

# Assessing Communication in Children with Autism Spectrum Disorder Who Are Minimally Verbal

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## Abstract

**Purpose of review** Children with autism spectrum disorder (ASD) who are minimally verbal children may often require timely and tailored intervention to optimize their short- and long-term communication outcomes. Effective intervention relies on appropriate and accurate assessment. The purposes of this review are to summarize current and emerging issues and practices in the assessment of these children and to consider implications for research and clinical practice.

**Recent findings** There is growing awareness of the need for improved assessment practices and emerging consensus regarding principles that should underpin the assessment process. Enhanced use of existing assessment tools, as well as emerging tools, has the potential to improve practice. However, there remains a general lack of specific, sensitive, and clinically useful tools for this population.

**Summary** Although the importance of appropriate assessment for children with ASD who are minimally verbal is well established, there remains a critical need for concerted effort to enhance approaches currently available.

**Keywords** Autism · Communication · Assessment · Prelinguistic · Minimally verbal · Language

## Introduction

Communication impairment is central to a diagnosis of autism spectrum disorder (ASD) and a key focus of interventions aimed at improving children's skills, adaptive functioning, and participation across the full range of life activities. Indeed, early communication development is both a central prognostic indicator for longer-term outcomes [1] as well as one of the most readily enhanced adaptive behaviors through intervention [e.g., 2, 3]. Yet, despite the development of a range of evidence-based focused and comprehensive interventions supporting communication development, as many as one in three children with ASD start school with limited spoken

language [4]. Identifying, understanding, and ultimately addressing the communication needs of children with ASD who are minimally verbal requires appropriate and accurate assessment of their communication skills and of the factors that are influencing their communication development [5].

An important first step towards understanding and addressing communication difficulties—including through improved assessment—is to clearly define the population in question. A number of terms have been used to refer to children with little or no functional speech, including *pre-verbal*, *non-verbal*, *minimally verbal*, *pre-linguistic*, and *non-linguistic* which account for, in various combinations, an individual's chronological age, communication skills, and likelihood of learning spoken language [6, 7]. For the purpose of this narrative review, we focus on assessment of children between 2 and 6 years of age. The term minimally verbal is defined as such children who have "...a very small repertoire of spoken words or fixed phrases that are used communicatively" [8]. This definition includes children who are not using functional speech. In typical development, this period from 2 to 6 years is characterized by children's rapid acquisition and use of spontaneous, creative, and flexible verbal and non-verbal communication modes for a variety of purposes across a range of contexts [9]. Accordingly, in framing this review and the recommendations that follow, we have focused on practices that are in

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60 keeping with this broad conceptualization of communication,  
 61 including those that acknowledge non-verbal, idiosyncratic,  
 62 and augmentative and alternative communication modes chil-  
 63 dren may be using.

64 Fortunately, there is growing awareness of the unmet needs  
 65 of children, adolescents, and adults with ASD who are mini-  
 66 mally verbal, and there have been a number of relevant pub-  
 67 lications in the past decade to guide research and practice. This  
 68 non-exhaustive list includes the defining of spoken language  
 69 benchmarks and guidance for selecting appropriate assess-  
 70 ment tools [10] and guidance on assessing minimally verbal  
 71 preschool and school-aged children with ASD [e.g., 8, 11, 12].  
 72 Here, we synthesize issues and previous recommenda-  
 73 tions, infusing them with insights from additional original  
 74 studies and our own clinical and research experience, to pro-  
 75 vide a summary of current issues and common  
 76 recommendations.

