PASS: Picture Augmentative Synsemic System. A new system for AAC habilitative practices, theoretical background

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Recibido: 02.10.2019
Aceptado: 24.11.2019
Publicado: 20.12.2019

Cómo citar este artículo:
Bonora, G., Dalai, G., De Rosa, D., Panunzi, M., Perondi, L., Rubertelli, C., 2019. PASS: Picture Augmentative Synsemic System. A new system for AAC habilitative practices, theoretical background. *Inmaterial. Diseño, Arte y Sociedad*, 4(8), pp. 33-78

Abstract

In this paper we discuss the theoretical linguistic and graphic preconditions of the design of PASS, a glyph system which we designed for use in Augmentative and Alternative Communication (AAC) habilitative practices that has been released under open source licence.

We highlight the relevance of graphic design supporting sustainable practices for people with Autism Spectrum Disorders (ASD), in a context in which the offer of public healthcare services for rehabilitation is insufficient.

We present the context in which the AAC is adopted and how a glyph system can be used by people with ASD to learn a language. This particular group of users can access a language by using the glyph system as an interlanguage or as an alternative language.

We analyse the most common glyph systems (ARASAAC, PCS, WLS, Blissymbolics), highlighting their strengths and weaknesses from a graphic and linguistic point of view.

We present the theoretical background of the design process for the PASS glyph system.

In particular, we provide an in-depth description of the graphic design strategy, which aims to develop a systematic and consistent approach to the construction of the glyphs. This approach is grounded in a reflection on how to solve the linguistic problems raised by the valency model and Chomsky's generative grammar theory in the visual domain.

We have designed the core of the glyph system by detecting the pertinent visual and linguistic variables in literature, with the objective of developing the system for clinical experimentation.

Keywords:
augmentative and alternative communication (AAC), glyph system, PASS, habilitation, autism spectrum disorders (ASD)

Resumen

En este artículo se abordan los prerrequisitos teóricos, lingüísticos y gráficos del diseño de PASS; un sistema de glifos proyectado por los autores para su uso en las prácticas habilitadoras de Comunicación Aumentativa y Alternativa (CAA), que ha sido lanzado bajo una licencia de código abierto.

Se pone de manifiesto la relevancia del diseño gráfico como apoyo a las prácticas sostenibles para personas con Trastornos del Espectro Autista (TEA), en un contexto en el que la oferta de servicios de rehabilitación del sistema sanitario público es insuficiente.

Se presenta el contexto en el que se adopta el CAA y cómo un sistema de glifos puede ser utilizado por personas con TEA para aprender un idioma; este grupo particular de usuarios puede acceder a un idioma utilizando el sistema de glifos como un interlenguaje o como un idioma alternativo. Se analizan los sistemas de glifos más comunes (Arasaac, Pcs, Wls, Blissymbolics) destacando sus fortalezas y debilidades desde el punto de vista gráfico y lingüístico.

Se presentan los antecedentes teóricos del proceso de proyecto gráfico para el sistema de glifos PASS.

Y, por último, y muy especialmente, se describe en profundidad la estrategia de diseño gráfico seguida y cuyo propósito es llevar a la práctica la construcción de los glifos respondiendo a un enfoque sistemático y regular; este enfoque parte de la reflexión sobre cómo gestionar, utilizando herramientas visuales, los problemas que emergen del modelo Valencial y de la teoría de la Gramática Generativa de Chomsky.

Es importante considerar que la estructura principal del sistema de glifos ha sido proyectada identificando en la literatura científica las variables visuales y lingüísticas fundamentales, con el objetivo de desarrollar un sistema que estuviese intrínsecamente preparado para la experimentación clínica.

Palabras clave:
comunicación aumentativa y alternativa (CAA), sistema de glifos, PASS, habilitación, trastornos del espectro autista (TEA)

The paper was written collaboratively by the authors. Specifically:

1. The urgent need for subsidiary healthcare practices. (G. Dalai, L. Perondi, C. Rubertelli)
    - 1.1. Visual strategies for improving communication (G. Dalai, C. Rubertelli)
    - 1.2. Books in symbols (or rather, glyphs) (G. Dalai, L. Perondi, C. Rubertelli)

2. The importance of AAC as a means to access language and reading-writing competences. Goals and critical aspects. (G. Dalai, M. Panunzi, L. Perondi, C. Rubertelli)

3. Analysis of the current systems supporting AAC (G. Bonora, G. Dalai, D. De Rosa, L. Perondi)
    - 3.1. Analysis of PCS (Picture Communication Symbols) (G. Bonora, D. De Rosa)
    - 3.2. Analysis of ARASAAC (ARAgonés Sistemas Aumentativos y Alternativos de Comunicación) (G. Bonora, D. De Rosa)
    - 3.3. Analysis of WLS (Widgit Literacy Symbols) (G. Bonora, D. De Rosa)
    - 3.4. Analysis of Blissymbolics (G. Bonora, D. De Rosa)

4. Building a new AAC system suitable for empirical experimentation. A linguistic and visual design perspective. (G. Dalai, L. Perondi, C. Rubertelli)

5. Linguistic background (C. Rubertelli, M. Panunzi)
    - 5.1. Towards a generative syntax of glyphs (L. Perondi, C. Rubertelli)
    - 5.2. Agglutination (G. Dalai, D. De Rosa, L. Perondi)

6. Graphic background (G. Dalai, L. Perondi)

7. The pictographic aspects of glyph design, the study of pictographic composition (G. Dalai, L. Perondi)
    - 7.1. The graphic implications of designing a system of glyphs (G. Bonora, G. Dalai, D. De Rosa, L. Perondi)
    - 7.2. Attribution of visual variables (Bertin, 2011, p. 42) (G. Bonora, G. Dalai, D. De Rosa, L. Perondi)
    - 7.3. Hierarchy and hierarchical distance (G. Dalai)

8. Future developments. A methodology for the development of glyph systems for clinical habilitation practices. (G. Dalai, D. De Rosa, M. Panunzi, L. Perondi)

1. The urgent need for subsidiary healthcare practices

Given the current state of healthcare, there is an urgent need for habilitating and rehabilitating practices which are subsidiary to hospital care and public services.

Communication design can play a fundamental role in the development of artefacts supporting habilitation and rehabilitation practices for people with Complex Communication Needs (CCN), and particularly those with Autism Spectrum Disorders (ASD).

Currently there are both rehabilitation practices (e.g. Augmentative and Alternative Communication – AAC; ASHA, 2018) and supports for the ASD diagnostic practice (e.g. Psycho-Educational Profile – PEP-R; Schopler and Reichler, 1979; SINPIA, 2018, p. 22) (Fig. 1) in which graphical elements play a fundamental role (see for example National Autistic Society, 2019; Mirenda and Iacono, 2009).

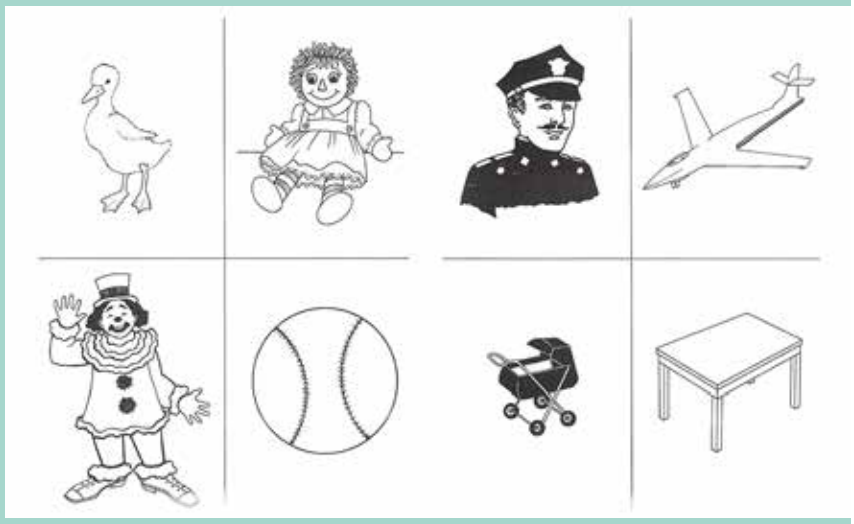


Fig. 1. Example of images (pictograms) which are used for ASD diagnostic purposes, displayed in the PEP-R diagnostic manual. Images retrieved from Schopler and Reichler (1979, pp. 171, 175).

In addition, the interfaces of medical instruments impact the ability of healthcare personnel to use such instruments efficiently; therefore, in this context, visual design issues play a pivotal role.

In particular, rehabilitation practices which involve AAC instruments, the reading of books and communication boards are in widespread use and are well known for their utility (Costantino, 2011; SINPIA, 2018, pp. 65–68; Iacono and Cameron, 2009; Chung, Carter and Sisco, 2012).
In Italy, these kinds of practices increasingly involve families and accredited private structures. The lack of shared diagnostic and therapeutic protocols among local healthcare units and regions results in a fragmented offer of public healthcare services and an overall lack of assistance for people with ASD and their families (Chiarotti, Calamandrei and Venerosi, 2017, pp. 3, 13–14).

In order to ensure the sustainability of this kind of therapeutic model, it is of the utmost importance to develop instruments that support communication between patients and caregivers. There is a need for communication that does not vanish when people with Complex Communication Needs (CCN) reach the age of majority, a time when the relationship between the families of people with ASD and the school system disappears. There is also a severe lack of appropriate rehabilitation programmes in Italy for adolescents and adults with psychiatric conditions (Chiarotti, Calamandrei and Venerosi, 2017, pp. 14–15).
In this context, a key point is providing lower-income families with the correct and fundamental self-production tools and competences for the fabrication of communication boards and other instruments for rehabilitation practices.

