

Chapter

# Multimodal Communicative Behaviours in Shy Children in Assessment Situations and Social Evaluative Contexts

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## Abstract

Shy children are characterised by reserved communicative behaviour, especially in novel situations or when interacting with unfamiliar interlocutors. Many of the contextual elicitors that trigger typical patterns of shyness reactions in children, such as gaze aversion, a more distant approach, or general hesitation, may be present in typical laboratory settings or in standardised testing situations, for example, language assessment tests. In our chapter, we review recent studies that operationalise shy children's communicative behaviour at verbal and nonverbal levels with different social partners, such as humans or social robots, as interaction partners, providing practitioners with a sound overview of communicative signals that are challenging to capture and measure in practical settings. From this, we derive critical implications for the design of testing situations for children that allow them to unfold their communicative potential and demonstrate their linguistic competence, taking into account their individual temperamental characteristics.

**Keywords:** shyness, temperament, assessment, language testing, communicative behaviour, multimodality

## 1. Introduction

Temperamental shyness, a stable yet context-sensitive trait, can profoundly influence how children engage with their environment, particularly in settings that assess social communication skills. This effect is especially pronounced in unfamiliar or socially demanding environments such as kindergarten, formal schooling, or experimental settings. In these contexts, shy children's multimodal behaviour can vary significantly, shaped by their unique temperamental characteristics. This article aims to achieve two primary goals. First, it reviews the current state of research on shy children's communicative behaviour in assessment and social-evaluative situations through the lens of both their verbal and nonverbal communicative modalities. By synthesising findings from studies across diverse contexts—including productive and receptive language assessments, group and individual settings, and interactions

with varying degrees of familiarity and with both human and robotic partners—we aim to provide a comprehensive understanding of shy children’s communicative tendencies. Second, we seek to apply these insights to inform interactions with shy children in educational settings, offering practical implications for parents, teachers, and practitioners. In this way, we aim to raise awareness of the diverse and often subtle communicative behaviours of shy children, which can easily be overlooked in environments where the focus tends to be on content and learning outcomes. In this vein, understanding the behavioural patterns of shy children can inform the development of supportive educational environments and the adaptation of practices to make learning activities more accessible to a range of children. It also provides a critical opportunity for researchers and practitioners to develop assessment strategies that may provide a more accurate representation of shy children’s abilities in diverse contexts. In particular, as in typical educational settings where spoken language is a primary assessment tool, shy children who may prefer alternative modes of communication may be misinterpreted or underestimated. Thus, this review aims to highlight these dynamics and propose ways to consider and assess shy children more effectively in educational contexts.

The review is structured as follows: First, we explore various conceptions of shyness, providing a foundation for understanding the trait. Second, we examine the different approaches used to measure shyness in previous studies. Thirdly, we synthesise the relevant literature on how shyness may affect children’s verbal behaviour, providing a comprehensive overview of current findings with a particular focus on children’s performative behaviour in language tests and interconnections with cognitive processes. Fourth, we review studies that focus on shy children’s nonverbal behaviours, including gestures, gaze, affective expressions, and proxemics, to explore how shyness manifests in different communicative modalities and to discuss the adaptive nature of these communicative signals. While we acknowledge that communication is inherently multimodal, and that separating verbal and nonverbal behaviours can be somewhat artificial, this structure is employed intentionally to organise the diverse findings and make them more accessible to readers. Finally, we discuss the broader implications of these findings, offering suggestions for designing future assessments that may enable shy children to fully express their communicative competencies across a variety of contexts, and propose directions for future research.

## **2. Conceptions of shyness**

Going back to the 1970s, Thomas and Chess [1] described the ‘slow-to-warm-up’ temperament type as one of three temperament constellations in children, primarily characterised by a timid approach to or withdrawal from the unknown which is true for approximately 15% of the total population. The shyness of inhibited children is not evident in many familiar situations (e.g. playing with caregivers or known children), but usually occurs in novel situations or with unfamiliar people, which, depending on the context, may involve a degree of uncertainty for the children. However, a shy temperament goes beyond what is perceived by others at the behavioural level as a slow and inhibited approach, withdrawal or avoidance of such situations because, at the level of subjective emotional experience, those affected feel discomfort in unfamiliar (in particular social) circumstances. Usually, timid children are interested in social contact but, to some degree, afraid to initiate it, which costs them a lot of effort, so their behaviour should not be confused with social disinterest [2]. Shy people also

often have concerns or even fears about being judged, especially when they are the centre of attention [3]. Somatically, this can sometimes manifest as trembling, sweating or blushing.

These physiological observations also underpin a theory that suggests that shy people exhibit a dysregulated fear system, which causes hyperarousal in social situations [4, 5]. By using (neuro)physiological methods, such as cortisol levels in a saliva sample [6] or measuring heart rate or brain waves [7], researchers found that these dependent variables are elevated in shy children after and during novel or social situations compared to less shy children [8–10], which provides information about whether a particular situation is perceived as stressful by the subject, without this possibly being perceptible at the behavioural level. The theory of behaviour inhibition to the unfamiliar [11–13] emphasises children's initially inhibited behaviour towards unfamiliar people, but also towards novel objects and situations, and identifies developmental stability from 21 months to 7;6 years. But this loses weight as children get older and become schoolchildren. In this context, it's unlikely that the shyness reactions of pupils who, after a period of acclimatisation, are very familiar with the school system (familiar with their teachers, their classmates, typical procedures, etc.) are due to inhibition towards the unfamiliar. Instead, concerns and anxieties about social evaluation, especially in a negative way, for example, after giving wrong answers in the classroom, may be the more likely underlying motive for this age group, culminating during adolescence [14–16]. For many shy children, these concerns are mixed with a reluctance to take risks [17], especially in social situations, but also in new and uncertain contexts, so that they tend to hold back and avoid speaking in front of the class.

