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ARTICLE

Metaphor comprehension in the acquisition of Arabic

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Abstract

Metaphors are key to how children conceptualise the world around them and how they engage socially and educationally. This study investigated metaphor comprehension in typically developing Arabic-speaking children aged 3;01-6;07. Eighty-seven children were administered a newly developed task containing 20 narrated stories and were asked to point at pictures that best illustrated the metaphoric expression. The results were examined through a mixed ANCOVA, testing the effects of chronological age, metaphor type (primary, perceptual) and metaphor conventionality (conventional, novel) on metaphor comprehension. Children could understand some metaphors just after their third birthday, and their comprehension increased with age. Children's performance was somewhat better on primary than perceptual, and much better on conventional than novel metaphors. These findings are discussed in light of conceptual metaphor theory (Lakoff & Johnson, 2008) and structure mapping theory (Gentner & Markman, 1997), confirming differences in the acquisition of different metaphor types.

Keywords: metaphor; comprehension; primary; conventional; novel

Introduction

Metaphor is a type of figurative device that relies on the duality of word meanings; it taps into alternative domains to describe, illustrate, and clarify single concepts which are otherwise difficult to convey in discourse. For example, when commenting on the kind and selfless acts of our children, we may praise their unusually virtuous nature by using a metaphor which likens them to supernatural beings (e.g., They're real *angels*). Aside from linking single concepts, metaphor can also be a way of understanding one whole domain in terms of another. For example, when making plans with our friends (e.g., for *next*

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weekend), we reveal that our perception of time reflects our perception of space (e.g., the *next* row of houses). Some metaphors are conventional phrases commonly recycled in one's speech community. Others are novel and created ad hoc, previously unregistered, either because they compare two concepts which are not usually compared in language (e.g., Your hair is *spaghetti*), or because they replace the metaphorical keyword with another similar word that sounds unconventional in the given construction (e.g., the weekend *close to* this one).

Until recently, metaphor comprehension was believed to emerge late in development. It had been postulated that very young children process figurative language literally even when such language does not make sense in the context, and only when they grow older, and develop more advanced lexical and pragmatic skills, do they acquire the ability to search for clues leading to a nonliteral interpretation of the input (e.g., Levorato & Cacciari, 2002). While most studies have focussed on older children, a few recent studies have shown that it is possible to capture metaphor comprehension as early as at the age of three as long as its use is neatly scaffolded in a suggestive context whose simplicity reflects the state of children's world knowledge (e.g., Di Paola et al., 2019; Pouscoulous & Tomasello, 2019). As metaphors are crucial for grasping key concepts across a wide range of school subjects, such as maths (Núñez, 2008), music (Zbikowski, 2008), biology (Taylor & Dewsbury, 2018) and chemistry (Mahootian, 2015), to mention but a few, more research in early metaphor comprehension is required to capture the extent of children's early metaphor abilities and their readiness to engage with their primary education.

While metaphors are frequent in everyday communication (Steen et al., 2010), studies in child metaphor comprehension have focused only on some metaphor types, and thus their findings should not be assumed to apply to all metaphors (e.g., Di Paola et al., 2019; Özçalişkan, 2005; Pouscoulous & Tomasello, 2019; Siqueira & Gibbs, 2007; Stites & Özçalişkan, 2012; Van Herwegen et al., 2013). Our study is the first to contrast both conventional conceptual (e.g., For *next* weekend) and perceptual metaphors (e.g., They're real *angels*), as well as their novel counterparts to bring together different theoretical accounts and work towards a more cohesive metaphor theory. Our article highlights several differences in their acquisition and discusses implications of these findings for classroom practice.

Our article is also the first to focus on children acquiring metaphors in Arabic, a Semitic language from the Afroasiatic family, thus complementing the current state of knowledge about early metaphor comprehension with data from a lesser studied linguistic environment. Arabic countries present a classic example of di- or even triglossia (Ferguson, 1959). Classical Arabic is the language of the Quran and old literary texts; Modern Standard Arabic is used primarily in formal settings such as education, media, and official documents; meanwhile, in everyday lives, Arabic-speakers from northern Africa, the middle East, and the diaspora dispersed across the globe use a number of mutually intelligible or unintelligible dialects descending from Classical Arabic (Al-Jahdali, 2011). These dialects are classified into six groups which share some geographical influences: Maghrebi Arabic (used in western Islamic Africa), Egyptian Arabic (used primarily in Egypt), Sudanese Arabic (used primarily in Sudan), Mesopotamian Arabic (used in Iraq, Iran, Turkey, Syria, and Kuwait), Levantine Arabic (used across the Levant, Syria, Jordan, Palestine, Israel, and parts of Turkey) and Peninsular Arabic (used across the Arabian peninsula). Each of these groups accommodates a number of distinct local varieties.

Studies have looked at Arabic metaphors in religious texts (e.g., Shokr, 2006) and in second language acquisition (Al Jumah, 2007; Zibin, 2016), but most have prioritised Classical Arabic, because it is viewed as more worthy of study than the local dialects (Albirini, 2016). We argue to the contrary; as local dialects are what children hear in

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everyday lives, they can tell us more about how children's language is acquired in the early years. With this in mind, this study recruited children from the areas of Saudi Arabia where the Hijazi dialect of Peninsular Arabic is spoken, specifically from the cities of Jeddah, Makkah, Madina, and Taif. Hijazi Arabic is the first language of the first author of our article.

Current theoretical accounts

Studies in metaphor comprehension in children are fairly sparse, but there is vast literature on the topic of metaphor processing in adult language users (e.g., Gentner, 1988; Gentner et al., 2001; Gentner & Markman, 1997; Gibbs, 2006; Gibbs & Colston, 2012; Giora, 1997; Glucksberg, 2001). Our study considers data from children's metaphor comprehension in light of these accounts.