The aim of our research is therefore to develop a system of glyphs by following an approach based on design and scientific research, in order to enable the control of graphic composition aspects and to test the effectiveness of design choices.

In this article, we will discuss and propose our hypothesis on which composition criteria should be used while developing a set of symbols. We take into account the visual features of the elements which constitute the symbols and how a specific language (Italian, in this case) interacts with the graphic design choices and how it affects the syntactic-semantic organisation of the symbol system.

From now on, we will be using the word “glyphs”, instead of the term “symbols” (which is commonly used in related literature). In some semiotics research areas (see Peirce, 2003), the term “symbols” is defined as a “sign with an abstract relation to the meaning.” Moreover, in some areas of pedagogy

(see for example Piaget, 1950; Bruner, 1967; Bruner, 1984) which are closely related to our argumentations, the locution "symbolic thinking" is related to abstract and metaphoric thinking.

Therefore, the term "symbol" is ambiguous and may lead to misconception. Instead, we use the term "glyph" to refer solely to the visual shape of a sign as this term is used by The Unicode Consortium (Unicode, 2004), which is devoted to establishing the standards for the codification of written languages.

1.1. Visual strategies for improving communication

As Hogdon (2004) describes, with the locution "visual strategies for improving communication" we define a group of tools which enhance the ability of children to understand and interpret information.

On an everyday basis, children with CCN and ASD use visual supports which are tailored to the subject's specific condition.
Among these tools, some of the most commonly used in habilitation and rehabilitation practice are communication boards, labels for objects and environments, and activity timetables (National Autistic Society, 2019).

Communication boards are structured collections of glyphs which allow children to express their needs, feelings and thoughts. The boards are tailored to each individual and their aim is to enhance the children's communicative competence and social interaction (Costantino, 2011).

Beukelman and Mirenda (2014) show how the most common communication boards display a grid layout, which is organised according to different structures:

— semantic-syntactic: in the original version from Fitzgerald, pictograms are organised by following a precise semantic-syntactic sequence from left to right: who (substantives), actions (verbs), modifiers (adjectives, etc.), what (complements), where, when, etc. (Beukelman and Mirenda, 2014, p. 361) (Fig. 2);
— taxonomic: the pictograms are organised by semantic categories, e.g. people, places, feelings, etc.; or
— by activity: the pictograms are organised by following a scheme pertaining to a specific activity or routine.

The most commonly used communication boards are the "**main boards**" (Fig. 3), namely those which include the "essential core or the vocabulary of the child with CCN" (Costantino, 2011, p. 73).

Fig. 2. Detail of a board based on a semantic-syntactic structure. Image retrieved from Beukelman and Mirenda, 2014, p. 361.

Fig. 3. An example of a child's main board used for eliciting communication interactions. Image courtesy of Elisabetta Cane, speech and language therapist.

Fig. 4. An example of drawer labelling. The drawers contain cutlery ("posate") and a tablecloth ("tovaglia"). Image courtesy of Elisabetta Cane, speech and language therapist.

Fig. 5. A child's activity timetable. The cards list the activities which the child will complete during the rehabilitative session. Image courtesy of Sara Scotto, speech and language therapist.

The **labelling of environments** with pictograms (Hodgon, 2004) aims to describe the environment through a communication system that is well known to the child, and which they can exploit to navigate the environment without feeling insecure or anxious. The pictograms are stuck on an object in order to identify it, or on a container to identify its contents (Fig. 4).

The activity timetables (Costantino, 2011, p. 65) allow caregivers to describe the schedule of activities, parts of the day, the whole day, weeks or longer periods. Their aim is to highlight a routine, providing the children with a sense of predictability of events (Fig. 5).

1.2 Books in symbols (or rather, glyphs)

As Costantino (2011, p. 76) describes, in order to facilitate access to reading for children with CCN, starting in the late '90s rehabilitation practitioners in Italy began using tailored "books with symbols", which were built around the needs of each child.

These books are mainly of two types (Costantino, 2011):

— reworked books: existing books which have been adapted to make them more accessible (e.g. a streamlined version of Little Red Riding Hood, built with materials which allow the child to better interact with the book Fig. 6); or

— customised books: books that are built from scratch based on the experience and needs of the child.

A large collection of reworked and customised books developed by specialist personnel is available in the Special Library of Centro Benedetta d'Intino Onlus, one of the most important Italian centres specialising in AAC.

More recently, new projects have emerged, which aim to transpose books that are already available on the market into glyphs. These book series have been publicly distributed in places such as libraries and local health departments (see for example the *inbook library network*, Costantino, 2011; *Libri per tutti*, Fondazione Paideia, 2019). Several Italian publishers (Homeless Book, Clavis, Erickson, Uovonero, Mondadori, Giunti, DeAgostini, GeMS) are currently experimenting with traditional books and digital devices by producing glyph-based narrative books (Fig. 6, 7), while other publishers (Auxilia) mainly focus on educational publications.

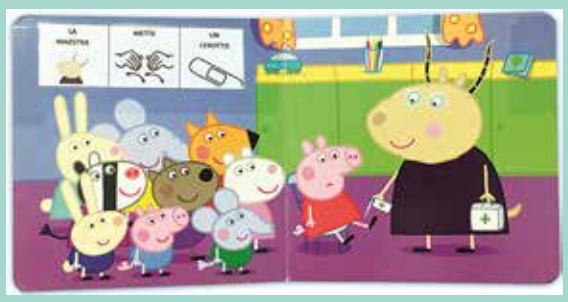


Fig. 6. An example of a reworked book. The text of Peppa Pig is reduced in length and written in symbols: "La maestra" ("the teacher") "mette" ("put") "un cerotto" ("a plaster"). Image retrieved from D'Achille, S. (2014) *Peppa—L'ospedale*. Firenze: Giunti kids.

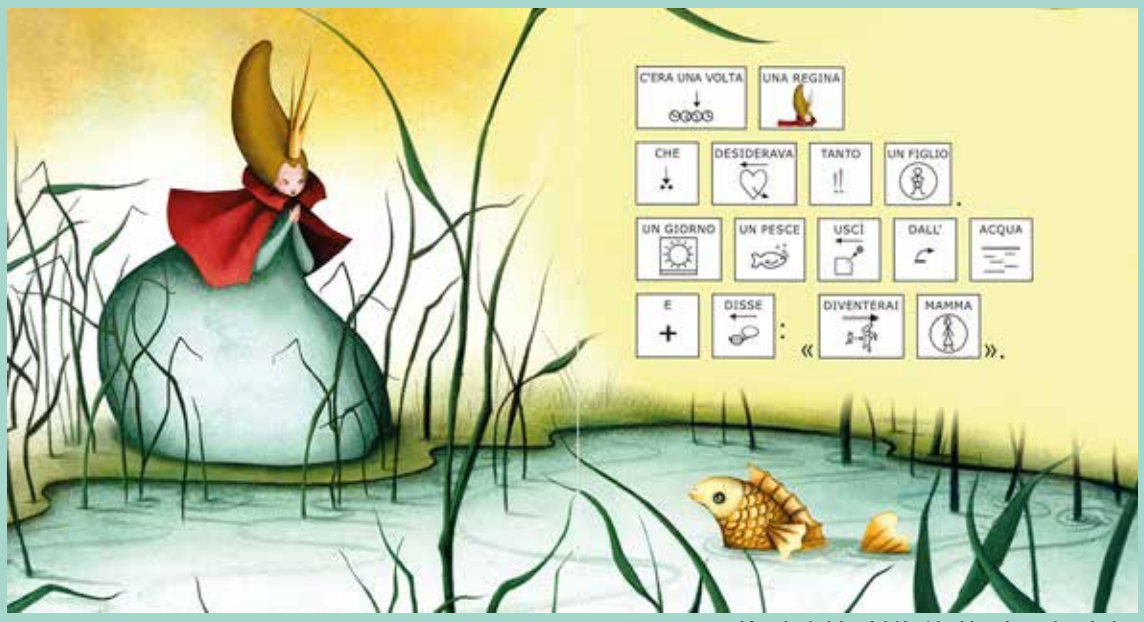


Fig. 7. Two pages retrieved from the glyph-based children's book by Roberta Zilio and Valeria Docampo (2019) *La Bella Addormentata* (*Sleeping Beauty*). Novara: DeAgostini.

2. The importance of AAC as a means to access language and reading-writing competences. Goals and critical aspects.

As the American Speech-Language-Hearing Association (ASHA, 2018) describes, "Augmentative and Alternative Communication (AAC) is an area of clinical practice that addresses the needs of individuals with significant and complex communication disorders characterised by impairments in speech-language production and/or comprehension, including spoken and written modes of communication. AAC uses a variety of techniques and tools, including picture communication boards, line drawings, Speech-Generating Devices (SGDs), tangible objects, manual signs, gestures, and fingerspelling, to help the individual express thoughts, wants and needs, feelings, and ideas. AAC is augmentative when used to supplement existing speech, and alternative when used in place of speech that is absent or not functional. AAC may be temporary, as when used by patients postoperatively in intensive care, or permanent, as when used by an individual who will require the use of some form of AAC throughout his or her lifetime."

With regard to the field of visual communication design, AAC makes use of the visual mode with the aim of lowering the threshold for access to language, facilitating the learning process for people who privilege this mode over others.