## **2.1 Measurements of shyness**

Although caregivers and educators often have a good sense of whether a child tends to be shy or not, vague observations can be quantified using two common methods. Interestingly, the way in which shyness is assessed is strongly linked to the underlying theoretical-conceptual construct. If shyness is regarded as a trait, then it is a permanent and innate temperamental characteristic that is relatively stable in many different (social) situations from early infancy through toddlerhood to school age and early adolescence [4]. Trait shyness is classically assessed using questionnaire items that are often part of a more comprehensive temperament questionnaire, such as the German Inventar zur integrativen Erfassung des Kind-Temperaments (IKT) für 2-bis 8-Jährige [18]. In questionnaires used to identify a shy temperament, caregivers are asked about their child's verbal and nonverbal behaviour in situations that typically trigger shyness. Although these questionnaires provide valid and reliable information about whether a child is shy, moderately shy or not shy at all, the behavioural definitions often remain vague at the individual item level. For example, in the Early Childhood Behaviour Questionnaire (ECBQ), caregivers are asked to rate on a Likert scale how often a particular behaviour has occurred in the last 2 weeks, such as whether the child feels uncomfortable, turns away, or is quiet when meeting new people [19]. Using the last term "quiet" to briefly describe the verbal communicative behaviour of shy children, any close caregiver would probably be able to answer this accurately if it suited their child in certain situations. However, it leaves open the question of how a child is quiet, that is, the following interpretations could apply, for example: Does she speak silently, does she speak at all, does she use only a few words instead of whole sentences, or does she refrain from initiating to talk or even answering a question? Similarly, when describing nonverbal communicative behaviour, for

example, when looking at the item “aversion”, does it apply to the whole body, the head or just the gaze?

In contrast, in behavioural observations and experiments explicitly designed to observe and operationalise nonverbal behaviour of shy and anxious children, a more fine-grained picture is drawn. These experiments are usually based on the assumption that shyness as a state, on the other hand, only manifests itself as a subjective (negative) feeling in specific unfamiliar situations through typical inhibited behaviour and is therefore not an integrative and stable part of temperament (so-called state shyness). An example of this is the study by Colonnese and colleagues [20], in which 4-year-olds were asked to sing a song in front of a small group of unfamiliar people in a new environment, and their inhibited behaviour was recorded specifically in this situation. In these observational contexts, two types of shyness could be distinguished, which differ mainly in facial expression and are predominantly perceived positively or negatively by a communication partner. On the one hand, the avoidant-ambivalent type of shyness is characterised by social avoidance and is interpreted as a non-adaptive form of behavioural regulation, expressed by involuntary reactions such as frowning combined with head and gaze aversion [20]. On the other hand, the approach-ambivalent form of shyness is defined by smiling accompanied by gaze and head aversion and is perceived more positively by interlocutors. Using this method of observation, it is possible to quantify the frequency and extent of inhibited behaviours in shy children and compare this with, for example, less shy children. Behavioural observations therefore usefully complement questionnaires for assessing shyness in young children in a more nuanced and quantified way and demonstrate that shyness is not a homogeneous construct [21].

However, staged behavioural observations are generally unsuitable for identifying shyness as they are in many ways too complex to be used in educational settings. Nevertheless, assessment situations that are typical of both nursery and school settings, as well as research contexts, contain many of the components that trigger shy behaviour in children, which practitioners should be aware of, but which can also be used for sensitive observation of shy behaviour. From our perspective, assessment covers all pedagogical situations in which, for example, linguistic or cognitive knowledge is (systematically) tested using standardised diagnosis instruments or other methods that measure learning and learning growth on a criterion-based scale [22]. Most assessment situations have in common that the child’s (linguistic) behaviour is being evaluated in a broad sense, although this is not always done explicitly, for example, in standardised language tests or in most language learning studies in university labs, where there is no open feedback as to whether the child’s answer was correct or incorrect. Nevertheless, the entire situation involves a (social) evaluation of their behaviour, to which particularly shy children become receptive as they get older [14, 16], for example, because an educator is taking notes of it or because cameras are present. Increased behavioural inhibition can also be expected in shy children due to unfamiliarity and novelty [11, 12]. This is present on many levels in assessment situations: the task formats, the visual stimuli (e.g. unfamiliar objects), or the verbal stimuli (e.g. pseudowords) itself are often new and unfamiliar [23, 24]. In addition, an assessment may be conducted by people who have never met the children, or in an environment or with robotic agents that are unfamiliar to the children. The fact that so many components of the assessments are unfamiliar means that the whole process, in terms of what will follow, what will be expected of the child, and how long the whole situation will continue, ultimately involves a degree of uncertainty and unpredictability in which the tendency of shy children to be risk-averse

may unfold [17]. In conclusion, for many children, especially those who are inhibited and shy, an assessment situation as a whole is in most cases a situation of novelty, evaluation, and even uncertainty.

### **3. Verbal behaviour of shy children**

In the first part of this chapter, we present a comprehensive overview of linguistic abilities in classical testing procedures. Particular emphasis is placed on analysing exactly what the test is measuring, that is, which linguistic abilities of reticent children are actually visible, as previous work has often hastily made a rough division between reception and expression without differentiating more precisely whether, for example, phonological awareness or expressive morpho-syntactic skills are involved. In addition, the reader is given a detailed description of how a test was actually administered (e.g. in school, with familiar people, and in groups). Furthermore, the subchapter takes a close look at how shyness was measured (e.g. by asking parents or teachers) and what comparison groups were used (e.g. the extreme poles of very shy vs. not inhibited at all). Finally, the section closes with an insight into cognitive learning processes.