## 77 Principles of Appropriate Assessment

78 Previous authors have outlined guiding principles of appropri-  
 79 ate assessment, including collecting information across a  
 80 range of contexts, targeted selection of informal and formal  
 81 assessment tools, and collecting information across a variety  
 82 of developmental domains [e.g., 5, 8, 13, 14, 15].  
 83 Fundamental to appropriate assessment for all children is  
 84 clearly specifying the purpose of the assessment, which may  
 85 include screening, diagnosis, goal setting, monitoring and  
 86 modifying interventions, and documenting outcomes, with  
 87 each having different practical implications. In each case, a  
 88 multifaceted approach is likely to be required, given the com-  
 89 plex set of communication skills (e.g., verbal and non-verbal  
 90 communication modes, for comprehension and expression,  
 91 across a variety of functions) as well as environmental factors  
 92 (e.g., communication opportunities, partner skills, availability  
 93 of AAC) under consideration. Speech-language pathologists  
 94 have the requisite skills to interrogate and consider all factors,  
 95 even if not all are directly assessed (e.g., they may not com-  
 96 plete a phonological assessment on a child who is minimally  
 97 verbal, but nevertheless informally document the child's pho-  
 98 nological inventory). However, a comprehensive assessment  
 99 requires, and benefits from, strategic multidisciplinary input,  
 100 particularly in relation to differential diagnosis and accounting  
 101 for comorbid conditions (e.g., intellectual disability).  
 102 Multidisciplinary and multiple stakeholder input is also im-  
 103 portant for intervention planning, whereby children who are  
 104 minimally verbal will need communication support across  
 105 multiple contexts and communication partners.

106 This process of assessment necessarily involves close col-  
 107 laboration with parents, caregivers, educators, and other  
 108 health professionals to determine why the assessment needs  
 109 to occur, what information is to be gathered and how best to

collect it, who will be involved and what roles will they play,  
 and how the findings will be communicated and used in prac-  
 tical ways. Central to all decisions is the welfare and interests  
 of the child in question, including scrutiny of the relative ben-  
 efits and burdens of all aspects of the assessment proposed.  
 Despite the fact that working in the best interests of the child is  
 implicit across guidelines to date, we suggest that explicit  
 statements should be included in future. Furthermore, plan-  
 ning for any assessment should include discussion about the  
 practical steps that will be taken to make assessments as nat-  
 ural and enjoyable as possible, to monitor for signs of distress,  
 and to ensure that approaches are selected that allow children  
 to demonstrate their own interests, personalities, and  
 strengths. Such an approach requires the targeted selection  
 of tools, including standardized and non-standardized tools  
 as well as emerging technologies.

## Standardized Assessment

Standardized assessments have an important role to play in  
 understanding communication development in children with  
 ASD who are minimally verbal. Standardization refers to ad-  
 ministration of the tools in a consistent manner, allowing con-  
 sistent collection of information, with a subset of these includ-  
 ing normative data that enable children's skills to be compared  
 to a broader community sample; in addition the tools should  
 have established reliability and validity [5, 16]. Because of  
 these benefits, standardized measures have featured promi-  
 nently in research involving children with ASD, including  
 those who are minimally verbal, in cases where there is a need  
 to establish or confirm diagnosis, characterize children's  
 skills, examine cross-sectional relationships between child  
 and environmental factors, and evaluate outcomes [9, 17].  
 To illustrate, the consistent, semi-structured play-based inter-  
 actions featured in the original and revised Autism Diagnostic  
 Observation Schedule [18, 19] have not only contributed to  
 reliable participant diagnosis and characterization, but can al-  
 so provide a consistent sampling context (semi-structured  
 play-based interaction) for comparing children's communica-  
 tion across clients in clinical settings and participants in re-  
 search studies. Furthermore, standardized, norm-referenced  
 assessments of prelinguistic skills, for example the  
 Communication and Symbolic Behavior Scales [20], have  
 the potential to shed light on early communicative behaviors  
 (e.g., use of gesture, rate of communicative acts, imitation)  
 that are established predictors of later communication gains  
 in children with ASD [5].

Yet despite the benefits, standardized assessments have  
 documented limitations including the influence of test taking  
 experience and skills on performance and the common need to  
 adapt administration procedures due to behavioral challenges  
 [5, 8]. General measures of receptive and expressive

160 language development spanning broad developmental periods  
 161 [e.g., Mullen Scales of Early Learning; 21] can have floor  
 162 effects for children who are minimally verbal when using  
 163 standard scores. Furthermore, as children get older, the op-  
 164 tions become more limited, with Kasari et al. [8•] completing  
 165 a comprehensive review and identifying very few valid and  
 166 reliable standardized tools for school-aged children who are  
 167 minimally verbal; a situation much unchanged 6 years later.  
 168 However, there have been advances in other areas, including  
 169 novel item level analysis of standardized tests (e.g., whether a  
 170 child uses 2-word phrases) to yield clinically meaningful data  
 171 not reflected in standard scores alone [4, 22]. Furthermore,  
 172 there have been ongoing attempts to optimize existing gold  
 173 standard individualized assessment (e.g., naturalistic language  
 174 sampling) and to develop new technological approaches for  
 175 assessing communication in these children [23••].