The end users of AAC (i.e. therapists, educators, people undergoing habilitating processes and their relatives and friends) can use this therapeutic practice for a twofold purpose: as an **(1) interlanguage**, which can provide access to linguistic competences pertaining to a specific linguistic region, and as an **(2) independent writing system**, which provides access to language competences tout court:

1. AAC can be used as an interlanguage.
An interlanguage (Giacalone Ramat, 2003) is a temporary linguistic system which a learner adopts while trying to master an unknown language. This system evolves constantly, and becomes richer when the learner understands rules and structures. The learner uses the interlanguage as much as proper grammar for their learning and language production.

2.AAC can be used as an independent writing system.
AAC can be used as an independent language, which means that it is possible to communicate by using this system instead of Italian or English. This means that the end users will utilise the glyphs available in the writing system without referring directly to the commonly used local language.

In everyday practice, AAC is frequently supported by a communication system, which is mostly a set of glyphs. As therapeutic practice with AAC is tailored to individuals, there is currently no general consensus on the way the AAC glyphs must be composed or the strategies of "translation in symbols" (CSCA, 2015; Minardi, 2018). This is also evident in the analysis of the methods for the transposition of texts in AAC carried out by the Italian publishers mentioned in Section 1.2 Books in symbols (or rather, glyphs).

All the publishers we reviewed in Section 1.2 adopt a previously developed pictographic system, which is often difficult to modify in its content and visual composition, and also due to copyright.

Within this group of publishers, some follow a set of rules for the transposition of texts which is explicit and formal—In-book (Costantino, 2011), Libri per tutti (Fondazione PAIDEIA, 2019), Homeless Book (Fare Leggere Tutti, 2017)—while others do not currently provide such a set of rules for composition, varying the transposition technique depending on the type of text.

The In-book model transposes all the elements of a clause in glyphs, following a word-by-word approach. All the grammatical morphemes—which are available to be transposed by the glyph composition system—are rendered visible and explicit.

The Libri per tutti model is currently defined as "logic-semantic" (Fondazione Paideia, 2019, pp. 14–15); it focuses primarily on the semantic properties of the clause and of the graphic signs, letting the alphabetic text interact with the glyphs. The alphabetic text is responsible for explicating the morphosyntactic complexity of the Italian language.

ASD treatment programmes cannot be standardised as every rehabilitation plan is tailored to the patient's needs (SINPIA, 2018). Therefore, it is important to allow for a variety of methods that can be used during rehabilitation activities. On this point, we are highlighting (see Section 3) some problems in the practical use of the most popular systems in Italy (CSCA, 2015; Costantino, 2011).

3. Analysis of the current systems supporting AAC

AAC systems are simultaneously used by patients with ASD and their communication partners (family, educators, friends and colleagues). Therefore, the challenge in designing these systems lies in making them usable by everyone involved in the communication process. Possibly due to this reason, all the glyph systems we reviewed apart from Blissymbolics are mostly iconic. We acknowledge that the obvious objective of the designers of these systems is to lower the perceived threshold for typically developed users to access the information conveyed by iconical glyphs. However, to our knowledge there is no scientific proof that this feature actually makes understanding the glyph semantics easier (Sevcik et al., 2018; Stephenson, 2009).

There are currently several AAC systems available on the market. In this article we analyse the most commonly used in Italy (CSCA, 2015): Blissymbolics, PCS, WLS and ARASAAC, with the objective of providing an overview of the subject matter pertinent to our design reflections on AAC.

PCS, WLS and ARASAAC consist of a series of glyphs which represent specific concepts or words (through depictions, metaphors and other visual rhetorical strategies; for a discussion about visual rhetorical figures see Dalai, Martini and Perondi, 2019). We could not find any evidence of regular or consistent patterns behind their design or in their appearance.

For people with ASD, the lack of regularity in a system can be an insurmountable obstacle to reading (Menyuk and Quill, 1985). Moreover, some of these systems are mostly based on the English language, and therefore they follow the structure of this language and contain no declension, no gender, no inflection, and no conjugation, which are, on the contrary, relevant in Italian. Consequently, these systems need supplementary elements to work with Italian and there is no general consensus on their usage (CSCA, 2015).

In all the systems, except Blissymbolics, the glyph is the basic articulation (Martinet, 1949; Rossi-Landi, 2005, pp. 102–105); we cannot find a lower level of articulation.

The glyphs are often inscribed inside a "box" and are labelled using words written in the Latin alphabet (there is no consensus on the use-size-shape of the box and on the position-case of the label; CSCA, 2015). Blissymbolics differs significantly from the other systems, mainly because it shows a higher number of articulations and because the glyphs are mostly non-pictographic. The glyphs of Blissymbolics consist of semi-finished parts which are joined

together, similar to the various parts of letters (like the bowls of the "b" or "d" letters). The glyphs are the first articulation with a semantic value. When they are combined together they make more semantic combinations: the clause. In most cases, the glyphs of Blissymbolics appear to be abstract, and only in some cases do they seem to have an iconic or analogical relation with their meanings (Bliss, 1949).

For each of the following AAC systems, we propose an analysis of the regularity features and the linguistic structure:

3.1. Analysis of PCS (Picture Communication Symbols)

PCS, is a set of colour and black-and-white drawings originally developed by Mayer-Johnson Company for AAC (Costantino, 2011).
Regularity: No regularity is evident in PCS.
Linguistic structure: The system is used mainly to reproduce the clauses word for word (CSCA, 2015) and therefore it requires some punctuation between the glyphs. Moreover, since PCS is based on English, the system does not convey some specific elements of the Italian language in a straightforward manner, such as the masculine or feminine genders of the nouns and articles (CSCA, 2015).

3.2. Analysis of ARASAAC (ARAgonés Sistemas Aumentativos y Alternativos de Comunicación)

ARASAAC (ARASAAC, 2019) is a set of colour and black-and-white drawings developed in Spain and funded by the Spanish Government.
Regularity: ARASAAC is the only free and open source AAC system among those we analysed. This is particularly relevant for the economic sustainability of families. Thanks to this level of freedom, the system is prone to triggering some of the mechanisms of natural language, such as adaptability and flexibility (see systolic and diastolic moments in Anceschi, 1992). The drawback is that the complete lack of composition rules may lead to a proliferation of incoherent glyphs.
Linguistic structure: Composition, syntax and pictogram design is similar to PCS.

3.3. Analysis of WLS (Widgit Literacy Symbols)

WLS (Widgit, 2019) is a set of colour and black-and-white drawings developed in the UK by a company called Widgit.
Regularity: Several graphical elements show some degree of regularity in their depiction, such as the shape of full-bodied humans, the arrows and some other markers (dashes, dots etc.).
Linguistic structure: WLS can represent grammatical morphemes of the va-

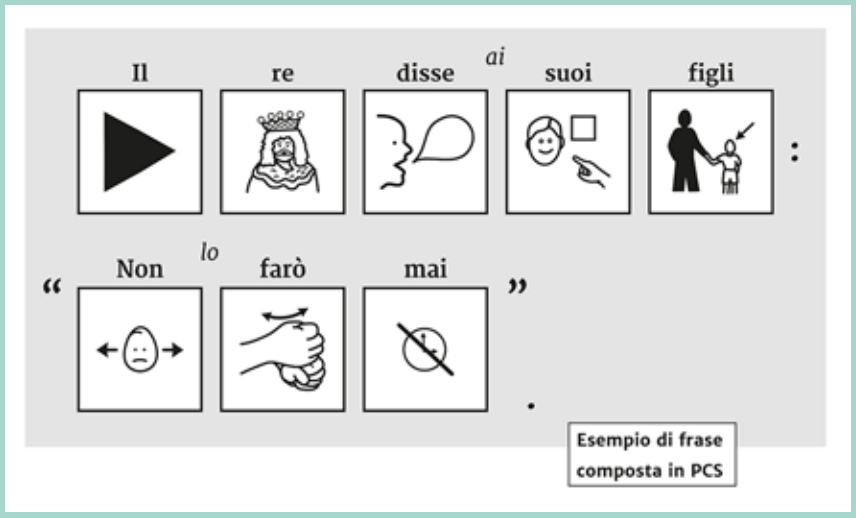


Fig. 8. PCS glyphs arranged to form two clauses: “Il re disse ai suoi figli: ‘Non lo farò mai.’” (“The king told his sons: ‘I will never do it.’”). Image retrieved from De Rosa, 2015, p. 67.

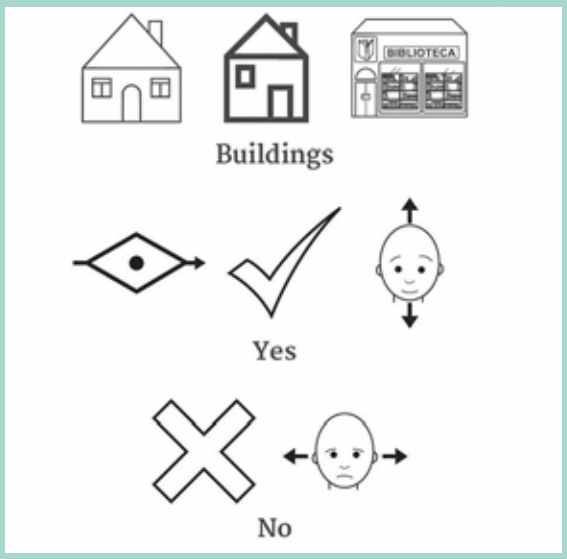


Fig. 9. Different glyphs from the Arasaac library, often expressing the same concept.