Broadly speaking, there are two basic theoretical approaches to metaphor interpretation. The differences between these two lie in the type of metaphoric language scholars attempt to account for and the theoretical motivations for these metaphors. The first approach treats metaphor as a form of linguistic expression in communication; it comprises work in psychology and cognitive pragmatics and includes categorization models such as the Class-Inclusion Model (e.g., Glucksberg, 2001) and Relevance Theory (e.g., Wilson & Sperber, 2012), comparison models such as the structure-mapping theory (e.g., Gentner & Markman, 1997), and salience-based models such as the graded salience hypothesis (e.g., Giora, 1997). The other theoretical framework is related to work in cognitive linguistics, where metaphor is not considered a linguistic phenomenon per se; rather, models within cognitive linguistics assume that metaphorical meaning goes beyond linguistic expressions and reflects the metaphorical structure of our conceptual system. This approach includes Conceptual Metaphor Theory (e.g., Grady, 1997; Lakoff & Johnson, 2008) and research on embodiment and cognition (e.g., Gibbs, 2013).

One debate central to metaphor research is how metaphors differ from each other, which in turn invites the question of how they differ in terms of processing. Some metaphors, such as nominal A-to-B metaphors, seem to be rooted in a similarity between two entities where the target concept is understood by invoking the qualities of the source concept. Such similarities can be either physical (e.g., This dancer is a *butterfly*), or relational (e.g., Your child is such an *angel*) as the target concepts of a graceful dancer, or a kind and selfless child, are processed by invoking the qualities of a graceful insect, or a supernatural being. While we recognise that relational metaphors may be more difficult to learn than their physical counterparts (e.g., Lecce et al., 2019), we combine these two categories together, capitalising on the observation of one aspect they have in common: each of them reflects a unique mapping, which is not used in any other linguistic expression. Proponents of the Structure Mapping Theory (SMT) argue that the processing of such A-to-B metaphors depends on establishing a structural alignment between two single notions (e.g., *child* versus *angel*) and projecting inferences (e.g., Gentner et al., 2001; Gentner & Markman, 1997). The processing of perceptual metaphors is guided by analogical inference: facts are not imported randomly from source to target; they are made complete by the common system of relations (Clement & Gentner, 1991).

Grady (2005) points out, however, that not all metaphors are likely to be processed in this manner as the vast majority of them link whole conceptual domains rather than single notions. In light of Conceptual Metaphor Theory (CMT; Lakoff & Johnson, 2008), he argues for a universal grounding of metaphoric speech. Since metaphors such as *warm person* are used across cultures, they must have their origins in basic human experiences: we all feel warm when our emotions are aroused as we are intimately close to other people.

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Under this account, it is proposed that linguistic metaphors (e.g., a *cold* look, a *warm* welcome) are linked to more abstract conceptual representations, often referred to as mappings or schemas (e.g., AFFECTION IS WARMTH). In processing a conceptual metaphor, an abstract concept encountered in speech is explored by activating the whole underlying schema and its network. Conceptual metaphors take many different guises, but in this article only primary conceptual metaphors will be discussed; as they are the most basic of all metaphor types, they are the ones most likely to be available to young children (Grady, 2005).

Another key debate in metaphor research focuses on whether metaphors are a matter of thought (e.g., Grady, 1999; Lakoff & Johnson, 2008), or linguistic products of past cognitive processes merely retrieved from memory (e.g., Glucksberg, 2003; Wilson & Carston, 2006). This seems to depend on metaphor conventionality, whether the listener comes across a metaphor which is novel and previously unknown to them, or conventional, and so familiar and common in their linguistic community. Proponents of SMT argue that each instance of novel perceptual metaphor is processed as a structural alignment between the source and target, but as repeated comparisons are made, the metaphorical meaning gradually comes to be associated with the base term. Thus, the comprehension of novel perceptual metaphors requires an impromptu comparison (i.e., online thought), while the comprehension of conventional perceptual metaphors relies on accessing and retrieving a lexically stored product of past comparisons (i.e., words) (e.g., Gentner et al., 2001), which would explain why processing conventional metaphors is faster than that of novel ones (Bowdle & Gentner, 2005). On the other hand, proponents of CMT tend to see each and every encounter with a primary metaphor, whether novel or conventional, as an activation of primary schemas which have emerged prior to language use (e.g., Mandler, 1999). However, there are also some who argue that ALL conventional metaphors encountered before, including primary metaphors, are understood in the same manner as any other lexicalised expressions (e.g., Keysar et al., 2000). Our study generates empirical data to bridge a gap between these two theoretical accounts and to compare these metaphor types (i.e., perceptual versus primary) and degrees of conventionality (i.e., conventional versus novel) in light of the current theories to contribute to a more comprehensive account of metaphor acquisition.

Metaphor comprehension in children

The developmental perspective offers a new testing ground for the current metaphor theories. As these theories emerged from research in adult language, testing them on child data can verify their contrasting claims about what enables metaphor use.

Earlier research in perceptual metaphor focused on comparing the ability to understand metaphors based on relational and physical similarities: to show that they understood the metaphor, children were expected to explain its metaphorical meaning (e.g., Gentner & Stuart, 1984; Winner, 1997; Winner et al., 1976). Using this methodology, Winner et al. (1976) demonstrated, for example, that children aged five or six can understand and interpret some conventional perceptual metaphors based on physical attributes (e.g., Sarah is a *giraffe*, i.e., very tall), but not those based around relational properties (e.g., Sarah is an *angel*, i.e., kind, and loving) with relational metaphors often inviting 'primitive-metaphoric' interpretations even among eight-year-olds, and genuine metaphorical interpretations only emerging beyond the age of ten. This pattern was also replicated in more recent work using a similar methodology (Dryll, 2009).