176 **Individualized Assessment**

177 Individualized assessment of communication is crucial for un-  
 178 derstanding how children, particularly those who are minimally  
 179 verbal, may be communicating. Children with ASD present  
 180 with a spectrum of individual strengths and needs, requiring  
 181 multidisciplinary input for diagnosis, and assessment for goal  
 182 setting and intervention [24]. Individualized assessment is par-  
 183 ticularly valuable in understanding communication in context,  
 184 including children’s broader repertoire of skills, needs, and in-  
 185 terests [5]; along with opportunities for interaction, access to  
 186 effective communication support including AAC, and the com-  
 187 munication partners’ knowledge and skills.

188 Brady and Keen [25] outlined three primary strategies for  
 189 the individualized assessment of communication: informant  
 190 report, direct observation, and structured observation.  
 191 *Informant report*, which often takes the form of parent inter-  
 192 views, is an efficient and effective way of gathering informa-  
 193 tion about a child’s skills as observed by a familiar communi-  
 194 cation partner [25]. Parents can provide information that is  
 195 both sensitive and specific regarding children’s developmental  
 196 strengths and delays [26] and is considered a crucial element  
 197 of information gathering [27]. Further, informant reports can  
 198 form an important first step in collaborative practice, whereby  
 199 the expertise of the parent is recognized and acknowledged  
 200 while supporting parents to increase their awareness of com-  
 201 munication acts [25]. Parents and caregivers may observe a  
 202 range of behaviors in different environments or at various  
 203 times of day to those seen by clinicians, and this may contrib-  
 204 ute to different understanding of children’s skills.

205 *Direct observation* involves identifying and then recording  
 206 information about behaviors of interest in naturalistic situa-  
 207 tions and can provide invaluable information about how and  
 208 why children communicate, particularly when the communi-  
 209 cation forms may be subtle or unconventional [25]. Indeed,

naturalistic language sampling is considered the gold standard  
 in comprehensive communication assessment for all children,  
 including those with ASD [8•, 9••, 28]. Recordings of chil-  
 dren’s spontaneous language across a range of environments  
 and with different people can be analyzed and coded for a  
 range of structural and pragmatic features [14••]. This tech-  
 nique can provide rich information about a child’s skills across  
 domains, along with their functional use of speech, and is  
 more sensitive to change. Analysis may include counting of  
 behaviors of interest or transcription of spoken language using  
 Systematic Analysis of Language Transcripts (SALT) analysis  
 [29] or similar approaches [10]. Nevertheless, direct observa-  
 tion including language sample collection, transcription, and  
 analysis can be time consuming and may not provide enough  
 opportunities to examine skills and behaviors of interest in the  
 timeframe available.

*Structured observation*, in which the environment is  
 engineered to create specific opportunities for communicative  
 behaviors to occur, can help to address this issue, by eliciting a  
 range of communicative behaviors in a more predictable way.  
 A common approach involves the use of communicative temp-  
 tations and can be particularly helpful in evoking information  
 about known predictors of communication development—such  
 as joint attention, symbol use, rates of communication, and  
 communicative functions—in a consistent manner. Structured  
 observations can also include the functional assessment of chal-  
 lenging behaviors in order to replace these behaviors with safe  
 and effective alternatives [30].

Yet, in considering the different strategies outlined here,  
 including standardized assessments, it is important to note that  
 they are not necessarily mutually exclusive. The ADOS [18,  
 19], for example, when used with children could be described  
 as a standardized assessment (based on standardized adminis-  
 tration) with both direct observation (naturalistic sampling of  
 social-communication interaction and behavior) and struc-  
 tured observation elements (a series of presses to create op-  
 portunities to observe specific skills and behaviors).  
 Furthermore, as new technologies emerge, and as clinicians  
 and researchers work to develop more accessible and sensitive  
 approaches to communication assessment for children who  
 are minimally verbal, the distinctions between approaches  
 are likely to become increasingly blurred.