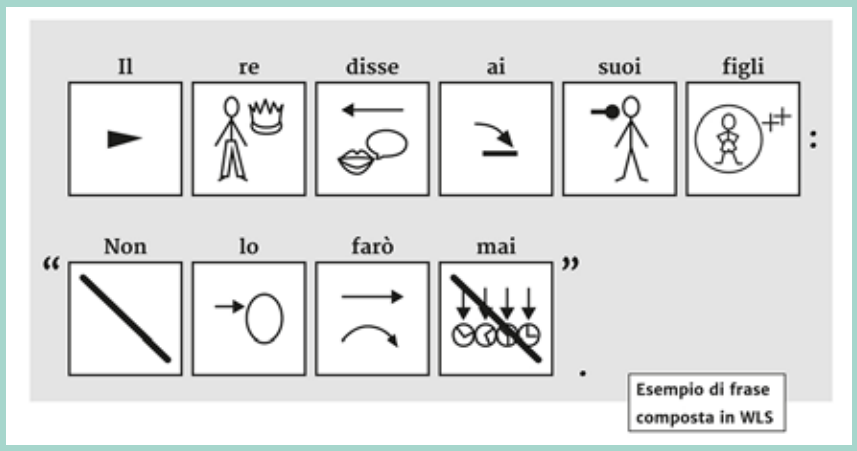


Fig. 10. WLS glyphs arranged to form two clauses. Image taken from De Rosa, 2015, p. 71.

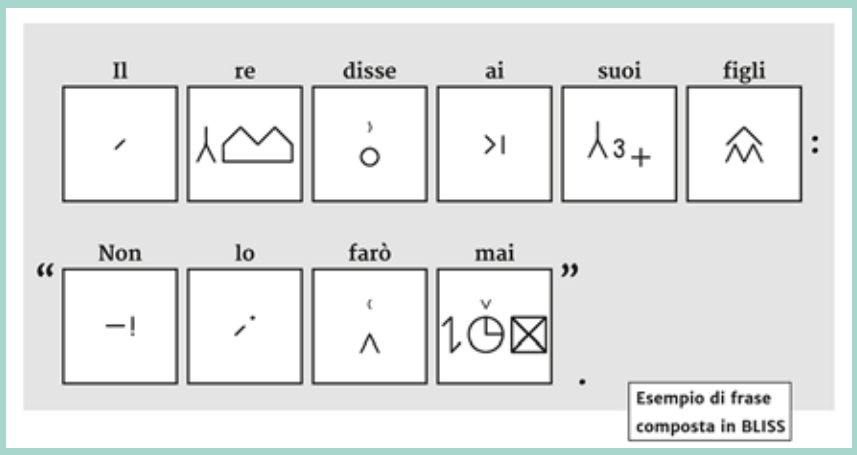


Fig. 11. Blyss glyphs arranged to form two clauses. Image retrieved from De Rosa, 2015, p. 75.

rious parts of speech by using a set of graphical elements (Costantino, 2011). On the other hand, there is no evidence of semantic coherence between glyphs and grammatical elements. For example, the same arrow may be used in the same size, shape and position with a different meaning and orthographic function. For instance, the verb "disse" ("he said", in Italian) includes an arrow pointing to the left that stands for the past tense, but many arrows exist in other glyphs such as "ai" ("to the", plural), "lo" ("it", object pronoun), "farò" ("I will do") and "mai" ("never"). Each arrow has a different semantic and morphographic function (sometimes it is used as a suffix, sometimes as a part of the glyph).

3.4. Analysis of Blissymbolics

Blissymbolics (Bliss, 1949; BCI, 2004) was invented by Charles Bliss between 1942 and 1949. The system, which was called World Writing until 1942 and Semantography until 1947, became Bliss or Blissymbolics in 1965.
Regularity: Due to its internal strict consistency and its regularity, it has proved to work well in habilitative or rehabilitative processes (Jennische and Zetterlund, 2015; Alant et al., 2013; Bornman et al., 2009). As emerged in CSCA (2015), Blissymbolics has the most consistent glyphs, and its grammar, orthography and syntax are much more refined than the other systems in use in Italy.
Linguistic structure: Blissymbolics was an experiment that aimed to create a Universal Language. It was inspired by the Chinese writing system, with recognisable English language patterns in syntax and grammar (Bliss, 1949; Eco, 1996).

While discussing with clinical operators how to choose the most appropriate glyph system for habilitation practices, we detected a possible weak point in the use of Blissymbolics: it can discourage the communication partners of people with CCN (such as educationalists, therapists and families) due to its abstract glyphs and peculiar grammar. It might seem difficult to learn for an adult who perceives the access threshold to be too high.

4. Building a new AAC system suitable for empirical experimentation. A linguistic and visual design perspective.

After the analysis we carried out on the current pictographic systems supporting AAC, we based the design of PASS on the following general principles:

1. sustainability;
2. regularity; and
3. independence from a specific language (as much as possible), but based on both the properties of language and the properties of images.

The design of the features of PASS is based on a deductive approach grounded in literature. Our purpose is to design a glyph system in which the independent variables of visual composition are evident and ready to be tested by following an empirical and/or clinical approach.

By following a dynamic perspective (Jezek, 2005, p. 18), we define as *lexicalisation* the process through which, in a particular language, a specific concept is related to a form, allowing the speaker to create a new unprecedented word (Talmy, 1985).

The process of creation of graphic signs can be interpreted as a form of lexicalisation, but with traits that are peculiar to writing and image composition. The steps of this process are as follows:

1. **Definition and design of the constituent traits**: the glyphs are built from constituent traits (Dalai, Martini, and Perondi, 2019).
2. **Definition of pertinent and facultative variants** (Eco, 2016): some of the constituent traits are pertinent and they are fundamental for the viewer to discern one glyph from another. Other constituent traits contribute to the connotation and the contextualisation of the glyph (Dalai, Martini, and Perondi, 2019). We assume a certain amount of "iconical transparence" (Moles, 1972; Peirce, 2003; Anceschi, 1992), even though it is not relevant for our purpose whether iconic images are unambiguous or purely conventional (Eco, 1975; Lussu, 2003). Indeed, the debate on iconism that involved Umberto Eco and Thomás Maldonado (Polidoro, 2012; Maldonado, 2005) during the '60s did not reach a solution.
3. **Definition of coherence criteria**: Our hypothesis is that the glyphs enhance their function (i.e. the reader can disambiguate them, recognise them, infer new glyphs and new combinations of glyphs from reading them, and use them in different composition

systems) if they are coherent with each other (by following coherence criteria discussed previously in Dalai, Martini, and Perondi, 2019; Bertin, 2011).

4. **Definition of entaxis and sinsemia**: the structure underlying PASS is built upon two different levels of composition: (1) the entaxis level (Vaillant, 1999), which refers to the non-linear composition of the glyphs, i.e. the position of graphic elements acquires semantic meaning; and (2) the synsemic level (Perondi and Perri, 2018) which refers to the graphical composition of the glyphs and their usage in a specific therapeutic setting (however, we will not discuss the synsemic level further in this paper).

Our objective is to set up the basic entactic rules of PASS in order to allow for different modes of composition (linear or non-linear, agglutinant or analytical syntax; see Sections 4.1.1 and 4.1.2) which adapt to different therapeutic approaches.

Given that the PASS system should prove flexible enough to be used in several contexts (with typically developing children, with a caregiver reading along with a child with ASD, etc.), the system is built to provide a solid basis for subsequent syntactic stratifications.

5. Linguistic background

When approaching the subject of syntactic composition, first of all it is important to define what we mean by clause. For the purposes of our work, we have mainly drawn upon Lucien Tesnière's valency grammar, in which a clause is defined as "a structure, that is, an organised system in which words are mutually dependant on each other" (De Santis, 2012, p. 18; free translation provided by the authors of this article). Within a clause, two orders coexist: a superficial linear order, which corresponds to the sequence of words, and an underlying hierarchical order, which consists in "the connections established by our mind" (De Santis, 2012, p. 18). Together with the valency model, we refer to Noam Chomsky's generative grammar theory for that which concerns how humans generate and understand languages, and the interaction between semantics and syntaxis (Chomsky, 1989; Graffi, 2012). Without focusing further on the more theoretical linguistics issues related to Tesnière and Chomsky, in the next section we discuss our synthesis of these theories and the design of glyph systems.

5.1. Towards a generative syntax of glyphs

According to recent approaches to generative syntax (Graffi, 2012; Frascarelli, Ramaglia and Corpina, 2014), each clause consists of a three-layer structure:

1. the first and deepest layer is that of lexical selection (or Verb Phrase, VP);
2. this is followed by the inflectional layer (or Inflectional Phrase, IP), that is, the level at which verbal inflection and the morphosyntactic structuring of the clause occur; and
3. on the surface is the modality layer (or Complementiser Phrase, CP), which is built around the clause introducer known as the "Complementiser".

The VP layer (1) is the level at which the lexical selection of the verb occurs and the thematic roles are assigned to its arguments. For example, in the sentence "Luca eats an apple", the verb "to eat" requires the presence of two arguments (two-argument verb): the person who eats (Luca), which is assigned the thematic role of AGENT (that is, a subject whose action is intentional), and the thing that is eaten (the apple), which takes on the role of PATIENT (that is, the passive recipient of the action). (See Puglielli, Frascarelli, 2008 for an in-depth analysis of the subject.)

