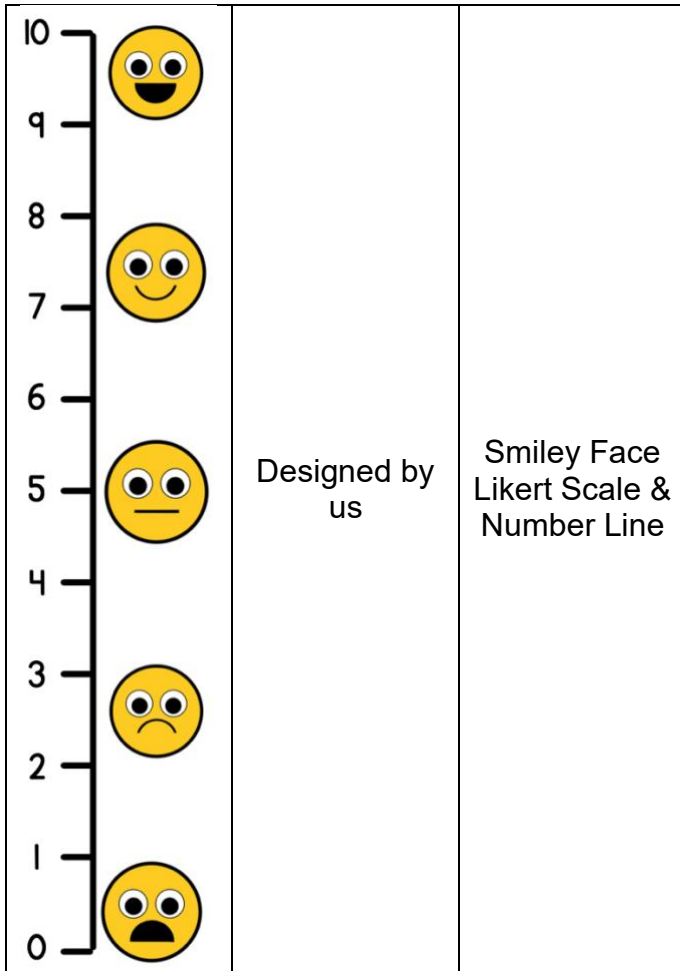
Appendix 3

Figure from Okabe and Ito (2002/2008) used to propose the modification of Modified Fitzgerald Key colours to align with colour-blind friendly colours.
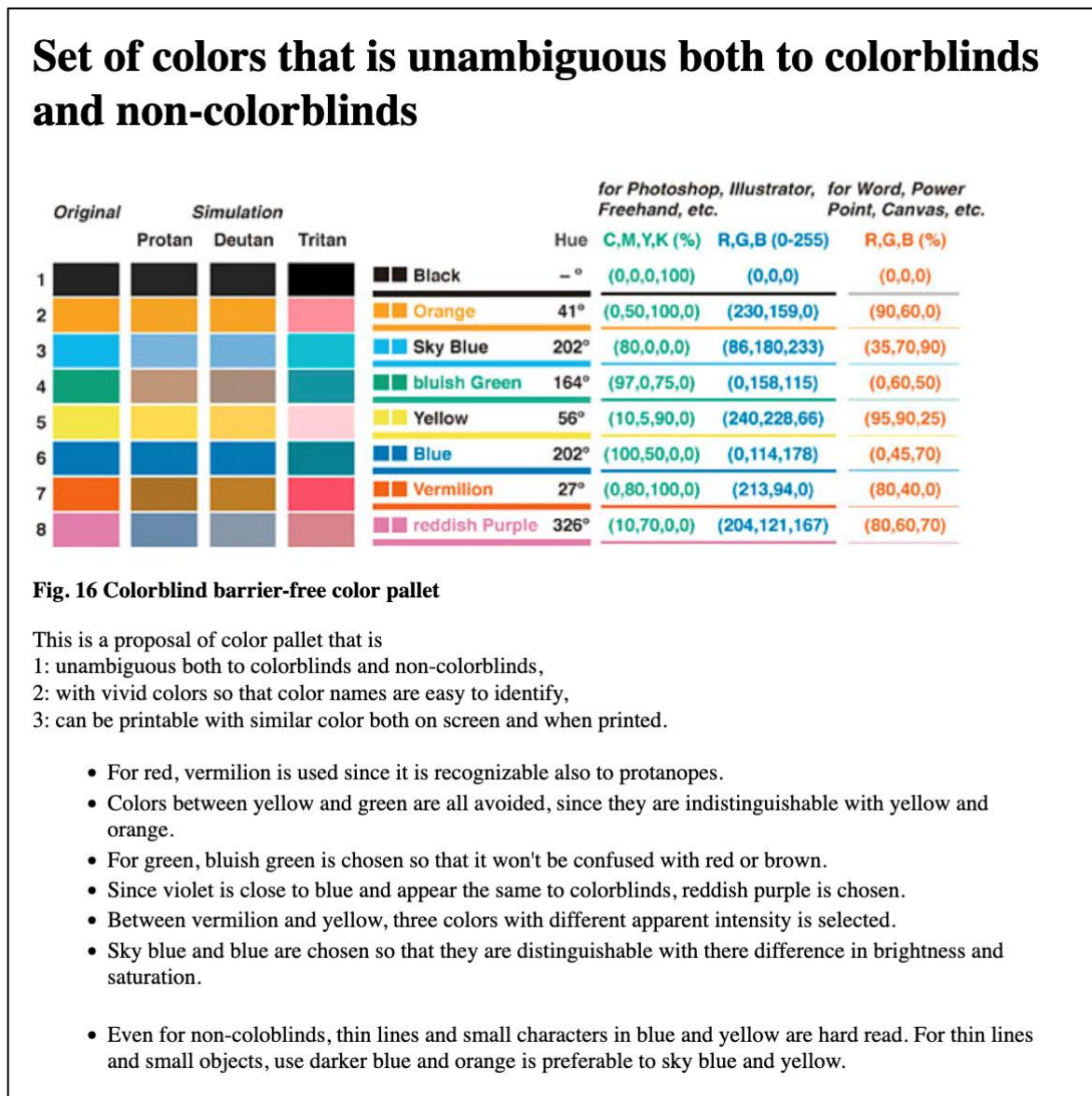
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Okabe, M., & Ito, K. (2002/2008). *Color Universal Design (CUD) - How to make figures and presentations that are friendly to Colorblind people*. Data depository for Drosophila researchers.

https://jfly.uni-koeln.de/color/