**Technology in the Assessment of Children  
 with ASD at the Prelinguistic Stage  
 of Communication Development**

The potential for technology to assist in assessing children  
 with ASD who are minimally verbal has long been identified.  
 For instance, Tager-Flusberg, Kasari [7•] identified eye-track-  
 ing, neurophysiological measures (event-related potentials,  
 electroencephalography), and magnetoencephalography as

260 having potential utility over 5 years ago, but noted that chal- 313  
 261 lenges to their use in clinical and research settings including 314  
 262 (a) the need for children to be trained and tolerate the testing 315  
 263 environment and (b) the development of reliable and valid 316  
 264 measures utilizing these tools. While eye-tracking now com- 317  
 265 monly features in dedicated AAC systems to support access  
 266 (i.e., operating the system via eye gaze), there has not been  
 267 widespread uptake of these technologies for assessment in  
 268 clinical practice. Presumably, as technology becomes more  
 269 wearable and infused in consumer level equipment (e.g., phys-  
 270 ical activity sensors in watches), new avenues for developing  
 271 clinically relevant applications of these technologies may fol-  
 272 low. Tager-Flusberg et al. [11••] outlined practices developed  
 273 and applied in their neurophysiological, eye-tracking, and be-  
 274 havioral research to enhance participants' experience and re-  
 275 search quality, based primarily on principles and techniques  
 276 derived from applied behavior analytic research (e.g., task  
 277 analysis, chaining, shaping, modeling, and reinforcement).

278 The most pertinent technological innovation has been the  
 279 development of automated approaches to language sample  
 280 analysis, which seeks to learn from the communication chil-  
 281 dren are already producing in interactions with other children  
 282 and adults. Parish-Morris et al. [31], for example, reported on  
 283 an initiative to establish an international repository of annotat-  
 284 ed language samples for children with ASD, based on ADOS  
 285 recordings, including algorithms capable of detecting speech  
 286 and language characteristics that differentiate children with  
 287 ASD from children with typical development or related disor-  
 288 ders (e.g., intellectual disability). In both research and prac-  
 289 tice, the Language Environment Analysis (LENA) system  
 290 [32] has been identified as having potential to provide insights  
 291 into communication development in children with ASD who  
 292 are minimally verbal, albeit with mixed findings. While a  
 293 number of authors have identified the potential for LENA to  
 294 act as a sensitive measure of vocal change in children with  
 295 ASD, including those who are minimally verbal, there is  
 296 growing evidence of challenges with reliability and validity,  
 297 particularly in children with echolalia and in older children  
 298 approaching (and certainly beyond) the designated age range  
 299 of 0 to 5 years [33–35].

300 While the number and nature of technology products that  
 301 may inform communication assessment for children with  
 302 ASD who are minimally verbal is growing, so is the impor-  
 303 tance of critically considering the strengths and limitations of  
 304 each approach in interpreting findings especially if consider-  
 305 ing their application in clinical contexts. Furthermore, there is  
 306 already evidence that even with the advent of new technolo-  
 307 gies, individualized approaches to assessment will remain crit-  
 308 ical. Plesa Skwerer et al. [23••], for example, compared four  
 309 methods for assessing receptive language skills in children  
 310 and adolescents with ASD who were minimally verbal.  
 311 These four approaches were (a) standardized direct assess-  
 312 ment, (b) caregiver questionnaires, (c) eye-tracking tasks,

and (d) a touch-screen task. The authors reported substantial  
 heterogeneity across participants and measures, and thus rec-  
 ommended that assessment decisions be tailored to individual  
 needs and multiple methods be employed in clinical and re-  
 search settings.

## Interpreting and Implementing Findings

Irrespective of the approach to assessment, integration of data  
 into a hypothesis, beyond a basic description of the profile of  
 behaviors children do and do not present with, is vital. This  
 hypothesis includes why the child is presenting as they are and  
 mechanisms to achieve maximum change. Consideration to  
 sources and methods of information collection is important.  
 Each stakeholder provides key information about distinct cir-  
 cumstances [36]. How this information was collected, includ-  
 ing modifications to testing/environment as is a common and  
 appropriate practice for this population [e.g., 37] must be con-  
 sidered. For example, providing different or additional  
 prompts, may substantially alter the task, making the use of  
 normative data inappropriate. Further, appropriate normative  
 data may not exist, with most measures developed and  
 normed with typically developing children [see review, 36],  
 and may be especially exacerbated in the case of adaptation  
 for responses using AAC [8•]. Interpretation should carefully  
 consider sources of information, adaptations to testing, and  
 normative data use.