The IP layer (2) is where the traits related to grammatical information are distributed, namely person agreement and tense, mood and aspect (TMA). It is at this level that the universal deep structure acquires the properties that are specific to each language. Finally, in the CP layer (3) the clause is completed with the information related to discourse grammar and illocutionary force (for some examples see Graffi, 2012, pp. 90–118, Fig. 12).

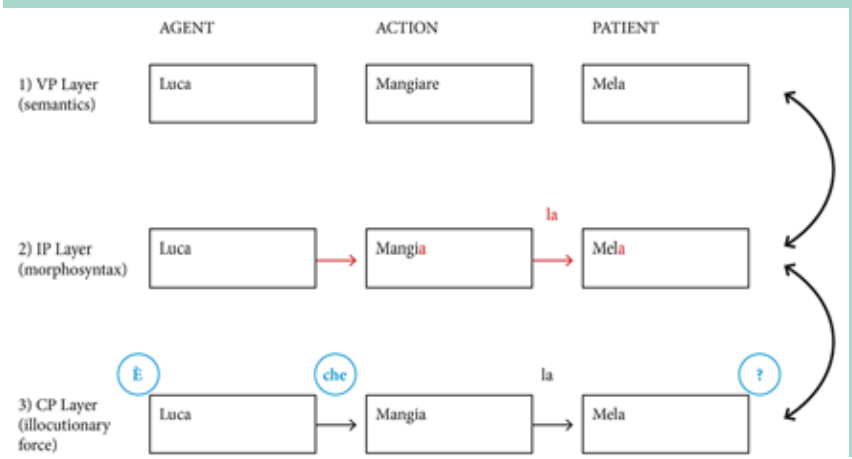


Fig. 12. Verb Phrase (VP), Inflectional Phrase (IP) and Complementiser Phrase (CP) layers and their interaction.

Considering the properties inherent to the graphic code, we may hypothesise that the glyph-based representation positions itself primarily on the first layer, since it is strictly related to the semantic content. Let us consider for example the clause "Luca fa la doccia" ("Luca has a shower").

"Fare la doccia" ("to have a shower") is a typical support verb construction, in which "fare" has a limited semantic weight (light verb) and mainly serves to express Luca's agency, while also codifying the grammatical categories that support the noun "doccia" ("shower") on which the predicative force is concentrated. As exemplified by the sentence above, the glyph does not rely on the morphosyntactic layer, in which "have"—being the morphosyntactic nucleus of the clause—would need to acquire the agreement traits; the glyph is instead built at the VP level, that is, on the semantic portion, establishing as it does a direct link with the conceptual content.

Fig. 13. PASS glyphs for the clause "Luca" "fa la doccia" ("Luca" "has a shower").

Thanks to their range of iconic properties, glyphs therefore enable us to guide the reader through the semantic nuclei without sacrificing morphosyntactic specificities, which at this first level of representation rely on alphabetic text (which constitutes the IP layer). In the context of shared reading, in which an adult helps the child to interact with the glyphs (e.g. the "modelling" practice), the adult will convey the morphosyntactic complexity of the reference language by reading the alphabetic text, while the child can visually engage with the deep semantic content. In particular, the graphic properties of the glyph enable the reader to achieve an even deeper level of synthesis, representing as they do both the AGENT and the action. The deep semantic representation of a clause may therefore be expressed within a single glyph.

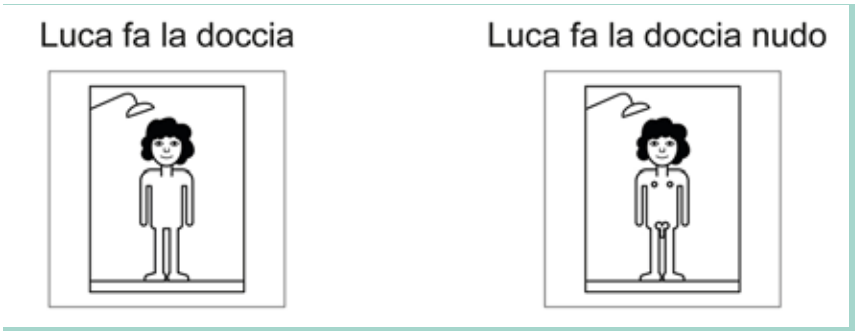


Fig. 14. PASS glyphs "Luca fa la doccia" ("Luca has a shower") and "Luca fa la doccia nudo" ("Luca has a shower naked"), both are agglutinated.

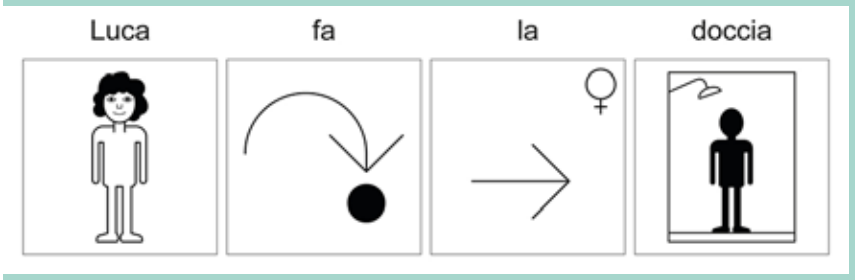


Fig. 15. PASS glyphs for "Luca fa la doccia" ("Luca has a shower") expressing the VP, IP and CP layers.

However, for the purposes of achieving certain specific rehabilitative, didactic or expressive goals, the connections inherent to the language may also need expressing, so as to highlight, for example, the syntagmatic relationships occurring between the different parts of a clause. In this case, the creation of glyphs expressing elements such as determiners, prepositions, auxiliaries, inflectional traits (e.g. TMA traits for verbs, and gender and number traits for nouns) and complementisers would also enable the reader to interact at a graphic level with the IP and CP layers.

5.2. Agglutination

As will be discussed further, it may therefore be beneficial to work on a multi-layered system that makes it possible to modulate glyph representation depending on the needs of the habilitative practice, moving between a strictly semantic level (where glyphs are used in a more synthetic/agglutinating way) and a morphosyntactic one (where a more analytical graphic structure is used). In this article we do not discuss which of these two strategies is the most effective; the objective of PASS is to provide clinicians with a tailored instrument for clinical therapy and experimentation.

Agglutination is "a grammatical process in which words are composed of a sequence of morphemes (meaningful word elements), each of which represents not more than a single grammatical category" (Encyclopaedia Britannica, 2009). Examples of agglutinative languages include Japanese and Nahuatl. In particular, Aztec writing, related to the Nahuatl language, "spells" agglutinative words by agglutinating the glyphs (mostly pictograms). Therefore, we use the term "agglutination" because we grounded PASS on the Aztec writing system.

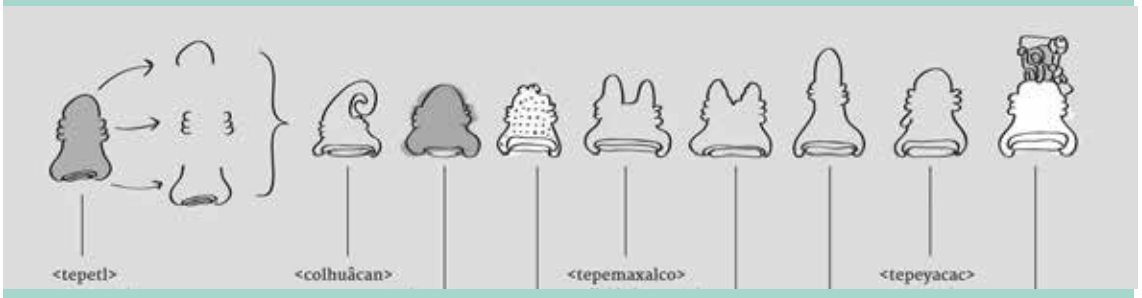


Fig. 16. Aztec glyph "tepetl", forming different agglutinating glyphs. Redesigned by the author Daniele De Rosa.

In PASS, the definition of a set of minimum units (types of morphemes) allows them to be modified and combined to systematically design a large amount of glyphs. This also occurs, for example, in Blissymbolics, where the meaning is generated through the combination of different minimum units and indicators. This process can be purely combinatorial, such as Blissymbolics, or involve plastic modifications of the basic elements, such as in the Aztec writing system. PASS attempts to use both processes. For example, the concept "couple" is represented by combining two pictograms in order to build a new glyph (Fig. 17). The verb "to want" combines the glyph which stands for the subject (or the generalising element) with the one which stands for the verb in a plastic way (Fig. 17, 18).

Fig. 17. PASS glyphs "volere" ("to want"), "volere un biscotto" ("to want a biscuit") and "coppia" ("couple").

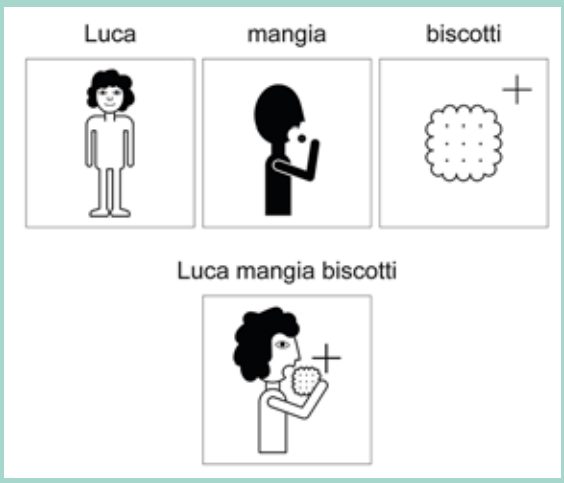


Fig. 18. PASS glyphs for "Luca mangia biscotti" ("Luca eats biscuits").