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However, overall, more recent work has taken a stricter view of what constitutes a perceptual metaphor in everyday communication, seeing conventional metaphors on a par with any other lexical items, and restricting the term of METAPHOR to expressions which are the result of pragmatic processes involving an ad hoc construction of novel meaning in a given situation (e.g., Glucksberg, 2001; Wilson & Sperber, 2012). At the same time, metaphor comprehension studies have exchanged verbal interpretation tasks for non-verbal tasks with fewer cognitive demands, such as handing objects (Pouscoulous & Tomasello, 2019), pointing at pictures (Deamer, 2013) and moving pictures (e.g., Di Paola et al., 2019). This line of work has captured the ability to comprehend some novel perceptual metaphors in children as young as three and show that it improves alongside the growing abilities of analogical perception (Di Paola et al., 2019; Pouscoulous & Tomasello, 2019) and alternative naming (Di Paola et al., 2019). While the use of binary object selection tasks in the study of Pouscoulous and Tomasello (2019) may not constitute sufficiently robust evidence for children's metaphoric abilities, the methods used by Deamer (2013) and Di Paola et al. (2019) are already more rigorous, as the selection is three way, with an additional distractor introduced to minimize bias and to reduce the possibility that a child might select the correct picture by chance (also Olofson et al., 2014).

Research in conceptual metaphor acquisition has remained largely understudied, with only a handful of exceptions. In theory, early childhood experiences featuring concrete entities (e.g., the sensation of warmth) and abstract notions (e.g., affection) result in children acquiring non-linguistic primary scenes (i.e., phenomenological experiences of basic events) (Grady, 2005). Repeated exposure to primary scenes compels the child to automatically activate concrete concepts (the sensation of warmth) when experiencing abstract notions (one's affection). Recurring exposure to such scenes leads to the emergence of primary metaphor schemas (e.g., AFFECTION IS WARMTH), which co-exist within a larger network of similar mappings.

Özçalişkan (2005) focused her research on a subset of primary metaphors structured by the source domain of motion in space. She examined the comprehension of conventional and novel primary metaphors in Turkish-speaking children aged three, four, and five, including the conventional category which contained high frequency words (e.g., time *flies*, hours *pass*) and the novel category which included lower frequency words (e.g., time *drips*, days *crawl*). Her overall data revealed a three-stage developmental pattern, where a) three-year-olds performed at chance, b) four-year-olds showed good comprehension in contextually supported situations, and c) five-year-olds showed an onset of a verbal reasoning ability about metaphorical mappings. Stites and Özçalişkan (2012) showed a similar developmental pattern to be true for metaphors of moving-time (e.g., His trip to the zoo is *coming up*), moving-ego (e.g., He has a *long way to go until* his party), and sequence-as-position (e.g., Carol says that ice cream *follows* lunch), albeit with a delay of one year in achieving each milestone. These two studies, however, only focus on a small subset of primary metaphors. Child metaphor production data identified in naturalistic interactions with her primary caregivers between the ages of two and three reveal that the child had a broad inventory of conventional primary metaphors in active use: primary metaphors accounted for 80% of all her metaphoric expressions, with perceptual metaphors used very rarely (3%) (Gaskins et al., 2023). This gives us reasons to believe that if a broader range of primary metaphors is included in this study, our project can capture an earlier onset of their acquisition.

Under CMT, it has also been claimed that once the child has developed an underlying mapping (e.g., TIME IS SPACE) and encountered their first corresponding linguistic

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expression (e.g., *between* three and four o'clock), they should automatically be able to understand all types of linguistic expressions associated with the same schema (e.g., *after* three o'clock, *before* four) (Grady, 2005). In support of this view, Özçalişkan (2005) and Stites and Özçalişkan (2012) demonstrate that children can understand conventional and novel primary metaphors equally well regardless of age. This, in turn, either weakens the stance that conventional primary metaphors are lexicalised and therefore very different from their novel counterparts or shows that in early acquisition all metaphors are novel as they are all instances of meanings children have not previously encountered.

Our research question and predictions

Based on these previous studies and our own predictions, we ask one question in our study: Does Arabic-speaking children's metaphor comprehension vary by their chronological age (3;01-6;07), metaphor type (primary, perceptual) and metaphor conventionality (conventional, novel)? Children's comprehension of metaphors has been previously tested in children as young as three, but previous studies focused either on perceptual (Di Paola et al., 2019; Pouscoulous & Tomasello, 2019) or primary conceptual metaphors (e.g., Özçalişkan, 2005). In addition, work in perceptual metaphors has been only concerned with their novel uses. Ours is thus the first study to compare both conventional and novel primary and perceptual metaphors, and the first one to do this in Arabic.

In line with previous studies (e.g., Di Paola et al., 2019), first and foremost, we expect that children's metaphor comprehension will improve as they get older and develop better non-verbal and verbal abilities. Second, due to the theorised differences between primary and perceptual metaphors (e.g., Grady, 2005), we expect young children to display a consistently better comprehension of primary than perceptual metaphors. Each perceptual metaphor contains a unique conceptual mapping between the source and the target domain (e.g., *You're my treasure*, i.e., you are dear to me, or *You're my sunshine*, i.e., you brighten up my day). Therefore, in theory, understanding each newly encountered perceptual metaphor should entail acquiring a completely new conceptual mapping, and proceed fairly slowly in development. This stands in contrast with primary metaphors, where a wide range of linguistic expressions are often associated with one conceptual schema (e.g., *After* three, *before* four, *next* week, i.e., TIME IS SPACE). In theory, as long as a link has been made between at least one linguistic expression and the given schema, understanding any new subsequent primary metaphor should be supported by activating a given conceptual domain rather than acquiring a new mapping.

Third, there is a growing consensus that when encountered in conversation, both types of conventionalised metaphors are merely retrieved from memory in comprehension, although this may or may not apply to primary metaphors (see Mandler, 1999 versus Keysar et al., 2000). Nevertheless, if perceptual and primary metaphors are taken together, conventional metaphors should be understood consistently better than their novel counterparts.

Fourth, the comprehension of conventional perceptual metaphors should significantly exceed that of their novel counterparts: with each opportunity to deconstruct a conventional perceptual metaphor, a child should enhance their skills of making any type of linguistic analogies and become better at processing those which have not been previously encountered. Meanwhile, the difference in children's comprehension of primary conventional and novel metaphors should be insignificant because once the first linguistic expression has been linked to the underlying schema, any instances of linguistic primary metaphor should be understood with ease, regardless of whether they are conventional or novel.

