Emotion Language Acquisition in Young Children

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Abstract

Young children gradually acquire the ability to label emotions with words; yet how children understand and develop emotion language is an under researched area. According to linguistic research, syntactical bootstrapping is a prominent factor in a child’s concept learning. While, research in emotion development suggests that children use physical context to guide the learning of emotion concepts. The present studies built off of this literature to examine the role of both syntax and context in children’s (aged 3-5) ability to understand that a novel word refers to an emotion category. In Study 1, (N=120) children watched videos of puppets presenting a novel ‘alien’ word in one of three syntactical structures (is, feels and feels about). After the video, children completed an image selection task in which they could choose one of three images, either a state of being (e.g., cold), an action (e.g., running) or an emotion (e.g., surprised) to indicate what the alien word meant. In Study 2, (N=113) context was included in conjunction with the different syntactical structures. Children watched 7 videos in which an alien portrayed an emotional scenario. After each video the child completed the same image selection task as in Study 1. Across studies, we found that that emotion images are chosen more consistently with age, syntactic structure, and that physical context increases emotion choices.

Keywords: Emotion, Syntax, Context, Children
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In the course of a day a young child can go from being upset to giggling with joy. These different emotional experiences are a critical part of a healthy development (National Scientific Council on the Developing Child, 2004). However, how children learn and experience emotions is relatively unknown. Thus far, research suggests that emotions emerge slowly throughout the early years of development (Izard & Ackerman, 2000). As children grow older more emotions emerge, starting with joy, sadness, anger, fear and disgust (Ridgeway, 1985). Eventually, children are able to display, experience, and understand emotions the same way an adult does (Izard & Ackerman, 2000). Nonetheless, relatively little is understood about the mechanisms by which children develop the ability to experience adult-like emotions.

A valence based approach to emotion development

One hypothesis regarding the development of emotions suggests that children begin by experiencing emotions in terms of the broad dimensions of valence and arousal (Russell & Ridgeway, 1983; Bullock, & Russell, 1984). Valence is the degree of pleasure-displeasure and arousal refers to felt bodily activation. In combination, valence and arousal make up one’s core affect (Russell, 1983; Russell & Bullock, 1986; Lindquist, 2013), or the basic feeling state that underlies emotions and other affective experiences such as attitudes, judgments and feelings (Barrett & Bliss-Moreau, 2009; Russell, 2003). It is proposed that children only begin to experience emotions more discretely as they learn to categorize their experiences of valence and arousal as specific emotion categories (Widen, 2013). This hypothesis is inspired by a psychological constructionist model of emotion, which proposes that experiences such as “anger,” “disgust,” and “fear” are not innate, but emerge when people categorize their core affective states using concept knowledge about specific emotion categories (Lindquist & Barrett,
2008). It is hypothesized that this ability develops slowly and is dependent on language (Lindquist, MacCormack & Shablack, 2015). According to this view, words for emotions are crucial, as words help children acquire emotion concept knowledge.

Preliminary evidence is consistent with a psychological constructionist hypothesis of emotion development. For instance adults tend to use emotion words in a discrete and specific way to label their emotions; however, both adults and children also understand emotions in terms of the underlying dimensions of valence and arousal (Russell & Ridgeway, 1983). For example, when children (aged 8-12) ranked the similarity between 50 different emotions words, the groups tended to be based on their degree of valence and arousal. This led to a two dimensional model that described the structure of emotion knowledge. The first dimension, valence, describes the degree of pleasantness-unpleasantness present in a facial expression. The second dimension, arousal, refers to how activated one’s bodily state is. Findings were also replicated in a college aged sample (Russell & Ridgeway, 1983) and robustly across the literature more generally (Kuppens et al. 2013).

Children’s ability to understand and differentiate between emotions was further examined by Bullock and Russell (1984) as a means of expanding on the idea that emotion words are conceptually organized by valence and arousal. Children (3-5) were given images of ten different facial emotion expressions that varied in their level of valence and arousal with an accompanying list of fifteen emotion words. The experimenter randomly laid out the ten facial expressions and children selected the three faces which matched one of the emotion words on the list. This was repeated for all fifteen words. Children most accurately picked the angry facial expression when asked which faces represented anger; however, they also often placed other negative or high arousal faces such as sad, disgust and surprised into this category. This pattern of errors suggests
that emotion categories between 3 and 5 years may be “fuzzy” and not entirely fixed. However, children still sorted based on valence (negative faces were sorted with a negative emotion word and positive faces were sorted with a positive emotion word), suggesting that they understand the meaning in terms of valence dimensions (Bullock & Russell, 1984; Widen & Russell, 2008).