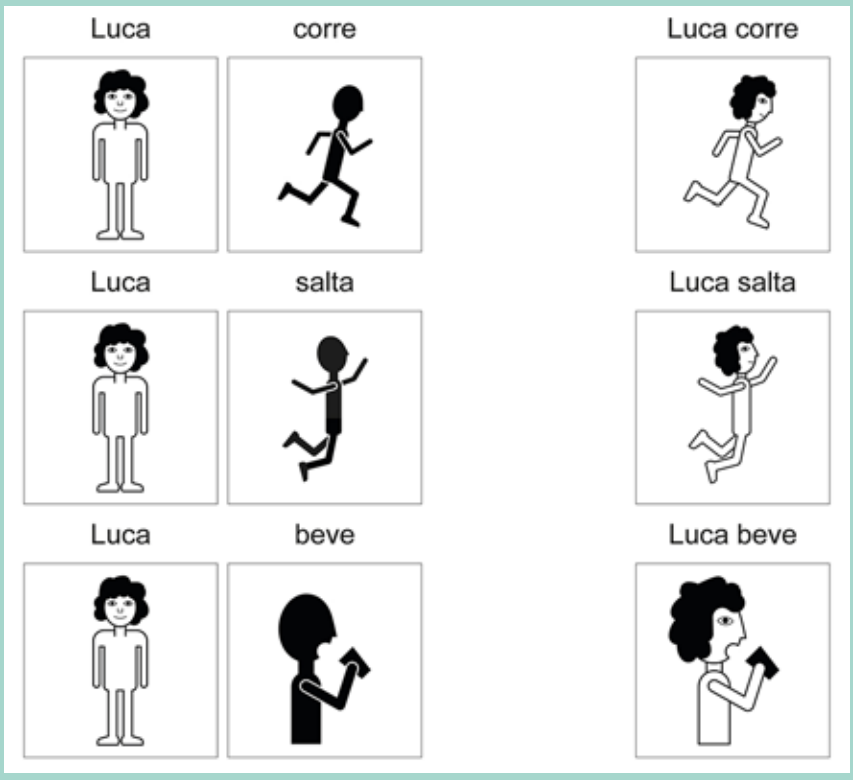


Fig. 19. We provide some other examples of the agglutinative propriety of PASS glyphs for the clauses "Luca" "corre" ("runs"), "salta" ("jumps"), "beve" ("drinks").

6. Graphic background

As a consequence of all the issues raised in the previous sections, we defined a series of construction criteria, which are also influenced by the contexts of use of the system.

In particular, in order to make the system suitable for therapeutic use and therefore flexible enough to function in various occasions of use, we propose building the system bottom-up from the components of the clause.

While developing a system of glyphs, the designers need to take into account that the perfect mimesis with a specific language (including all its ambiguities, etc.) cannot be an objective; this is a condition that affects every translation or transposition process, even the most encoded transcription systems. As we discussed in Section 2, AAC systems can be used as a written-graphic language—which is more or less independent from the commonly used local language of the users—or a transposition system for an already existing language—which can be more or less literal. Therefore, the actual uses of an AAC system like PASS lie somewhere on a continuum between these two extremes. Indeed, in the current rehabilitation practices (Costantino, 2011; Cafiero, 2009; Beukelman and Mirenda, 2014) the attempt to teach language in a linear and sequential way asks for the expansion of a graphic system, in order to provide a more ample segmentation of the glyphs which can graphically make explicit all the grammatical morphemes which would otherwise remain implied in the agglutinated version.

To date, there is no evidence that an "insulating" transposition approach—which transposes every grammatical morpheme—or an agglutinative approach are favourable by themselves for aiding the teaching of a language to people with ASD. Nevertheless, there is clinical evidence that a tailored approach to this task according to the specific condition of the subjects is necessary and favourable (SINPIA, 2018).

A system which is nearer to a written-graphic language allows the reader/writer to use the agglutinative properties of depictive images (e.g. "Luca eats an apple" can be written by using a single glyph). This happens in Aztec writing too (Fig. 20), however this writing interacts with Nahuatl, which is an agglutinative language on its own. Therefore the discrepancies between the two languages are minimal. As we saw in the previous examples (Fig. 13, 14, 15), in Italian and PASS the discrepancies are much bigger.

On the other end of the abstraction continuum, if the objective of the glyph system is to transpose a non-agglutinative language as the Italian (in order to use AAC as an interlanguage), PASS needs to make use of abstract and arbitrary elements in order to reproduce grammatical morphemes (prepositions, articles, conjunctions, auxiliaries, etc.) and inflectional features (gender and number for names, time, aspect and modes of the verbs) (see figure 11 and 12).

The abstraction management processes which we defined and designed for PASS are:

1. The usage of a generalising element, which allows a sentence that would be agglutinated to be segmented by replacing a specific element (usually a verb) with the generalising element. For example "Luca fa la doccia" ("Luca has a shower") can be translated with a single glyph, or with a sequence of glyphs in which the element "Luca" inside the shower is replaced by a generalising element "human" (a silhouette) and taken outside the "shower" glyph (see Fig. 13 and 14).
2. When using abstract, very broad terms or auxiliary verbs, e.g. "volere" ("to want") or "fare" ("to do") (Fig. 21), it is almost impossible to avoid using metalogical rhetoric figures while creating the glyphs.

As discussed previously in Dalai, Martini, and Perondi (2019), we refer to the rhetorical figures in the metalogic area (the tropes of the classical rhetoric) which are related to the signified. Therefore, since this area of the rhetoric is related to the contents, it is independent from the form and the modes of expression (Bonfantini, 2000).

However, the usage of these figures has to follow some criteria for regular composition. In particular, we focused (Dalai, Martini, and Perondi, 2019) on the visual synecdoche (i.e. representing a part to signify the whole), and the visual metonymy (i.e. to represent the cause for the effect or the effect for the cause), especially for the representation of liquids or for objects which do not have a well-defined and recognisable shape otherwise (Fig. 19, "to drink").

For example, the pictograms of the 1968 Mexico Olympic Games can be seen as a visual synecdoche (a ball stands for "soccer", a shoe with cleats stands for "athletics") (Fig. 22), while the icon of the basket on the macOS interface can be seen as a visual metonymy (the tool for the effect).

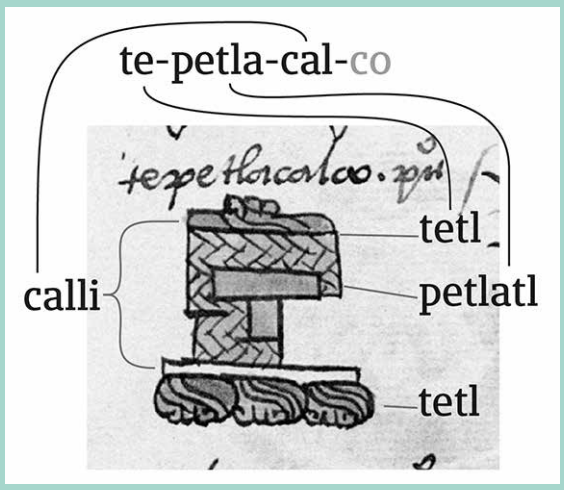


Fig. 20. Agglutinative properties of Aztec writing. Codex Mendoza f20 r. detail "Te-petlacalco", with its transliteration. Image retrieved from Perondi and Perri, 2018.

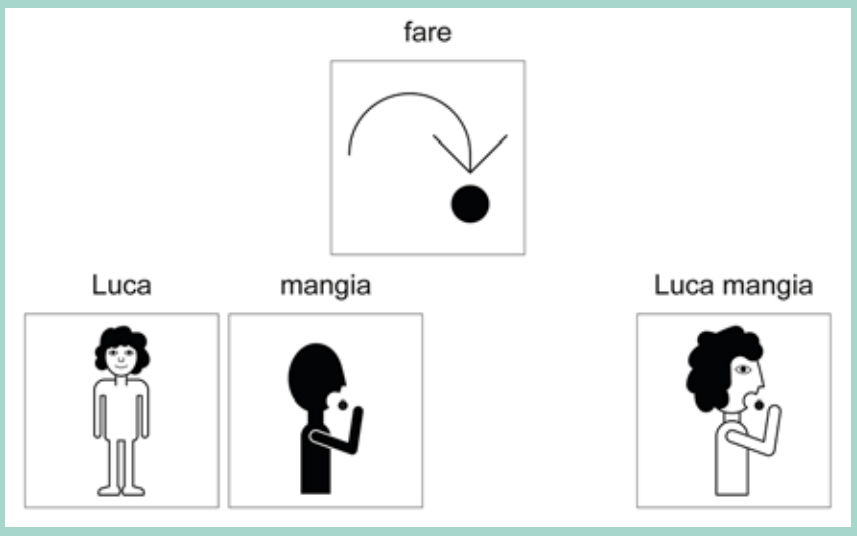


Fig. 21. PASS glyphs for "fare" ("to do") and "mangiare" ("to eat").

Fig. 22. Icons of the Olympic games in Mexico 1968, by Lance Wyman.

Fig. 23. PASS glyphs "juice" and "biscuit". Showing a visual metonymy (apple juice) and a visual synecdoche (biscuit).