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Methods

Participants

Recruitment commenced upon the receipt of ethical approval from King's College London Research Ethics Committee (REP(EM)/13/14-11). Initially, 95 children from one preschool and one primary school in Jeddah, Saudi Arabia, were recruited to participate in the study. The inclusion criteria required that they: a) have no history of language disorders or vision or hearing problems; b) are monolingual speakers of Hijazi Arabic; c) display typical cognitive and linguistic development; and d) are able to demonstrate a sustained interest in our materials.

The first two criteria were checked by the schools using school files, which included parental forms with data on children's general development. Two bilingual children were excluded on the understanding that bilingualism may affect overall cognitive abilities (Carlson & Meltzoff, 2008). One other child was also excluded as their parents were deaf and thus, the child seemed to present a case of atypical linguistic exposure. The last two criteria were checked through tests. To examine whether the participants would be able to sit through, and focus on, a fairly long story comprehension task, a warm-up task of a comparable length and complexity was administered prior to the metaphor story comprehension task (see e.g., Deamer, 2013; Olofson et al., 2014; Stites & Özçalişkan, 2012; Van Herwegen et al., 2013). The warm-up task did not include any metaphors so as not to provide training prior to testing. In the trial, children listened to five short stories that followed exactly the same structure and length as the experimental items in the metaphor story comprehension task and they were asked five questions about the specific detail. Based on this, one three-year-old was excluded as they did not answer the required minimum of four out of five questions. To ensure children were typical in terms of their cognitive development, they were tested on age-appropriate non-verbal reasoning using Raven's Coloured Progressive Matrices (RCPM) and four participants were excluded because they did not answer correctly on the first five of the 36 test items. All the other children's scores fell within the normal IQ range for their age. Our final sample contained 87 children aged 3;1 to 6;7, with comparable numbers of children recruited per age group, ensuring an even distribution of data (Table 1).

As there are no standardised tests in Hijazi Arabic to measure children's lexical abilities against normative data (see BPVS: Dunn et al., 1997 for English), one of the participating schools made available a test widely used by local schools for pupil admittance applications, which was used to test children's lexical acquisition. The raw scores were plotted against the children's chronological age in order to check whether there is a linear development (Figure 1). There was an increase in performance with increasing chronological age, as expected of a typically developing population ($R^2 = .751$).

A control group of 19 participants aged 18–35 were also recruited to validate the metaphor comprehension task. They were all undergraduate and postgraduate students at a university in Jeddah, Saudi Arabia, and they were all native speakers of the Hijazi dialect of Arabic.

Metaphors tested in the study

Twenty metaphors were used in the study: five conventional and five novel primary metaphors (see Table 2) and five conventional and five novel perceptual metaphors (see Table 3). While in several previous studies that focused exclusively on novel metaphors (Di Paola et al., 2019; Pouscoulous & Tomasello, 2019) a metaphor was

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Table 1. Children's characteristics and their scores in RCPM and lexical task

Age	Gender	Statistics	Age in months	RCPM (raw scores)	Receptive vocabulary (raw scores)
Three-year-olds (N=21)	12 females; 9 males	Mean	40.81	15.00	43.33
		SD	2.62	1.67	7.01
		Min	37	12	33
		Max	45	18	59
Four-year-olds (N=23)	12 females; 11 males	Mean	52.65	17.00	60.30
		SD	3.59	1.82	12.16
		Min	47	14	41
		Max	59	20	97
Five-year-olds (N=22)	9 females; 13 males	Mean	64.09	19.00	95.64
		SD	3.04	3.22	17.05
		Min	60	14	50
		Max	70	24	118
Six-year-olds (N=21)	15 females; 6 males	Mean	74.57	21.33	104.62
		SD	2.20	2.22	12.11
		Min	71	18	77
		Max	79	25	127

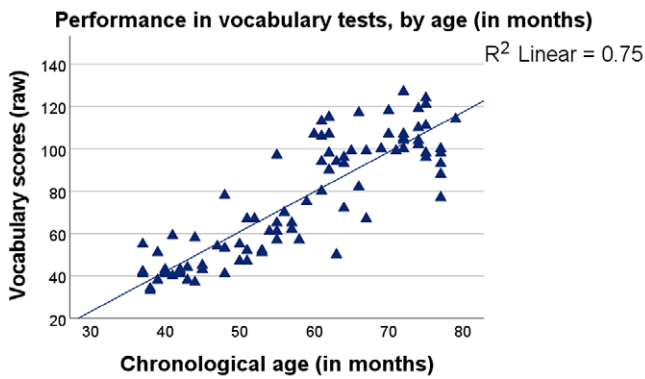

Figure 1. Children's receptive vocabulary scores, by chronological age.

considered novel if it contained a novel mapping between two familiar objects (e.g., *The carrot with the hair*), our study followed the procedure adopted by Özçalişkan (2005) where the key word (e.g., The time of sleep has *come*) was replaced with another from the same grammatical category, which is not typically associated with the given construction (e.g., the verb *arrived* in Arabic). The primary metaphors were built around the schemas of PURPOSES ARE DESTINATIONS, AFFECTION IS WARMTH, BAD IS DOWN,

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Table 2. Primary metaphors included in the experiment (novel words in bold)

Conventional expression	Familiarity rating mean	Novel expression	Familiarity rating mean	Aptness rating mean	Meaning in English
Walking in the right direction أنا ماشي على الطريق الصح	5.321	***Running*** *in the right direction* أنا أجري على الطريق الصح	3.528	4.790	To be on the right track
Greet someone with heat سلمت علي بحرارة	5.811	*Greet someone with* ***warmth*** سلامه مرة دافي	2.717	4.770	To greet someone with love
Fall from one's eyes طاح من عيني	6.540	*Fall from one's* ***head*** طاح من فوق رأسي	1.980	5.400	To lose respect for someone
The time of sleep has come قرب وقت النوم	6.630	*The time of sleep has* ***arrived*** وصل وقت النوم	2.220	6.250	It is time to sleep
I cannot believe my eyes ما أصدق عيوني	6.283	*I cannot* ***trust*** *my eyes* ماني واثقة في عيوني	3.472	4.100	Said in disbelief