#### **3.1 Linguistic performance in language tests**

One of the earliest insights into how timid infants use and respond to language came from a large-scale longitudinal study of same-sex twins that examined the early relation between behavioural inhibition and receptive and expressive language skills [25]. The latter were measured using the Sequenced Inventory of Communication Development (SICD; [26]), over a period of 1 year at three time points (14, 20, and 24 months), in which an experimenter asked the infants to imitate words, respond to short questions, and follow instructions with increasing difficulty. Behavioural inhibition was assessed by combining maternal and paternal reports from three different subscales of temperament inventories with behavioural observations at home and during laboratory visits. Latent growth models were used to analyse individual change and variation over time. A key finding of the study was that greater temperamental inhibition was more strongly associated with low expressive language skills than with low receptive language skills. The results of the study most support the “I know it but won’t say it” hypothesis originally postulated by Coplan and Evans [27], which holds that young children with inhibited and non-inhibited temperaments are well comparable in terms of vocabulary size, but differ in their reticence to respond, which is most pronounced in language production, particularly in expressive language tests. In other words, shy children usually have the same language competence but are poorer at demonstrating and performing it in interaction with others, especially with novel interlocutors and in unfamiliar situations. Given that the children were being tested on a language battery, these results are not surprising, as receptive tasks often do not require children to respond verbally at all but rather to perform actions or point to something, which may represent a lower inhibition threshold for shy children than saying something. However, a more exact picture of the relation between shyness and language skills could be obtained by including parental questionnaires on language, as this would provide a more complete profile of infants’ language skills outside of a test situation.

A very detailed picture of shy children’s language skills, which extends the above findings, is drawn in the study by Crozier and Perkins [28], who researched various

linguistic abilities (vocabulary and morpho-syntax) using standardised tests and semi-spontaneous language measures in two different age groups, namely preschoolers (5 to 6 years old) and primary school children (8 to 9 years old). First, the children were assigned to either a dichotomous extremely shy or not shy group based on their teacher's judgement who had been briefed on the definition of shyness. Second, an unfamiliar researcher tested their receptive vocabulary with the short version of the British Picture Vocabulary Scale (BPVS; [29]), which includes different word classes such as nouns, verbs, and adjectives and in which children are asked to match a word to one of four pictures by pointing to it, characterised by different lexical proximity (so-called distractors) to the target item. Third, the children were presented with two short picture stories in order to elicit a narrative which they recounted to the researcher and which was tape-recorded. Various linguistic measures were then analysed, such as the total number of words uttered, an indicator of talkativeness in an assessment situation. The mean length of utterances (MLU) was also determined, which is an indicator of the complexity of the syntactic structure of an utterance, that is, how advanced a child is in his or her grammatical development. Finally, the language sample was used to identify how many different word roots used by the children in order to obtain an index of lexical diversity. Both groups differed significantly on all measures, that is, extremely shy children achieved lower mean scores than non-shy children, regardless of their age group. On the receptive level, the differences reached statistical significance, but on the expressive level, the differences were even very highly significant so that very shy children produced less varied lexical units and less complex syntactic constructions in their structured narratives, even when the influence of receptive vocabulary was held constant. These findings reflect those of Smith Watts and colleagues [25] for an older group of subjects but go further by considering the productive linguistic abilities of very shy children at multiple linguistic levels. One of the key findings is that extremely timid children are linguistically inhibited in semi-spontaneous narratives in an assessment situation, which also supports the "I know it but won't say it" hypothesis to some extent. However, due to the selection of the sample, which only allows a comparison of the extreme temperamental characteristics, it must also be taken into account that very uninhibited children may have a significantly above-average performance [27], as they have no aversion to novelty and risk, and thus do not represent the appropriate comparison group. It would therefore be interesting to observe the performance of middle-shy and moderately non-shy children and to use a familiar person to run the tests.

Although the study by Spere and colleagues [30] again only compares the extreme temperament poles, this study helps to provide a picture of the receptive language skills (measured by the Peabody Picture Vocabulary Test—Revised; [31]) and phonological awareness (measured by the Test of Auditory Analysis Skills—TAAS; [32]) of four-year-old very shy children. Their level of shyness was assessed by their parents using selected questions from the Colorado Childhood Temperament Inventory (CCTI; [33]). An important finding is that very shy children performed normally on both tests of their language skills, that is, they were not constrained on the critical phonological awareness test, which involves a novel task that requires children to omit parts of words or phonemes from words of varying complexity, that is, to manipulate and produce the heard words in such a way that a pseudoword is generated. This task challenges children to disengage from semantics and concentrate solely on the formal-abstract aspect of language without the aid of pictures, which is still difficult for kindergarten children as this ability is just beginning to emerge [34]. However, in the shy group, more children withheld an answer, especially when they did not know

the correct answer, the authors suggest. Children who were not shy at all scored above average, which again supports the hypothesis that being very open and outgoing is an advantage in verbal assessment tasks [27].