Consideration should be given to the level of analysis, given  
 that total scores can reflect very different individual pro-  
 files. Analysis of raw scores may yield valuable insight into  
 communication form and function [4, 8•]. For example, un-  
 derstanding the number of words used, or whether a child  
 initiates and/or responds to joint attention bids, and under  
 what circumstances. Contextual information (e.g., familiar  
 vs. unfamiliar examiner; prompted vs. unprompted skills) aids  
 in our interpretation of whether the observed absence of a skill  
 reflects performance potential or that a skill is lacking [8•],  
 thus informing not only potential goals, but also whether in-  
 tervention focuses on acquisition or generalization. Consider-  
 ation of what the constellation of skills taken together  
 means is also important. For example, what does the presence  
 of a range of gestures (for communicative) purposes mean in  
 the absence of spoken language? We could simply interpret  
 gestures as a strength to build on or hypothesize (and test) that  
 the child's attempts to communicate in non-verbal mode may  
 indicate the underlying contribution of motor speech  
 difficulty.

Careful consideration of assessment findings is also critical  
 to appropriate and meaningful goal setting. Parents and clini-  
 cians define important change (i.e., magnitude, priorities) dif-  
 ferently [36]. Selection of goals should be driven by an under-  
 standing of the best available evidence (e.g., predictors,

363 evidence-based practices), clinician expertise (e.g., operation- 413  
364 ally defining goals, training in practices), and understanding 414  
365 of the child and family values and preferences (e.g., socially 415  
366 valued goals) in order to appropriately interpret and imple- 416  
367 ment findings driving intervention selection. Research to date 417  
368 points to the importance of setting goals that will lead to great- 418  
369 er learning and participation across a range of meaningful life 419  
370 activities. Within a bio-psycho-social model of disability, this 420  
371 includes goals targeting the development of individual skills 421  
372 while at the same time enhancing opportunities, accessibility, 422  
373 and supports in the environment [38]. 423

374 In terms of monitoring children's development and/or re- 424  
375 sponse to interventions, some caution with existing tools and 425  
376 further evaluation of emerging tools is required. For instance, 426  
377 ASD-specific tools developed to inform diagnosis have been 427  
378 used in research to monitor changes over time, despite a lack 428  
379 of validation for this purpose [36]. Further, most measures 429  
380 lack ASD normative data [for an exception see the 430  
381 Psychoeducational Profile-3, 39]. However, new measures, 431  
382 along with evolving approaches to interpreting existing mea- 432  
383 sures, have the potential to address these issues. For instance, 433  
384 Grzadzinski et al. [40] published preliminary data indicating 434  
385 that their new measure—the Brief Observation of Social 435  
386 Communication Change (BOSCC)—may be a sensitive mea- 436  
387 sure of social-communication change. Regarding existing 437  
388 measures, item level analysis of raw scores may be useful to 438  
389 track changes such as the number of words understood or used 439  
390 [4, 8•]. In addition, aggregating data across sources of infor- 440  
391 mation may enable broad tracking, using tools such as the 441  
392 Developmental Disabilities Children's Global Assessment 442  
393 Scale [41]. Further, given the diversity of communication 443  
394 needs, an idiographic assessment, such as goal attainment 444  
395 scaling shows validity for this purpose [42], and may provide 445  
396 the most sensitive measure of intervention progress. Thus, a 446  
397 hypothesis-testing approach is valuable from assessment se- 447  
398 lection and interpretation, through to intervention and 448  
399 evaluation. 449