Table 3. Perceptual metaphors included in the experiment

Conventional expression	Familiarity rating mean	Novel expression	Familiarity rating mean	Aptness rating mean	Meaning in English
X is a chick النونو مرة كتكوت	5.566	*X is a* ***bird*** النونو مرة عصفور	2.960	4.070	Said when X is very cute
X must have swallowed a radio الدكتور شكله بالع راديو	5.830	*X must have swallowed a* ***mobile*** يوه المذيعة بالعة جوال	1.790	5.080	Said when X talks too much
X is honey ياسر أنت عسل	6.610	*X is* ***sweets*** جنى أنت حلاوة	1.790	4.980	Said when X is pleasant
X's head is a rock أنت رأسك حجر يا أحمد	5.415	*X's head is* ***cement*** أنت رأسك اسمنت يا	2.792	4.600	Said when X is stubborn
X is a moon أنت قمر	6.302	*X is a* ***lamp*** أنت لمبة	2.470	4.290	X is beautiful with a glow

TIME IS MOTION and SEEING IS BELIEVING (Grady, 2005). The perceptual metaphors were all A-to-B nominal metaphors built around the notion of physical similarity (*moon, chick, radio*), or relational similarity (*honey, rock*) (Winner, 1997).

To select the appropriate metaphors, a larger set of expressions was rated for familiarity and aptness on a seven-point Likert scale by 99 native speakers of Hijazi Arabic aged 18-35. The familiarity test listed 102 conventional metaphors, both primary and perceptual, drawn from the existing literature (Grady, 1997; Winner, 1997) and their novel counterparts, created by substituting one word in the conventional metaphor with a related but novel word. The metaphors selected as the most novel were subsequently submitted to an aptness test: 90 native speakers of Hijazi Arabic aged 18-35 were asked whether they were plausible.

We ensured that each conventional metaphor rated as very familiar was paired up with its novel counterpart rated as both very unfamiliar and highly apt. A one-way ANOVA revealed that in the final set of 20 metaphors (Tables 2-3), there was a significant difference between all conventional and novel metaphors ($F_{(1,\ 19)} = 181.046,\ p < .001$). No significant difference was found between conventional primary and conventional perceptual metaphors ($F_{(1,\ 9)} = .448\ p = .522,\ \eta p2 = .154$), or between novel primary and novel perceptual metaphors ($F_{(1,\ 9)} = 2.390\ p = .161,\ \eta p2 = .615$). However, the effect of metaphor type on aptness had a borderline p value ($F_{(1,\ 9)} = 4.521,\ p = .066,\ \eta p2 = 2.256$), which we will return to in the discussion as it may have impacted the results.

Metaphor comprehension task

Experimental tasks used in other comprehension studies included multiple-choice (e.g., Winner et al., 1976), enactment (e.g., Vosniadou et al., 1984), matching (e.g., Di Paola et al., 2019), elicited production (e.g., Gottfried, 1997), story comprehension (e.g., Özçalişkan, 2005; Van Herwegen et al., 2013), justification (e.g., Özçalişkan, 2005), pointing at pictures (e.g., Rubio-Fernandez & Grassmann, 2016), and handing over the named objects (e.g., Pouscoulous & Tomasello, 2019). As we wanted to use a highly controlled task with few cognitive demands to enable working with very young children, we opted for simple story comprehension and pointing at pictures (e.g., Olofson et al., 2014).

The metaphors were embedded in short stories, all narrated by a female speaker of Hijazi Arabic, and piloted on two adults and four children (a three-, four-, five-, and six-year-old) to validate the wording of the instructions. All stages of the narration were accompanied by hand-drawn, black-and-white pictures depicting the actions of the story, starting with a picture that illustrated the story (Figure 2A), and a picture which contained the metaphor (Figure 2B). The instructions that followed reflected the procedure used by Deamer (2013): the children were shown three pictures, which depicted: a) a literal object (Figure 2C); b) a situation which captured the metaphorical meaning (Figure 2D); and c) a distractor representing an unrelated but plausible meaning (Figure 2E). The literal objects chosen for our study were the kind of objects that are associated with the key metaphorical terms. For example, sometimes when talking about the time, we point at a watch. To understand that we are not referring to a watch but the actual recording of the time, children have to move beyond thinking about the concrete watch to the abstract thinking about time. The distractor was used to minimize bias and the possibility that a child might choose the correct picture by chance (Deamer, 2013; Olofson et al., 2014).

The order of the stories was further randomized so that conventional and novel stories of the same metaphorical expression did not occur together in the same session and so that no

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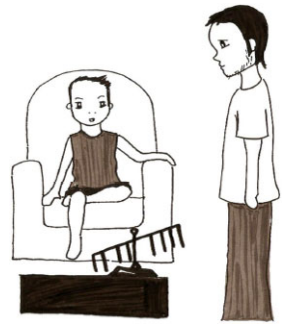

Figure 2A. Yazen is watching TV. His dad wants him to sleep.

Figure 2B. His dad says, "Yazen, turn off the TV and put on your PJs. *Time of sleep has arrived."*

Figure 2C. A literal picture.

more than two stories of the same type (primary, perceptual) followed in a row. For each experimental session in which the participants listened to the stories, half of the participants were presented with the stories in a reverse order so as to limit a potential order effect.

Testing procedure

Children participated in three half-hour sessions, which took place in a quiet part of the school library. In the first session, children did a warm-up task, and were tested on the

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Figure 2D. A metaphorical picture.