One of the few studies addressing the productive lexicon of shy preschool children in a testing situation is Coplan and Armer's study [35]. The Expressive One-Word Picture Vocabulary Test: Revised [36] requires the children to name drawn pictures with one word (e.g. nouns, verbs, and adjectives), with the concepts becoming increasingly difficult as the test progresses. Significantly, the test was administered by someone the children knew from a previous interview 1 week earlier and in a familiar setting, namely the classroom, in the presence of their classmates and their teacher. It is therefore likely that the lack of association between productive vocabulary and levels of shyness, as assessed by parents using the Child Social Preference Scale (CSPS; [37]), was due to the fact that the overall setting was not novel and less test-like, which may also have reduced children's social evaluative concerns and stress, allowing them to overcome their reticence in responding. The study by Zhu and colleagues [38] fits in with these non-existent relations, which also found no correlation between the shyness of kindergarten and preschool children from China and their receptive vocabulary. The latter was assessed using the Chinese version of the Peabody Pictures Vocabulary Test (PPVT-III; [39]) by a research assistant in a quiet corner of the classroom, similar to [35]. This shows that data on language behaviour of shy children in test situations, which have been obtained predominantly in Western cultures, can also be replicated in Asian culture. The study by Tolksdorf, Viertel, and Rohlfing [24] also found no correlation in preschool children between shyness and productive vocabulary, as measured by the German Aktiver Wortschatztest für 3-5-jährige Kinder – Revision (AWST-R; [40]), in which children are asked to name individual pictures with nouns and verbs. This was also the case for the results of the comprehension test (subtest of the German test Sprachentwicklungstest für 3-5-jährige Kinder – SETK 3-5; [41]), where children were supposed to act out a sentence they had heard with objects. However, these results must be interpreted in light of the fact that the children were already familiar with all the contextual factors (such as the experimenter, the laboratory room, etc.) from the previous three sessions, with the exception of the language tests themselves.

Another piece of the puzzle regarding the importance of the contextual testing environment is added by the study by Spere and colleagues [42], in which surprisingly all preschool children, regardless of their level of shyness, scored higher on a test of expressive vocabulary skills in a preschool setting compared to a highly familiar home setting. In the preschool setting, the language tests were administered by an unfamiliar experimenter in a quiet place and at home by a parent with an experimenter present but not involved. To assess shyness, parents answered several questions from the Colorado Childhood Temperament Inventory [33], after which the children were categorised into three shyness levels, with the two extreme groups (shy and not shy) resulting from at least one standard deviation above or below the group mean (middle shy). The language tests reported here include the Comprehensive Receptive and Expressive Vocabulary Test (CREVT-2; [43]), which requires children to name pictures, describe situations and provide definitions in the expressive domain, but also indirectly tests other linguistic levels such as grammar, that is, the CREVT-2 is not a pure measure of productive vocabulary. The Sentence Imitation – Test of Language Development – Primary – Third Edition (TOLDP-III; [44]) was also included, which captures knowledge of the correct word order in a sentence and grammatical markers, but also places high demands on phonological working memory. Another key finding

was that shy children did not differ significantly from the other temperament groups on any of the language measures, regardless of the context in which they were tested. The strong influence of the testing context for all children may be explained by the fact that even young children are more accustomed to such testing formats in their preschool environment than at home, where formal tests and the different role of the caregiver as experimenter are much more unusual and possibly more irritating for the children, which ultimately also applies to the shy cohort.

The study by Crozier and Hostettler [15] essentially sought to answer the question of whether the general test environment, together with peers, is more conducive to the performance of shy children on cognitive tests than individual tests. In this study, a large and broadly selected sample of 9- to 10-year-old primary school children were tested, who were consequently significantly older than the children in the previously reported studies. The children were divided into different groups so that their productive vocabulary and arithmetic skills were assessed by a researcher in either a group or individual setting in the written modality, with an additional oral condition in the individual setting. The two most shy girls and boys in each class were selected by the class teachers, who also randomly selected two comparison children from the same class to participate in the study. This represents a methodological improvement as it meant that the most extreme poles were not compared with each other. Levels of shyness were assessed by the Teacher Ratings Form of the EAS Temperament Survey [45, 33]. Productive vocabulary was measured using the Crichton Vocabulary Scale 1988 Revision (CVS-R; [46]), which requires children to define words of increasing difficulty. The children's mathematical skills were tested using a specially constructed test based on formats from a standard intelligence test and the content of current classroom material. The results of the study show that in the written group test of their productive vocabulary and arithmetic skills, the shy children performed about as well as the less shy children, albeit at a slightly lower level. In the individual tests, the results were different, with the shy children scoring significantly lower than the less shy children, especially for productive vocabulary in the written language modality.

These pronounced differences in the productive lexicon must be seen in the context that the CVS-R actually requires children to draw on other language skills such as grammar, pragmatics or receptive vocabulary in order to formulate a correct response which places more demands on children's language processing than the arithmetic test. The way children formulate their definitions also reveals much more about their thought processes. In this sense, it may be that shy children experience the CVS-R as more socially evaluative, which apparently cannot be mitigated by staggering the timing of correction, as is the case with written test formats. Interestingly, in a more anonymous group setting, a less socially evaluative atmosphere seems to be at work, as shy children are noticeably less the focus of the tester and corrector than in a face-to-face test. The "lack of practice" hypothesis [27], which suggests that avoidance of social situations reduces the exposure and opportunity to practise language with others and results in a lower proportion of speaking in experimental or assessment situations [28], could be particularly true for such verbal definition tasks.