## 400 Proposed Future Directions

401 As we progress with expanding research on younger children 450  
402 with ASD who are minimally verbal, we can begin by work- 451  
403 ing toward achieving greater consistency in the ways in which 452  
404 children are assessed across different research studies, and 453  
405 eventually in clinical practice with a greater emphasis on di- 454  
406 rect assessment methods (rather than relying exclusively on 455  
407 parent report). There is general agreement across a range of 456  
408 studies that there are several important precursors for language 457  
409 development [e.g., joint attention, imitation, play, gestural 458  
410 communication; 43], but currently, there are no common 459  
411 methods used for assessing these skills in children with 460  
412 ASD. A few structured protocols have been developed—

such as the Early Social Communication Scales [44] to assess 413  
joint attention skills and the Rogers Imitation Battery to assess 414  
oral and manual/object motor imitation skills [45]—but there 415  
is still no gold standard practice in the field for incorporating 416  
assessment of prelinguistic skills. Furthermore, the reliance on 417  
standardized structured protocols with preselected materials 418  
means that some children will find it difficult to engage and 419  
may thus be non-compliant. 420

New inroads are being made in implementing more natu- 421  
ralistic ecologically valid approaches to collecting and mea- 422  
suring communication in children with ASD. Natural lan- 423  
guage samples have long been recommended for assessing 424  
expressive language skills [cf. 10] and the recent introduction 425  
of ELSA [Eliciting Language Samples for Analysis; 46] and 426  
ELSA-T (toddler version in development) provides the field 427  
with a standardized protocol that could be widely used for the 428  
collection of such samples. The inclusion of engaging play- 429  
based activities that could be tailored to the individual inter- 430  
ests of a child makes this approach especially useful for 431  
assessing communication, both linguistic and gestural, in chil- 432  
dren with ASD. Protocols such as ELSA could also be 433  
adapted in future work to incorporate in a more naturalistic 434  
and child-friendly way opportunities to respond or initiate 435  
joint attention, imitation of actions or activities by an exami- 436  
ner, and even the evaluation of play skills. 437

We currently lack useful tools for directly assessing 438  
receptive language skills because standardized tests of- 439  
ten yield floor effects with children with ASD who are 440  
minimally verbal. One direction that future research 441  
might take would be to adapt the naturalistic approaches 442  
that are used in expressive language assessment to the 443  
assessment of receptive language. For example, using an 444  
array of carefully selected age appropriate toys, the ex- 445  
aminer could interact with the child on a joint activity 446  
and issue requests or questions that would test the 447  
child's understanding of lexical terms (e.g., nouns, 448  
verbs, adjectives), phrases (perhaps contrasting different 449  
prepositions), or even simple sentences (e.g., testing 450  
grammatical word order). The child's responses, includ- 451  
ing the time taken to comply with the examiner's state- 452  
ment, might yield very useful information about recep- 453  
tive abilities. As with ELSA, a semi-structured but nat- 454  
uralistic play context that includes favored toys and a 455  
carefully designed examiner script would need to be 456  
developed and tested for its utility. 457

Another direction for future work is the expanded use 458  
of technology both for the collection of children's com- 459  
municative behavior as well as for its analysis. As 460  
wearables become more popular, inobtrusive micro- 461  
phones and video cameras might be used to support 462  
the collection of continuous vocal and non-vocal com- 463  
munication measures that can provide a unique window 464  
into the everyday lives of children with ASD who are 465

466 minimally verbal. Technological advances in computer  
 467 vision and speech recognition algorithms will be needed  
 468 to provide automated analyses of the behaviors collected  
 469 in this way. For all these examples, it will be important  
 470 to keep in mind the need to evaluate the psychometric  
 471 properties of these innovative approaches to assessment  
 472 including both reliability and validity as well as estab-  
 473 lishing some basic norms not only from typical chil-  
 474 dren, but especially from the full range of the ASD  
 475 population.

476 **Conclusion**

477 There is growing awareness, and an increasing evidence-base,  
 478 to guide appropriate communication assessment for children  
 479 with ASD who are minimally verbal. Advancing practice re-  
 480 quires adherence to best practice principles, enhanced use of  
 481 existing tools, and the development and validation of new  
 482 tools including technology. At the heart of the issue is the need  
 483 to accurately capture, understand, learn from, value, and work  
 484 with the unique strengths of each individual child, to promote  
 485 and support her or his right to communicate, learn, and par-  
 486 ticipate in all aspects of life. Further research into valid and  
 487 reliable assessment will provide vital information to under-  
 488 stand these strengths and inform targeted, and consequently  
 489 more efficacious, interventions to achieve this important goal.

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- Of importance 519
- Of major importance 520

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