Figure 2E. A distractor.

background measures, including RCPM and the lexical comprehension task. In the second session, children were tested on the first set of stories, and in the third on the second set of stories. There was a period of two to three weeks between sessions two and three to rule out the possibility that the understanding of conventional metaphors may facilitate that of novel metaphors.

During the testing, the pictures were shown to children on a computer screen and the story was played from the recording. After hearing each story and the metaphor embedded in it, children were asked to point at one of three pictures which best illustrated the metaphor. For responses on the comprehension task, participants received a score of "1" (correct) if they pointed at the expected picture, or "0" (incorrect) if they did not respond, of if they pointed at one of the other two pictures.

Analyses

All the participants in the adult control group showed a performance rate of 100% on the metaphor stories, which meant that the materials were well-designed, and the task was fit for purpose.

To address our question, children's data were analysed through a mixed ANCOVA, with two within-subject repeated measure variables of metaphor type (primary vs. perceptual) and conventionality (conventional vs. novel), and with chronological age (in months) as a co-variate. One-way ANOVAs with Bonferroni corrections, and Pearson's correlation, bootstrapped for 95% CI, were also used for complementary analyses. All statistical tests were two-tailed, and significance was set at .05.

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Results

A Pearson correlation coefficient confirmed that children's chronological age (in months) is highly correlated with their non-verbal IQ ($r = .751$, $p < .001$), and their verbal skills ($r = .866$, $p < .001$). As a result, only chronological age (in months) was used in the mixed ANCOVA. As predicted, the mixed ANCOVA revealed a significant main effect of chronological age (in months) on metaphor comprehension, $F_{(1,,85)} = 29.252$; $p < .001$, $\eta p2 = 88.006$ (Figure 3), which indicates that children's performance improved with increasing age.

Likewise, as predicted, the mixed ANCOVA revealed a near significant main effect of metaphor type on metaphor comprehension, $F_{(1,\ 85)} = 3.523$, $p = .064$, $\eta p2 = 3.309$, showing that children had a somewhat better understanding of all primary than perceptual metaphors (Figure 4A), and a significant main effect of metaphor conventionality on metaphor comprehension, $F_{(1,\ 85)} = 6.322$, $p = .014$, $\eta p2 = 3.627$, showing that children had a much better understanding of all conventional than novel metaphors (Figure 4B). Although the main effect of metaphor type did not reach the canonical level of .05, we nonetheless decided to include metaphor type in further interactions. However, caution must be exercised when interpreting these results.

The mixed ANCOVA then moved on to testing two-way interactions. In line with our predictions, no significant interaction was captured between metaphor type (primary, perceptual) and chronological age, $F_{(1,\ 85)} = 1.484$, $p = .227$, $\eta p2 = 1.394$, or between conventionality (conventional, novel) and chronological age, $F_{(1.\ 85)} = .238$, $p = .627$, $\eta p2 = .136$. This shows that children had a better understanding of all primary than perceptual metaphors, and a better understanding of all conventional than novel metaphors throughout the data sampling period and regardless of age.

However, a significant two-way interaction was found between metaphor type and metaphor conventionality, $F_{(1.\ 85)} = 4.589$, $p = .035$, $\eta p2 = 2.426$, suggesting a greater difference between conventional and novel metaphors in one of the two metaphor types (primary, perceptual). As no significant interaction was found between metaphor type, metaphor conventionality, and chronological age (in months), $F_{(1.85)} = .538$, $p = .465$, $\eta p2 = .284$, the trend seemed to hold throughout the data sampling period and regardless of age. This in turn warranted further analyses.

A series of univariate ANOVAs with Bonferroni corrections were used to determine whether the difference in children's comprehension of primary versus perceptual

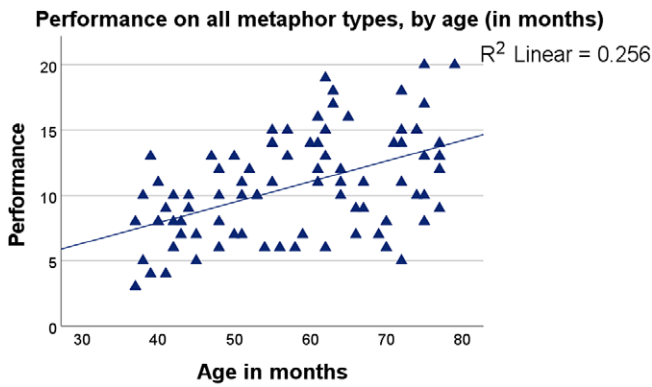

Figure 3. Performance on all metaphor types, by age.

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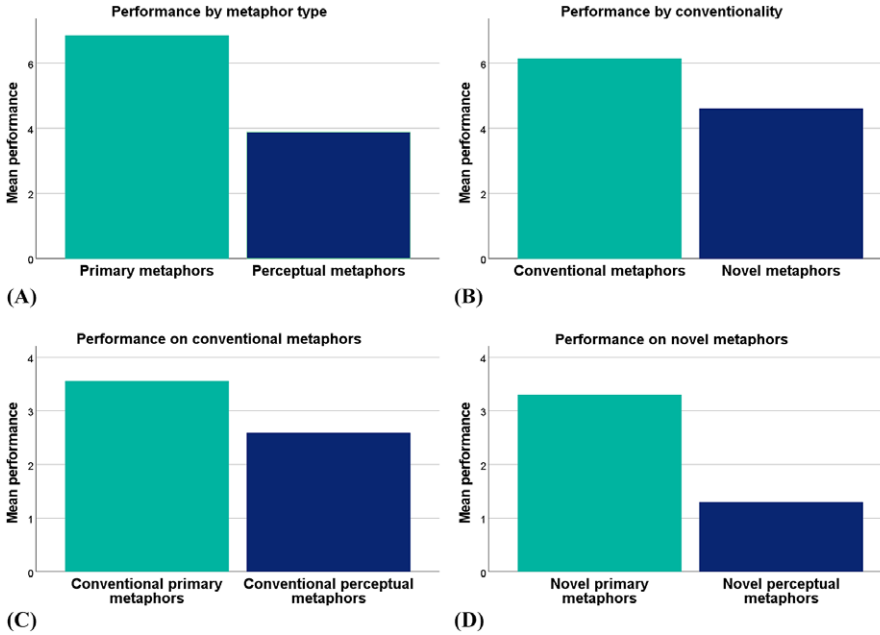