Lastly, Coplan and Weeks' study [47] offers interesting insights into the productive pragmatic performance of shy pupils at the beginning and end of the first school year, as assessed by the so-called 'pragmatic judgement' test of the Comprehensive Assessment of Spoken Language (CASL; [48]). The children were read some short everyday situations as vignettes and were asked to complete them according to the communicative intentions, wishes and emotions of the protagonists in the stories. This test was administered by previously unknown research assistants. The students'



mothers assessed their level of shyness using the shyness subscale of the Child Social Preference Scale (CSPS; [37]). At the beginning of the school year, shyness was negatively associated with pragmatic language skills, whereas at the end of the year the negative correlation was modest. This may well be related to the fact that by the end of the school year many of the contextual factors at school are familiar to the children, but also to the fact that the test itself is already known, which means that even shy children may be more confident in giving an answer. Interestingly, however, the authors emphasise that the tests were unable to diagnose a deficit in pragmatic skills in shy children, which is consistent with previously reported test results at other linguistic levels. The authors explain that pragmatic skills in particular are a protective factor, especially in shy children who are characterised by a socially anxious component, that is, advanced receptive and productive pragmatic skills (e.g. also, humour and irony) make it easier for shy children to engage adequately in social interaction and to respond appropriately than when these skills are poorly developed. The fact that advanced pragmatic abilities predicted a reduced level of shyness at the end of the school year, particularly for boys, lends support to this protective role.

### **3.2 Cognitive performance in word-learning experiments**

In addition to these extensive findings from language tests with shy children, there is already evidence that temperament can influence basic word-learning processes at an earlier developmental age. In typical word-learning experiments, children are presented with novel or very rare objects (e.g. a tea strainer) in real life or on pictures, which are repeatedly named by an experimenter using so-called pseudowords (e.g. koba) in order to form a label-object association, that is, to learn a new word. After a few minutes, either receptive learning can be tested by asking the child to choose the target object for the label heard before from among other possible referents. Alternatively, productive learning can be assessed by asking the child what the target object is called. In a word-learning study with two-year-olds, in which shyness was measured using a parent questionnaire [19], less shy toddlers outperformed shy toddlers in the word-learning process itself, being better at establishing a new word-object association by mapping a novel word to a novel object among familiar objects. Subsequently, shy toddlers were less able to receptively retain the novel label [23]. Critically, in the same learning scenario, shy toddlers preferred to pick up a familiar object over a novel object when they heard a novel word, even though the familiar objects could be ruled out by mutual exclusivity. The authors conclude that novelty avoidance, paired with risk avoidance, could hinder the word-learning process in that novel words are falsely mapped with familiar objects. Although one might be tempted to interpret these results that shy toddlers tend to avoid new objects and labels in the learning situation, but changing the overall setting or even the experimenter to be more familiar might have a different effect on the results as demonstrated in the following studies. Hilton and Elsner [49] modified the learning situation with two-year-olds by presenting objects and words in two different conditions by a familiar or unfamiliar experimenter on a screen. Analysing eye movements, the authors found that when learning words with the familiar experimenter, shy children's attention tended to focus on the new object, making a word-object mapping more likely than when learning with the unfamiliar experimenter. A more recent study even went so far as to establish familiarity by having the children's caregivers take on the role of experimenters [50]. Interestingly, this reversed the findings of Hilton and Westermann [23], that

is, the shy 2-year-olds associated the pseudoword with the novel object just as well and were even able to retain it significantly better than their less shy peers in the subsequent retention phase. Overall, this shows the important role of caregivers in early learning scenarios, especially for inhibited children, to allow them to focus on the cognitive demands of the task and express their language skills. It shows that the results of many experiments involving infants may be more affected by trait effects and that small methodological changes can have a large effect. In section 4, we will look in more detail at the findings on attentional patterns during word learning.

Also, the assumption that shy children are less likely to take risks by making mistakes in the retention situation may be mitigated if the whole setting is familiar. Indeed, in a word learning study in which familiarity was established through a repeated measures design, we investigated how familiarity with a learning and test situation affected word learning in shy preschool children interacting with a robotic partner [24]. The word learning was embedded in a short narrative by the robot in which the children encountered six novel words (colour adjectives), whose referents on pictures the children helped to uncover in a joint activity with the robot. This word-learning activity was repeated twice, with a break of a few days in between, so that the whole procedure was familiar and predictable to the subjects. However, unlike Hilton and Westermann [23], the focus of this study was not on the mapping process itself, that is, not on observing which object the children matched to the word, but on learning success, in particular, whether the children were able to generalise the novel adjectives to other objects in a subsequent test situation. The first test situation took place a few minutes after the last learning situation and was repeated a few days later, so that the subjects were again familiar with the situation on the second occasion. Here, the test content was presented in a context similar to a shared book reading that all children are involved in on a daily basis. When tested for word learning for the first time, shy children scored lower than less shy children; but once the whole test situation was known, the shy children caught up in the second test. Interestingly, the level of shyness positively predicted gains in word learning, that is, the shyer a subject was, the greater the gain in word learning on the second test.

Taken together, these results show the importance of familiarity and routinised formats in learning arrangements, which may allow shy children to feel more confident about expressing themselves verbally in a test situation, as they dare to say a word regardless of their uncertainty about the correctness of their response. Also, the avoidance of novelty at the level of words or items, or even towards the novel robotic partner, seems to fade into the background under the familiarity of the whole situation. In this respect, it is worth noting that the robot could have been perceived more as a coequal learning partner compared to an adult experimenter, which could have reduced the social load and the feeling of being evaluated in the situation itself [24].

#### **4. Nonverbal behaviour of shy children**

In addition to the work demonstrating how shyness can be reflected in children's verbal behaviour towards an interaction partner, there are several, albeit fewer, studies that investigated the influences of children's shyness on different nonverbal modalities across different interactional contexts, typically investigated by observing children's behaviour during social exposure or in unfamiliar socially evaluative settings.