We argue that we can evaluate the following issues through the application of a system of glyphs for AAC:

1. Does a morpheme-by-morpheme transposition show evident and significative advantages for people with ASD compared to the usage of the Latin alphabet?
2. By using the valency model for grammar (Sabatini, Camodeca and De Santis, 2011) as a model for learning, the reader/writer focuses on the lexical selection without first having to think at the morphological level. Can it be beneficial to apply a model like the valency model when the teacher/therapist decides to use a visual system for conducting rehabilitation with people with CCN?

7. The pictographic aspects of glyph design, the study of pictographic composition

The process we follow in the development of PASS starts by basing the drawing of the glyphs upon well-defined and established constructs emerging in the reference literature. This allows the detection of relevant variables to investigate afterwards through empirical research, by following an iterative process of design, testing and revisions.

7.1. The graphic implications of designing a system of glyphs

In this section, we discuss the modalities for controlling the construction of the glyphs.

Starting from the definition of Synsemia: "Synsemia means the deliberate and conscious disposition of elements of writing in the space in order to communicate, in a reasonably unambiguous way and in a regular manner, through the spatial articulation and the other visual variables. These regularities (Greimas and Courtés, 2007) can be valid only for a specific text (but consistent, rigorous and interpreted without the aid of the author) or defined by specific patterns and settled habits of use" (Perondi and Romei, 2010).

From this standpoint, by taking advantage of regularity the reader triggers the inductive reasoning that allows them to disambiguate the elements that compose the text (Perri, 1994). At the same time, the writer attributes meaning to graphical elements by using them consistently in the same artefact or corpus. The regularity is, in our hypothesis, the guiding principle and ultimate goal in designing new glyphs in an AAC system.

The definition of "regularity", also meaning "graphic consistency", includes the definition of visual variables (Bertin, 2011), distinctive features, and reference frames (Perondi, 2012; Bonora et al., 2019) that we used for the design of the system of glyphs.

The graphical definition of the constituent traits of a glyph, as much as the pertinent ones and the range of variation of their number (Dalai, Martini, and Perondi, 2019), is a fundamental graphic composition element for a glyph composition system.

In the PASS system, we kept the range of the number of constituent traits (Migliore, 2007; Polidoro, 2008; Dalai, Martini and Perondi, 2019) relatively narrow, in order to avoid producing glyphs that are "too fat" or "too thin". Planning to use a range of constituent traits that is too broad can make diffe-

rences in the visual aspects of the glyphs in the system more evident, which can generate a visual hierarchy that is unwanted and out of the control of the designer.

Another salient design issue is that printing problems arise with an excessive number of features: the reproducibility of little graphical details becomes more unpredictable, depending on the printing apparatus.
Therefore, the definition and the design of the constituent traits and pertinent traits are critical steps in the design process of a glyph system (for example, a man who is depicted in a glyph should be recognisable even if he is drawn in different positions and with different features without varying its visual weight).

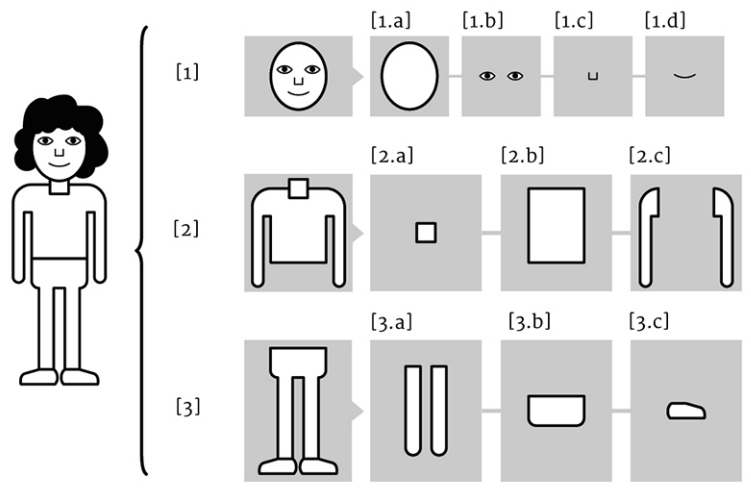


Fig. 24. PASS constituent traits.

The set of criteria for the visual composition of the glyphs is the synsemic quatrefoil. Earlier, we described (Bonora et al., 2017; Dalai, Martini, and Perondi, 2019) in detail the characteristics and the theoretical bases of each component of the quatrefoil.

1. **Attribution of visual variables**, each set of visual variables matches a semantic group.
2. **Definition of elements and aggregates**
3. **Description of hierarchy and hierarchical distance**
4. **Establishment of reference frames**

7.2. Attribution of visual variables (Bertin, 2011, p. 42)

The definition of the **visual variables** for each glyph is the crucial step in the design process of PASS.

7.2.1. Orientation

In a first phase, in order to have control over the amount of distinctive features available and to impose a consistent orientation in the glyphs, we chose to use only two-dimensional drawings (using neither perspective nor axonometry). However, this position appears to be too restrictive.

Nevertheless, we kept the usage of the 2D-3D orientation variable coherent within semantic and functional groups.

Frontal, lateral and three-quarter view

In PASS, for example, every glyph depicting a human being has only two possible two-dimensional views: frontal and lateral (Fig. 25).
A three-quarter view is allowed only when it is impossible to do otherwise.
The effectiveness of this design choice is under investigation.

Orientation is also a critical variable for the entaxis of the glyphs, in the composition of some constructs, such as pronouns.

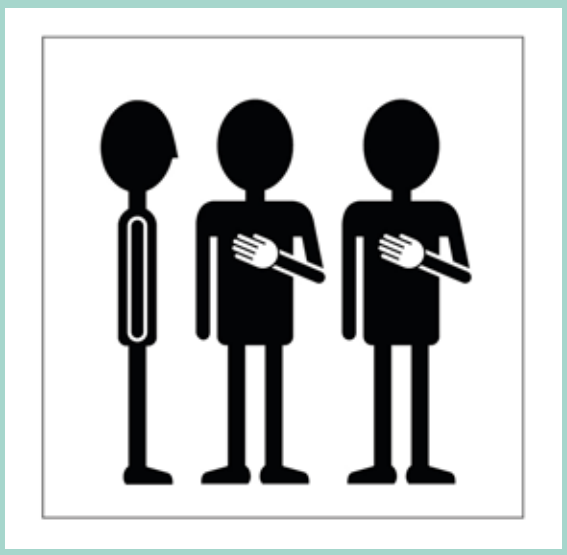


Fig. 25. PASS glyph for "essi" ("they").

7.2.2. Value

The **Value** (tone) is a visual variable which has different uses in some AAC glyph systems. For example, in PCS it is used to simulate colour fill, to highlight some drawing elements or to simulate perspective (Fig. 26).

Greyscale is not used in PASS in order to increase the figure-ground contrast (Peeters and De Clercq, 2012).

Furthermore, avoiding the use of value will prevent all printing issues, since it could be difficult to control greyscale rendering on different printers and supports.
Black areas are used for generalising elements.

7.2.3. Texture (or grain)

There is evidence against the use of dense **textures**, since they could cause perception problems and an information overload (Bogdashina, 2011) among the users of AAC glyph systems.
In our analysis, we did not find evidence of regularity in the use of textures in PCS, WLS or ARASAAC.
For these reasons, we limited the use of textures and when we used them (Fig. 27) we drew the lowest possible number of repetitions of similar modules.

7.2.4. Shape

WLS, PCS and ARASAAC lack an evident definition of a consistent graphic style. Blissymbolics shows well defined parameters for the composition and design of glyphs, which support the language without compromising the graphic consistency.

We decided to base PASS on "shape" regularities which aim to preserve the homogeneity in the disambiguation process of the glyphs. One of the essential elements for drawing the shapes is the construction of the glyphs within a grid (Fig. 28) and using modular elements.

7.2.5. Size

In PASS, the variable **size** has two different functions: (1) the size of the components of a glyph, including the thickness of the strokes; (2) the size of the syntactic markers, inflectional traits and grammatical words in the entaxis of an agglutinative glyph.

1. One of the problems that may arise when using unregulated line thickness is that some of the glyphs may become unreproducible at small sizes. Moreover, lack of regulation on the size of the components allows the creation of glyphs which present unbalanced visual weight or showcase an excessively high richness of detail. Moreover, by not carefully controlling the thickness ratio of the strokes, this visual variable can actively cause the reader to form semantic hierarchies which were not planned by design. For these reasons, we have decided to reduce the stroke ratio number down to two at present.

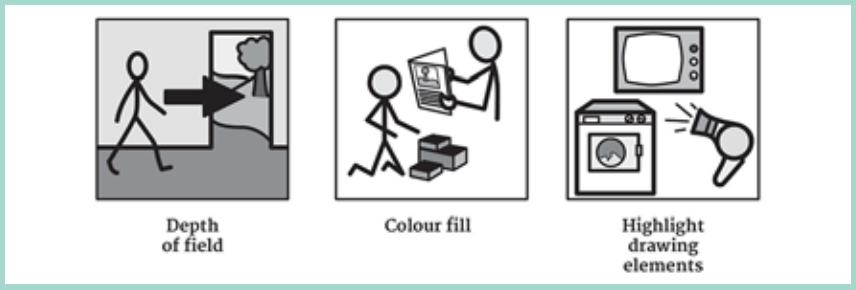


Fig. 26. Different glyphs from the PCS catalogue, showing different usages for the visual variable "value".

Fig. 27. PASS glyph for "giraffa" ("giraffe").