Figure 4. Metaphor comprehension by metaphor type (left), Figure 4B: Metaphor comprehension by metaphor conventionality (right), Figure 4C: Conventional metaphor comprehension by metaphor type (left), and Figure 4D: Novel metaphor comprehension by metaphor type (right).

metaphors was apparent for both conventional, and novel metaphors. In line with our predictions, they confirmed that across the cohort, the comprehension of conventional primary metaphors was significantly better than that of conventional perceptual metaphors, $F_{(5,86)} = 8.071$, $p < .001$, $\eta p2 = 29.103$ (Figure 4C), and the comprehension of novel primary metaphors was significantly better than that of novel perceptual metaphors, $F_{(5,86)} = 7.164$, $p < .001$, $\eta p2 = 5.901$, with the latter consistently the lowest (Figure 4D).

Likewise, univariate ANOVAs with Bonferroni corrections were used to evaluate the extent of difference in children's comprehension of conventional versus novel metaphors of both types (primary, perceptual). The difference in children's comprehension of conventional perceptual and novel perceptual metaphors was statistically significant, $F_{(5,86)} = 8.838$, $p < .001$, $\eta p2 = 11.655$, which was in line with our predictions. However, the statistically significant difference in children's comprehension of conventional primary and novel primary metaphors, $F_{(4,86)} = 27.517$, $p < .001$, $\eta p2 = 12.538$, contradicted the predictions of our study.

Discussion

This study examined the comprehension of conventional and novel primary metaphors, and that of conventional and novel perceptual metaphors in Hijazi Arabic-speaking children aged 3;01 to 6;07. In our study, primary metaphors were seen as manifestations of the metaphorical structure of our conceptual system rather than a linguistic phenomenon per se (e.g., Lakoff & Johnson, 2008), while perceptual metaphors are seen as a form of

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linguistic expression (e.g., Gentner et al., 2001); conventional metaphors were viewed as those very familiar to the speech community, and novel metaphors as both highly unfamiliar and highly apt.

First, we found a significant effect of chronological age (in months) on children's metaphor comprehension. This is in stark contrast to earlier views that genuine metaphorical interpretations become available to children only around the age of ten (Dryll, 2009; Gentner & Stuart, 1984; Winner, 1997; Winner et al., 1976). It also adds to the growing body of evidence that if tested through tasks which are cognitively less demanding, and which do not involve an element of verbal explanation, children's metaphor comprehension skills can be captured as early as after their third birthday (e.g., Di Paola et al., 2019; Pouscoulous & Tomasello, 2019). Capturing early metaphor comprehension creates implications for classroom practice: metaphors could be used to support the teaching of science and maths which are often seen as abstract and complex, and therefore difficult to get into (Kellner & Attrops, 2015) to maximise pupils' engagement with education.

Second, we demonstrated that children's comprehension of conventional metaphors, both primary and perceptual, was better than that of novel metaphors of both types. This fits with the findings that adults process conventional metaphors faster than novel ones (Arzouan et al., 2007; Gibbs & Colston, 2012). For example, Arzouan et al. (2007) report that although novel metaphors and conventional metaphors appear to be accessed initially in a similar manner, brain imaging data indicate that adults process novel expressions with more difficulty than conventional metaphors. It is possible that novel primary metaphorical expressions are easier to comprehend than their perceptual counterparts as they are not genuinely novel; instead, they are creative modifications of well-established primary metaphors. Thibodeau and Durgin (2008) argue that such well-established metaphors continue to activate mappings that can be extended to the comprehension of novel metaphorical counterparts. If we take the Arabic novel primary metaphor *The time of sleep has arrived*, we can expect that the children had already drawn a conceptual connection between the domains of TIME and MOTION, respectively, and that their understanding of the moving time was not novel; the only novel element was the linguistic expression derived from the well-established primary metaphor. To understand this novel linguistic expression, the children would need to liken it to established time-related senses. By contrast, novel perceptual metaphors are not derived from the same mapping as their pre-existing conventional counterparts; they represent completely new one-shot mappings between the source and the target (Gibbs & Colston, 2012). For example, the mapping in the conventional metaphor *She is the moon (i.e.*, beautiful with a bright face) is not the same as the one in the novel metaphor *She is a lamp*, although the intended meaning is the same or very similar for both. While the former could be simply retrieved from the lexicon because of conventionality, a child would need to construct the meaning of the latter from a one-shot connection between the word *lamp* and someone's bright face. As the mapping of the latter is novel, it is not retrievable, and thus it is more difficult for a child to arrive at the meaning of the novel expression (Wilson & Carston, 2006).

Third, we demonstrated that Arabic-speaking children have a somewhat better understanding of primary than perceptual metaphors. Although the difference in the comprehension of the two metaphor types did not reach significance, there seemed to be a trend: the comprehension of conventional primary metaphors was significantly higher than that of conventional perceptual metaphors and that the comprehension of novel primary metaphors was significantly higher than that of novel perceptual metaphors. There are at least two reasons for this observed trend. One explanation for it is that

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understanding a perceptual metaphor requires utilizing fairly advanced cognitive and linguistic abilities to transfer the salient properties from the source to the target. Perceptual metaphor understanding becomes even more challenging when this similarity is based on relational non-physical similarities (Winner et al., 1976), which were part of our task design. When the child encounters Arabic metaphors such as *X is a sweet*, they are expected to align the concept of a person and a sweet treat and to understand that the similarities between one and the other are to be explored on the level of non-physical properties (*X is a pleasant person*). As Gentner (1988) argues, it is only around the age of six that children's cognition undergoes a relational shift, moving away from understanding only mappings that rely on physical similarities to also understanding those that are dependent upon abstract relational attributes. This developmental change is partly due to the increased domain knowledge in which the conceptual knowledge is restructured to include abstract and complex functional information (Castillo, 1998). Gentner (2005) argues that with growing domain knowledge, children's relational representations grow richer and deeper and thus children can start to perceive and interpret purely relational matches (Gentner, 2005, p. 254). As the children in our sample are aged three to six, this developmental shift may not yet have taken place, which is why they scored somewhat worse on perceptual than primary metaphor comprehension.