Much of the literature on shyness has focused on children's gaze behaviour and their facial expressions as important nonverbal indicators of shyness [51–55]. One of the key studies that systematically examined these nonverbal indicators, particularly in terms of children's gaze behaviour and affective facial expressions, while also exploring their role as strategies for social and emotional regulation, was conducted by Colonessi and colleagues [56]. In their study, 3-year-old children were asked to imitate animal sounds in front of an unfamiliar person and then observe their own performance. The authors specifically analysed their behaviours in terms of positive and negative expressions of shyness. The nonverbal cues studied included gaze aversion, head movements, and facial expressions (e.g. smiling). In line with previous literature [57], positive shyness was characterised by behaviours like smiling while averting gaze. In contrast, negative shyness was marked by avoidance behaviours such as gaze aversion without smiling or expressions of discomfort like frowning. The study found significant differences in nonverbal behaviours between shy and less shy children. Shy children exhibited more frequent gaze or head aversion during interactions where they were the focus of attention during the interactions with the unfamiliar interaction partner, while less shy children were more likely to maintain eye contact and engage in positive expressive behaviours. Crucially, Colonessi and colleagues [56] highlighted that such positive expressions of shyness can function as an adaptive social strategy, helping shy children navigate socially demanding or stressful situations. On the other hand, negative shyness was more closely associated with social withdrawal and anxiety. In a more recent study addressing children's gaze and expressions of positive and negative affect, Hassan and Schmidt [58] examined how dyads of preschoolers responded to the task of giving an impromptu speech about their most recent birthday in front of an experimenter. After one child in the dyad delivered their speech, the other child took their turn. The children were unfamiliar with each other and were matched by age and gender. Heightening the social-evaluative setting, the authors not only required the child to give the speech in front of the unfamiliar experimenter and peer but also informed the child shortly before the task that the speech would be recorded to show to other children later. In their results, the authors found that shyness was positively associated with nonverbal avoidance behaviours, such as gaze aversion. In particular, when confronted with the communicative task of giving a speech, shy children were more likely to avert their gaze and show less positive affect while speaking. Moreover, the authors found that children who observed their shy peers deliver a speech exhibited less positive affect and more avoidance when it was their turn to speak, suggesting that shy children's nonverbal behaviours can influence the subsequent nonverbal responses of their peers. Based on their findings, the authors speculated that shy children who spoke first might signal to the observing child that the task was intimidating, leading the other child to exhibit less enthusiasm and more restricted positive affect during their own speech.

While these studies identify nonverbal behaviours such as gaze aversion and facial expressions as strong indicators of shyness, it is important to highlight that in recent years, a body of work has demonstrated that these behavioural patterns function as important protective mechanisms for shy children in socially stressful situations, such as public speaking or interactions with unfamiliar people [55, 59, 60]. Interestingly, this line of research has recently expanded to examine children's interactions with socially interactive agents, such as social robots, and how shy children's interactions evolve over longer time scales. Tolksdorf, Viertel, and Rohlffing [24] observed the behaviour of preschool children, focusing on temperamental shyness and tracking their expressions of pleasure (e.g. smiling) and discomfort (e.g. frowning) across

four consecutive sessions involving multiple novel word learning and testing tasks. While the results showed that shy children consistently exhibited fewer positive reactions over time, an intriguing finding emerged regarding their expressions of discomfort. When given the opportunity to familiarise themselves with the learning or testing context (e.g. the first learning or testing situation), shy children showed significantly lower levels of discomfort compared to their less shy peers. The authors proposed that this faster reduction in negative reactions might suggest a familiarisation effect, particularly pronounced in shy children, as they became more accustomed to the demands of the specific situation. These findings highlight that, depending on the context, shy children may adapt differently to task demands, demonstrating a nuanced capacity for adjustment.

Considering another nonverbal modality, Colonnese and colleagues [61] explored the relationship between shyness and infants' use of gestures at 12 and 15 months of age. The study measured infants' positive and negative shyness when they first entered the laboratory rooms, carried by a parent, and were welcomed by the experimenter—a person unfamiliar to them. Following this, the researchers examined the infants' gestures during a task in which the child sat at a table facing an experimenter, with the parent nearby. A second experimenter, positioned behind a curtain, presented various stimuli: pleasant (e.g. a spinning spiral), unpleasant (e.g. a toy spider), and neutral (e.g. potholders). The study revealed a developmental shift in how infants' shyness and pointing behaviours are linked between 12 and 15 months. At 12 months, positive shyness (smiling while averting gaze) was negatively associated with pointing gestures, suggesting that shy infants were less likely to use pointing during interactions. However, by 15 months, this relationship reversed, with positive shyness becoming positively associated with pointing, particularly in infants who also displayed negative shyness. Additionally, infants who exhibited more negative shyness pointed more frequently at unpleasant stimuli. These findings suggest that shyness plays a role in shaping early nonverbal communicative behaviours, such as gestures, particularly in directing attention to emotionally charged stimuli. Colonnese and colleagues [61] concluded from their findings that as infants might become more aware of themselves and others during social interactions, they may also develop a better understanding of their role in these interactions and become more adept at regulating their emotional responses, even in unfamiliar or ambiguous situations. This increased awareness may allow them to engage in more coordinated social behaviours, such as using pointing gestures to share attention or direct the focus of others. This investigation of children's multimodal communicative behaviour, specifically their use of gestures when interacting with different social partners, represents an innovative approach (see also [62]). In fact, current research emphasises the need for deeper exploration of the nuances in children's gestural behaviour related to shyness, while also highlighting the critical role cultural differences play in shaping these behaviours [63]. Further research in this area could provide valuable insights into how shyness influences the development of different multimodal patterns of behaviour, including gestures, in different cultural contexts, thus providing a more comprehensive understanding of how shyness shapes early social-communicative development.