Finally, work by Widen has most clearly documented the slow emergence of children’s understanding of emotions as discrete and specific. Widen (2013) has a broad-to-differentiated hypothesis of emotion development, in which she argues that children do not have emotion categories to begin with, but are able to acquire them throughout their development. Widen found that children’s understanding of facial expressions begins with “feels good” or “feels bad.” As children develop and grow, valance-based categories of emotion begin to slowly differentiate into discrete emotions. Widen (2013) observed that this differentiation accompanies children’s acquisition of emotion words.

**Psychological constructionism in emotion development**

The gradual development of emotions, starting with valence and arousal follows a psychological constructionist model of emotions (Lindquist, 2013). A psychological constructionist model of emotion theorizes that emotions are made up of more basic components, such as core affect and conceptual knowledge. As described earlier, the two dimensions of core affect are valence (pleasantness-unpleasantness) and arousal (activation-deactivation) (Lindquist, 2013). According to the psychological constructionist view, core affect is made meaningful as experiences of specific discrete emotions when conceptual knowledge is used to categorize a state of valence and arousal. Conceptual knowledge is the mental “cache” of knowledge that an individual has pertaining to their internal and external states. Conceptual knowledge develops through daily experience, socialization, and critically, language (Lindquist & Barrett, 2008;
Lindquist & Gendron, 2013; Lindquist, MacCormack & Shablack, 2015; Lindquist, Satpute & Gendron, 2015; Lindquist, Gendron & Satpute, 2016). The Conceptual Act Theory (CAT), in particular, is a psychological constructionist model of emotion which focuses on the automatic and ongoing process of making meaning of one’s core affect, using concept knowledge that is supported by language (Barrett, 2014; Lindquist, MacCormack & Shablack, 2015).

According to the CAT, the use of concept knowledge to make meaning of core affect relies on language and past experiences (Lindquist, MacCormack & Shablack, 2015; Lindquist, Satpute & Gendron, 2015; Lindquist, Gendron & Satpute, 2016). Accordingly, language has been shown to be a pivotal part in emotion categorization and learning in adults. Adults who are temporarily deprived of the definition of an emotion word (i.e., anger) have a harder time distinguishing if two facial expressions are exhibiting the same emotion or not. This inability stems from the inaccessibility to use language, in this case the emotion word, to access the concept knowledge pertaining to the emotion (Lindquist, Barrett, Bliss-Moreau, & Russell, 2006; Lindquist & Gendron, 2013; Barrett, Lindquist & Gendron, 2007). Another example of the importance of language in understanding distinct emotions can be seen in patients with semantic dementia. Semantic dementia effects one’s knowledge about concepts as well as one’s ability to use concept knowledge (Hodges & Patterson, 2007; Lindquist, Gendron, Barrett, & Dickerson, 2014). When dementia patients were asked to sort facial expressions by their emotions they were only able to differentiate the expressions by positive and negative valence, thus showing the importance of language (Lindquist, Gendron, Barrett, & Dickerson, 2014). The evidence that language is a key component in understanding the physical aspects of an emotion and creating and accessing concept knowledge is clear and supportive of the psychological constructionist approach to emotions (Lindquist & Gendron, 2013; Lindquist, MacCormack & Shablack, 2015;
Despite the growing evidence that language plays a role in children’s acquisition of emotion knowledge, it is still unclear how language truly impacts children’s emotion knowledge, who are developing these concepts while simultaneously learning language.

**Language’s role in development**

Language is key in adult emotion perception and the importance of language may be even greater when looking at emotion knowledge of children than that of adults. Although research examining the direct role of language and emotions is small, evidence suggests that a relationship may exist.

As children grow, they learn to communicate in various ways. One major way is through language both verbally and nonverbally. Of particular interest is their development of spoken language which includes emotion words. In one of the first examinations of children’s emotion word development, Ridgeway, Waters and Kuczaj (1985) examined at what age children begin to understand different emotion words. Among a sample of 270, the only emotion language toddlers, under 24 months of age, were able to produce was the word “good.” From 24 to 36 months children began to produce additional emotion words starting with happy, followed by sadness, anger and fear.