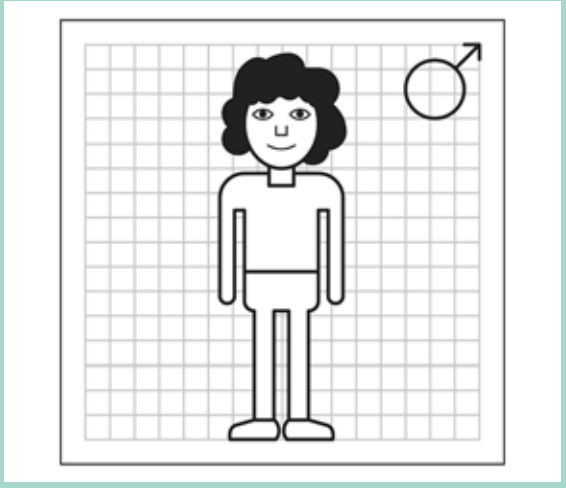
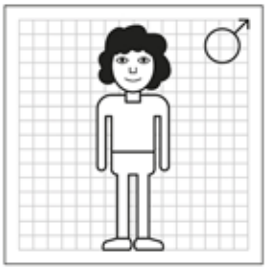


Fig. 28. PASS construction grid.

Fig. 29. PASS glyphs "Luca's nose" (the nose of a specific man) showing different line thicknesses (pointer, outline, details).



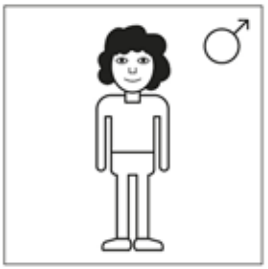


Fig 30. PASS glyph "Luca is a male" with and without construction grid.

The primary ratio defines the outline or the main stroke of theglyph; the secondary ratio (half of the primary one) describes some elements inside the glyph or necessary details for the disambiguation of the glyph.
In the drawing of the pointer used to highlight a specific part of a glyph, e.g. the nose (Fig. 29), the pointer stroke thickness is twice the primary one.
2. The size of the glyphs in an agglutinate glyph has grammatical, semantic and entactic value.
For example, in an agglutinate glyph of name or adjective type, the name occupies nearly the full extent of the construction grid, while the adjective occupies just the nine units in the top-right of the grid. This feature also impacts the definition of the hierarchical distance between the elements of the glyph (see Section 5.1.3).

7.2.6. Colour

The use of colour in AAC glyphs poses several problems: the higher the number of colours, the more difficult it is for the reader to discern and name them (Johnson, 2014, p. 93; Miller, 1956); the perception of colour is subjective and never unequivocal (Johnson, 2014, pp. 37–47); a large part of the

population has a colour vision deficiency (Johnson, 2014, pp. 37–47; Sharpe et al., 1999).

Often picture books or AAC communication boards (Costantino, 2011, pp. 69–75, 160) show coloured glyphs. However, the end users of the PASS system have particular needs: ASD is often combined with perception disorders (Bogdashina, 2011), hence a large amount of colours could cause a cognitive overload. In addition, there is documentation (Peeters and De Clercq, 2012) discussing the possibility that subjects with ASD may interpret colours in the environment by associating them with other concepts in a rigid and univocal way.

For these reasons, we think that it is not possible to control the colour perception of PASS users.

Other factors impacting the usage of colours are the saturation and the figure-ground colour contrast. In order to obtain optimal results, it would be necessary to compute the level of brightness of the paper used, the printed colour, and the print media, for which there is not currently an internationally shared standard to our knowledge. On the other hand, there is a shared standard for colour contrast measurements on digital devices (W3C, 2016). Due to all these technical issues, it is evident that the reproduction of a colour is not always feasible in family and therapeutic contexts.

Due to all the listed reasons, the PASS system limits the usage of colour as much as possible (it is used when it can serve a strictly semantic function, Fig. 31). However, it leaves the user the freedom to personalise specific glyphs. In the Aztec writing system, textures were used when text was monochromatic (De Finis et al., 1996), but the textures have a theoretical drawback as we highlighted in Section 3 of this chapter.

To this date, we have not found alternatives to the limited usage of colours and textures.

Fig 31. PASS glyphs "Luca ha i capelli rossi" ("Luca has red hair") and "l'uomo ha i capelli rossi" ("the man has red hair").

7.2.7. Position

Position is a crucial variable for the entactic (Vaillant, 1999) composition in PASS, due to the fact that all the glyphs are composed of graphic elements on a grid.

The entactic construction process is driven firstly by iconic depiction, and secondly by the arrangement of the elements by conventional means, which determines the position of grammatical morphemes (e.g. adjectives or other indicators) (see Fig. 20).

PASS uses pointers/indexes (also displayed in Fig. 29) when the depiction of an object which has been deprived of the surrounding context shows too few details. The pointer function and presentation (Fig. 32) relies on the relation of physical contiguity (position) with the object which is represented.

7.3. Hierarchy and hierarchical distance

Hierarchy and hierarchical distance (Bonora et al., 2017) between the basic elements in PASS is exploited in order to highlight the glyph structure and the function of every element (indicators, generalising element, grammatical morphemes when needed, actors when needed) (Fig. 33).

8. Future developments. A methodology for the development of glyph systems for clinical habilitation practices.

This article presents a methodology—which is grounded in linguistics and graphic design theories—for the development of a glyph system. The peculiar trait of the following methodology is allowing for the measurement of the effectiveness of the glyph design and composition choices in the specific context of use of clinical habilitation of children with developmental conditions. This goal can be achieved by structuring a set of composition rules for the design of the glyphs. Through the systematic application of these rules, it would be possible for designers to develop new glyphs which are consistent in their relationship with the semantics they aim to convey, and in their presentation as a cohesive series. The objective of this methodology is to provide caregivers and clinicians with self-production tools for Augmentative and Alternative Communication (AAC) practices.

This work does not provide empirical scientific validation for a clinical rehabilitation instrument, but it proposes a structured methodology for the development and analysis of AAC aiding instruments, which relates graphic design, linguistics and semiotics from a scientific experimentation perspective.

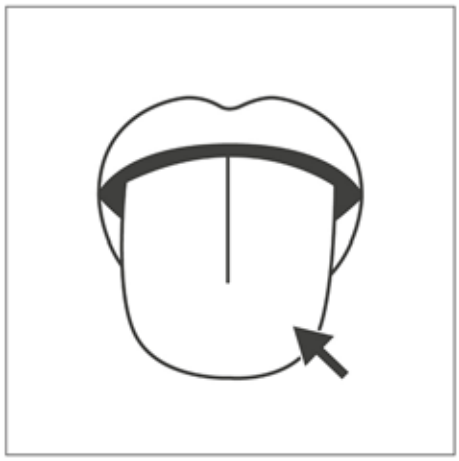


Fig. 32. Pointer usage in PASS, identifying a tongue.

Fig. 33. PASS glyphs "happy man".

We have conducted an initial experiment on the clinical usage of PASS on a digital device. The experiment was conducted by Marta Panunzi in 2016, with the supervision of Luciano Perondi and Simone Minichiello (a speech therapist specialising in ASD who works in a private health centre in Ferrara, Italy). This preliminary experiment has not been discussed in this paper. Recently, we have been working to redefine the theoretical basis of the construction of a system of glyphs, from the graphical and linguistic points of view, which is reported in this paper.

We advocate that designers can develop strictly structured glyph systems by deepening their knowledge of rehabilitative clinical practices and the application of linguistics principles. These systems can then become flexible enough to be used in a variety of clinical settings.

The consistency of composition and visual presentation of a glyph system allows designers to expand the pool of available glyphs and therefore accommodate the ever-changing needs of clinical practices. We affirm that the strictness of the set of composition rules for glyphs contrasts positively with the flexibility needed in clinical settings, and that this principle should be followed by designers while developing communication artefacts for clinical habilitation.

The PASS system is therefore currently undergoing a redesign process, embracing both its synsemic composition system and its digital application.
From the perspective of involving end users in the development of PASS, we are planning to carry on the research on PASS by maintaining a clinical approach.

The clinical personnel, who were part of the research team during this first testing phase, support the hypothesis that the response of the end-users of PASS will always be extremely variable and unpredictable. This is due to the high subjectivity of ASD. If, during further testing, some consistency in the end-user responses is discovered, then the research team will proceed with more quantitative research.

Acknowledgements
We thank Ruth Varela, from Escuela Técnica Superior de Arquitectura de A Coruña, and Linda Zennaro, from Università Iuav di Venezia, for their precious help with the translation in Spanish.

Disclaimer
The present article draws upon a previously unpublished conference proceeding from the Face Forward International Typography Conference, Dublin Institute of Technology, 2015. The present article shows a revised, expanded, updated and improved dissertation on some of the topics partially covered in the previous proceeding, for which few similarities can currently be read. However, the contents of this article are inherently original, since the previous proceeding has not been published at present.

Glossary
— AAC: Augmentative and Alternative Communication
— Blissymbolics: The name of a glyph system derived from the name of its original developer, Charles K. Bliss
— ARASAAC: ARAgonés Sistemas Aumentativos y Alternativos de Comunicación
— ASD: Autism Spectrum Disorders
— CCN: Complex Communication Needs
— CP: Complementiser Phrase
— IP: Inflectional Phrase
— PASS: Picture Augmentative Synsemic System
— PCS: Picture Communication Symbols
— VP: Verb Phrase
— WLS: Widgit Literacy Symbols

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