The results across the studies discussed above consistently suggest that shyness can critically influence an individual's nonverbal behaviour, leading to the emergence of distinct patterns in unfamiliar social situations, however, much of the research to date has focused on the behaviour of shy children as it unfolds over the entirety of an interaction. As a result, these behaviours are often methodologically studied in isolation from their interaction partners. Consequently, less is known about how

shy children's behaviour evolves dynamically in relation to their partners' actions in unfolding interpersonal contexts, overlooking the fluid and adaptive nature of communication, which involves continuous adjustments based on the signals and behaviours of others. Addressing this gap, Tolksdorf and colleagues [64] investigated how shyness influences children's proxemics—specifically, the coordination of physical and social space between children and their interaction partners. The study measured shy children's proxemic behaviour during similarly designed interactions, but groups of children encountered different social partners with either an unfamiliar social robot or an unfamiliar human partner. Observed nonverbal behaviours included the physical distance the child maintained and the time spent in different proxemic zones (e.g. close or distant) relative to the interaction partner. The researchers found that shy children consistently maintained greater physical distance during the unfolding interaction, regardless of whether their partner was human or robotic. The shyer the child, the less time they spent in close proximity to their partner. These findings suggest that shy children exhibit similarly restrained proxemic behaviour, even though their partners—whether human or robot—may impose different levels of social demands. In this respect, despite the potentially different social complexities, shy children's approach distance persisted in both conditions, suggesting that their behaviour may not be driven solely by the specific partner's social behaviour, but may reflect a more general reluctance when interacting with unknown partners. This points to the intriguing question of which (social) contextual cues may have influenced children's proxemic behaviour and which other factors, such as the novelty of the interaction or internal feelings of self-consciousness, may have played a role. The authors originally expected that shy children would keep a greater distance from the robotic partner due to the inherent novelty of interacting with such a socially interactive agent for the first time. However, previous research suggests that children may perceive social robots as less judgemental [65–67], and the robot's toy-like appearance, and predictable behaviour may have mitigated the expected distancing effect. Consequently, shy children's preference for greater social distance with the robot may have been less pronounced than anticipated, leading shy children to exhibit similar proxemic behaviours towards both the robot and human partners, suggesting a more general pattern of distance-keeping in unfamiliar social situations.

While these findings highlight how shyness influences children's physical distancing behaviour, they may also point to a larger theme: the context sensitivity of shy children's behaviour and how it may shift depending on the specific parameters of social interaction. A related study explored this line of thought by looking at patterns of visual attention in word-learning situations. Inspired by Hilton, Twomey, and Westermann [68], who found that shy children showed different patterns of visual attention during word learning compared to their less shy peers, Tolksdorf, Viertel, and Rohlfing [69] analysed visual attention in the context of a naturalistic learning situation, again using a humanoid robot in their methodological approach. A key difference in this study was the focus on familiarity, which was operationalised through repeated social learning situations. Contrary to Hilton et al. [68], the authors did not find a lower level of visual attention to target items that were labelled in very shy children. Instead, a strong relationship was observed between the proportion of gaze directed to the target referent and successful word learning, regardless of the child's shyness. These findings suggest that establishing routines and familiarity in learning environments can help shy children to feel more comfortable expressing themselves, and may act as a buffer to enable shy children to unfold their attentional processes in ways that support learning experiences. In a related study, Tykhonenko and colleagues [70] examined how shy and

less shy children adapt to changing task demands through turn-timing behaviour in interactions with a social robot. The study revealed that although shy children consistently showed longer response latencies compared to their less shy peers, this difference was particularly pronounced when they were introduced to novel tasks. While both groups exhibited faster turn-taking in familiar tasks, shy children's timing slowed significantly in response to novel task characteristics, indicating heightened sensitivity to situational changes. These findings suggest that while shy children may take more time to adapt to novel demands, their delayed responses might reflect a more careful approach, potentially facilitating richer situational processing. These findings are consistent with the broader notion that although shy children show different temporal coordination in their interactive behaviour, this may be due to a more nuanced processing and awareness of situational changes, which is crucial for understanding their adaptive behaviour in dynamic learning environments.

In summary, the available evidence highlights the significant role shyness plays in shaping children's nonverbal behaviours, which are highly context-sensitive and influenced by factors such as novelty and perceived social demands. However, much of the current work relies on static, laboratory-based stimuli, limiting our understanding of how shy children behave in dynamic, naturalistic contexts. In addition, there have been very few longitudinal studies that have examined the developmental stability of shy children's multimodal behaviours and the long-term effects of familiarity with different partners or tasks. Despite these gaps, current research offers a foundation for developing more inclusive educational activities and assessment formats tailored to shy individuals. The next section will explore the practical implications of these findings for designing testing environments that better accommodate the unique needs of shy children.

## **5. Implications for designing testing situations for shy children**

Designing testing environments that meet the specific needs of shy children is essential to accurately assess their abilities and encourage meaningful participation. As discussed in previous chapters, shy children often face heightened challenges in social-evaluative situations, which can affect their interactive behaviour and engagement with their social partners. Making educational activities and assessment formats more flexible to accommodate shy children's behavioural patterns is crucial to gaining a more accurate understanding of their competencies. In doing so, we can promote an environment that supports their unique communication needs and an inclusive environment for all children with a range of temperamental characteristics. To create an environment that allows shy children to express themselves comfortably, several key implications arise.

First, as shy children often hesitate to provide verbal responses [30], a simple yet effective solution is to allow more time for them to respond. This, however, requires the interlocutor to tolerate longer pauses in the conversation. While modifying standardised tests may be challenging due to quality criteria, in many other contexts—such as informal assessments, classroom discussions, or laboratory experiments—providing shy children with additional time to formulate their responses could be crucial not only for assessing their competence but also for enabling them to participate at their own pace. Research shows that highly shy preschoolers initiated responses significantly slower than their medium and less shy peers in expressive language tests requiring verbal answers but not in comprehension tests involving

nonverbal responses [71]. This highlights the importance of extended wait time, particularly in verbal question-and-answer formats. Increasing wait time not only benefits shy children, but also their less shy counterparts, as it allows children more time to process the question and develop thoughtful responses. In fact, extending wait time beyond three seconds has been shown to improve both the quality and quantity of student responses, fostering the use of higher-level cognitive processes. Additionally, it enhances students' confidence and promotes deeper engagement in conversations and classroom activities [72, 73].