Another explanation for the difference between primary and perceptual metaphors is that the primary metaphors included in our study were sometimes encoded in verbs (e.g., *walking, fall, come*), while the conventional perceptual metaphors were always encoded in nouns (*chick, radio, honey, stone, moon*). As verbs have higher token frequencies than nouns (Goodman et al., 2008), the individual instances of primary metaphors are likely to be recycled in child directed speech more frequently than those of perceptual metaphors. Also, if primary metaphors are more frequent than perceptual metaphors, it is more likely that they have become more conventionalised. However, it is difficult to determine how conventionalised a metaphor has become and whether the figurative meaning has been established in the mental lexicon (e.g., Van Herwegen et al., 2013). To make any claims of conventionality, one would need to analyse interactions between children and their parents and determine the frequencies of different metaphor types. In constructing metaphor elicitation tasks, future studies should then choose items of similar frequencies across metaphor types.

Third, we found that the difference between conventional metaphors of each type (primary, perceptual) was statistically significant not only for perceptual but also for primary metaphors. This finding is inconsistent with other studies of primary metaphor comprehension that show no significant difference in children's comprehension of conventional versus novel primary metaphors (e.g., Olofson et al., 2014; Stites & Özçalişkan, 2012). At first glance, this seems to challenge the view that conventional primary metaphors activate mappings extended to the comprehension of novel metaphorical counterparts (Thibodeau & Durgin, 2008). However, we argue that this difference may have been caused by the fact that for very young children, like the ones tested in our study, all conventional metaphors, be they perceptual or primary, are to an extent like novel metaphors if they had not been encountered previously in speech. Regardless of their level of conventionality to an adult speaker, each instance of metaphor use encountered by a child, whether conventional or novel, calls for a certain level of deconstruction. Overall, children performed the worst on novel perceptual metaphors which was in line with our expectation: as children had never encountered the novel perceptual metaphors, they would have needed to construct the meaning online, without any access to pre-existing mappings, and this requires more sophisticated analogical reasoning abilities (Gentner,

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2005; Winner, 1997). Another reason why novel perceptual metaphors generated somewhat lower performance rates may be related to the aptness ratings. The aptness mean for the novel perceptual metaphors was somewhat lower (3.55) than for the novel primary metaphors (5.11).

Last, we also confirmed that the differences between primary and perceptual metaphors on the one hand, and conventional and novel metaphors on the other, held regardless of age. This was in line with our expectations. Perceptual metaphors, with their unique mappings and the fact that they are encoded in low frequency words, are expected to display a disadvantage in acquisition, and never catch up in development. The same applies to novel perceptual metaphors, which require some level of deconstruction regardless of age, while conventional perceptual metaphors get entrenched through frequent use, and are embedded in dense lexical networks, with each encounter strengthening their entrenchment and facilitating subsequent retrieval (e.g., Gershkoff-Stowe & Hahn, 2007). If the comprehension of novel primary metaphors does rely on the activation of the underlying mappings (Thibodeau & Durgin, 2008), this is not apparent at the young age tested in our study.

Future work should follow several lines of enquiry. There are reasons to believe that children can understand some metaphors even before their third birthday but confirming this would require the use of experimental tasks and procedures appropriate to children's both linguistic and conceptual knowledge. One such procedure may involve using even simpler stories with colour pictures and eye tracking technology to follow the children's gaze (e.g., Falkum, 2022). Research should also employ a wider range of background tests to capture the factors which are most important for the onset of metaphor comprehension. Deamer (2013) attributed lower performance in three-year-old's comprehension to their lack of inhibition control abilities and lack of executive functions, which do not start to develop until children are four. Research also suggests that these mechanisms are necessary to suppress irrelevant and conflicting information during metaphor processing (Carriedo et al., 2016) and well-made materials can control for such potential issues. Apart from background tests that focus on inhibition and executive functions, studies should also consider using standardised lexical tasks, such as BPVS, which means that we need to construct such tests for a much larger number of languages, as well as sensory and cognitive tasks to bridge the gap between the two metaphor types.

Conclusion

Early research into metaphor development (e.g., Winner et al., 1976) may have underrepresented children's metaphorical abilities because the tasks were too difficult for young children, and the metaphoric expressions were not selected in terms of metaphor type, familiarity and aptness. Taken altogether, our results show, however, that children can understand some metaphors at the age of three, which is consistent with the results of more recent studies (e.g., Deamer, 2013; Di Paola et al., 2019; Pouscoulous & Tomasello, 2019; Rubio-Fernandez & Grassmann, 2016). While the focus of previous metaphor processing research has mostly been on children's understanding of novel metaphors (e.g., Deamer, 2013; Di Paola et al., 2019; Pouscoulous & Tomasello, 2019; Rubio-Fernandez & Grassmann, 2016) or on differences in comprehension of novel and conventional metaphors between typically developing children and the atypical population (Mashal & Kasirer, 2011; e.g., Olofson et al., 2014; Van Herwegen et al., 2013), our study is the first to compare typically developing children's comprehension of

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conventional and novel metaphorical expressions and to highlight how and why they are different. Our study is also the first to compare Hijazi Arabic-speaking children's comprehension of two theoretically distinct types of metaphors – namely, primary and perceptual metaphors in light of two contrasting theories, revealing significant differences in the way they are comprehended between the ages of three and six.

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