However, in particular unfamiliar or socially stressful situations, for very shy children, it can be quite relieving to be given the opportunity to participate with a very short verbal or even nonverbal response, such as a gesture, rather than requiring a longer verbal response. The importance of considering different nonverbal means of communication, especially in shy children, is demonstrated by Viertel [74], who examined early social cognition in 19-month-olds in the context of a helping paradigm. Interestingly, the shy children outperformed their less shy peers in this experiment by using more diverse communicative means (e.g. showing or pointing) from a distance to inform the experimenter about a hidden object than those means by which they had to approach her (e.g. giving). The result would have been exactly the opposite, to the disadvantage of the shy children, if only proxemic gestures had been considered. These findings highlight the importance of paying close attention to subtle nonverbal means of communication, especially with young children, in tests or experiments designed to assess their cognitive or linguistic abilities. It also underlines that shy children prefer to act within their comfort proxemic zone and it is crucial to allow them the space and time to observe the ongoing social interaction before they become actively involved. Lastly, knowledge of the use of more subtle communicative signals and of typical (positive and negative) expressions of shyness is particularly helpful for practitioners to be aware of a shy child in key situations and, if necessary, to interpret test results accordingly.

Another important element is to encourage shy children to respond, that is, to prompt and motivate them to share their thoughts with their classmates, for example, or to say something in formal tests even if they are unsure whether their answer is correct or appropriate. One promising approach is the way in which questions are framed, for example the technique of less controlled questions, which is characterised by a more conversational style with fewer specific questions directed at the child, but with occasional reference to and elaboration of what the child has said [75]. This less controlled questioning technique used by teachers in their kindergarten classes during 'show and tell' were clearly more beneficial than a more controlled questioning technique in terms of eliciting longer speech, higher word counts, and voluntary communication of more content, especially with shy children. This technique seems to reduce the socially evaluative nature of an assessment situation and more closely resembles a casual personal conversation, which lowers the pressure on shy children and allows them to overcome their initial inhibitions more quickly [28].

Closely linked to this is support in the event of failure or mistakes, which may have been made publicly in the classroom in front of other pupils. This is a particularly precarious and uncomfortable situation for many shy children as it increases their concerns about social evaluation [76], which could raise the threshold for taking risks in front of others. It is important to convey the attitude that it is fine to make mistakes and that mistakes should be seen as part of the learning process and an approach to learning success for everyone [77]. In addition, inhibited children should be given the confidence and support to try again, rather than withdrawing and remaining silent because of possible failure.

Moreover, the presence of a familiar person, especially a primary caregiver, can be highly beneficial for shy children, particularly younger ones, during standardised tests or word-learning experiments. Research examining children's social referencing during formal language assessments found that the level of shyness significantly predicted how often children looked to their caregiver for reassurance [78]. Shy children, in particular, used their caregiver as an emotional resource to help them regulate their feelings in these uncertain situations [79]. This role of the caregiver is especially important considering that very shy children tended to use social referencing more frequently when they were unsure of an answer or had already provided a response [78]. The caregiver's presence, in these instances, indirectly contributed to the smooth continuation of the test. Additionally, recent studies suggest that shy children's reliance on social referencing may increase when faced with unfamiliar situations, such as language assessments or word-learning tasks. Tolsdorf, Crawshaw, and Rohlfing [80] found that children sought their caregiver's support more frequently when interacting with a robot, likely due to the robot's unfamiliar behaviour creating additional uncertainty. This finding aligns with the notion that very shy children, who may already feel unsure in these contexts, greatly benefit from the emotional support and reassurance provided by their caregivers, leading to smoother interactions and potentially improved test outcomes. Thus, caregivers not only help shy children regulate their emotions but also facilitate continuity and success in unfamiliar settings such as experimental testing or learning contexts.

Our previous analyses also demonstrate that different temperaments require different learning arrangements, especially for young children in word-learning settings. While extroverted and open children benefit from novelty, for shy children contextual factors need to be modified to maximise familiarity, for example, in terms of the predictability of the setting, the presence of the caregiver, or even the caregiver taking on the role of experimenter [23, 50]. This familiar framing allows them to concentrate on the cognitive demands of the task and to unfold and demonstrate their actual knowledge, rather than a constrained performance due to suboptimal contextual factors. As many studies of linguistic performance in language tests of shy children have shown, it is not necessary to tailor a whole package of familiar contextual factors, especially for preschool or school-age children. Instead, it is often sufficient to administer the test in a familiar environment or with a person they already know to encourage shy children to participate and to feel comfortable in producing language. Older, more literate children benefit from more anonymous group tests [15, 42], which are less socially evaluative and less focused on their individual performance. In addition, this type of test often provides them with more time to formulate their answers.

However, sometimes it is not possible to change contextual factors to create a more familiar situation, so practitioners should be aware that even if they receive a response from a shy child in the test situation, it may not necessarily represent the child's actual knowledge and a valid measure of it [23]. As a consequence, this means that children's language performance gained from formal language tests should not be overestimated or misinterpreted. If the test procedure allows, it could be repeated under the same or similar conditions after a period of time as a means to increase predictability and a possible attempt to capture actual knowledge.

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