Additional correlational evidence suggests that the relationship between a child’s age and language ability is positively related to their emotion understanding (Pons, 2003). An examination of children ages 4 to 11 correlated emotional understanding and language abilities. It found that a child’s age alone accounted for part of the relationship between emotional understanding and language ability, about 20%. Language alone accounted for a significantly greater amount, about 27%, of a child’s emotional understanding; however, the combination of
language and age accounted for 72% of the variance in the relationship. This study created a preliminary link between emotional understanding, age and language ability (Pons, 2003).

Just as children learn different emotion words in a certain order, their performance regarding recognizing and conceptualizing these emotions improves correspondingly. When Widen and Russell (2003) gave children (aged 2-5) emotional facial expressions to label they were first able to correctly label the happy face followed by the angry and sad faces. The next set of faces they were able to label, although with less accuracy were scared, surprised and lastly disgusted. This suggests a connection between when children learn an emotion word and their ability to properly label a face as that expression (Widen & Russell, 2003). The broad-to-differentiated hypothesis, mentioned earlier, also found that emotion vocabulary impacts how a child interprets emotional facial expressions. Children who did not know the word disgust were more likely to label a disgust face as anger than children who knew the word disgust. This shows that while children start with overarching categories the addition of new concept knowledge (language) can facilitate the differentiation process for creating discrete emotion categories (Widen, 2013).

Abstract Concept Acquisition

Evidence posits that the capacity for children to learn and understand emotion language is based on how children understand and learn language overall and more specifically concrete and abstract semantic concepts. Concepts are generally something tangible. Concepts are considered to be abstract when there can be no direct interaction or perception of them. Emotion words are often thought as abstract concepts insofar as they often involve unobservable internal states (Speed & Vigliocco, 2015). Therefore, it is informative to examine abstract concept acquisition. One such way that children learn abstract concepts is through syntactic bootstrapping. Syntactic
bootstrapping is the process by which one uses the sentence structure and grammar to understand a new word (Gleitman, 1990). For example, in the sentence “the bird is blurb” in order to understand what blurb is one uses syntactic bootstrapping. Using the verb in the sentence, is, one can decipher that the bird could be in a state of being such as blue or cold, doing an action such as flying or any number of things. If the sentence is changed to “the bird said blurb” then one can use the change in the syntax to understand that blurb is a sound such as chirp. The change in verb type from “is” to “said” is an example of restriction. Restriction refers to the possible meanings of the novel word. The sentence including “is” had a low level of restriction because there were many possible meanings of blurb, such as cold, blue, flying, or chirping. “Said,” on the other hand, institutes a higher level of restriction because it limits the possible meanings to sounds (Gleitman, 1990).

The role of syntactic bootstrapping has been implicated in a child’s acquisition of verbs for many years. The grammatical structure of sentences helps a child understand the meaning of unknown words by providing contextual information through the syntax (Naigles, 1988). Becker and Estigarribia (2013) further examined the role of syntactical bootstrapping by applying it to how children understand more abstract forms of verbs. They found that children still heavily rely upon syntactic bootstrapping to determine the relative meaning of the word as well as the fact that it was a verb (Becker & Estigarribia, 2013). Becker (2014) expanded the work on verb acquisition to other parts of speech such as children’s learning of novel adjectives. She predicted there would be a similar emphasis on the syntax for children’s adjective learning as seen in verb learning; but, instead found that context in the form of a story was the largest indicator for how a child was able to understand a novel word to be an adjective (Becker, 2014).
Children use different types of context when it comes to learning verbs and adjectives (Becker, 2014). Syntactic bootstrapping shows children tend to use the context provided from the sentence and grammar to create an understanding of abstract or unknown verbs (Naigles, 1988). When learning that an abstract word is an adjective, children place a greater focus on the context which they gather from a story as opposed to the grammar of the sentence (Becker, 2014). Children may utilize syntactic bootstrapping to help them understand the emotion word since the grammar related to emotion words can be specified to indicate that only an emotion word can fit into the sentence. Alternatively, since emotions are used to describe a noun, they are often considered to be adjectives and it is reasonable to expect that just like learning normal adjectives, children will be able to use story context to help them understand that a novel word is an emotion word.

The role of visual environmental context in emotion acquisition has also been explored by emotion researchers in a few different ways. Here researchers find that when children are asked to label a face with a scrunched nose with any of seven possible categories their decision can be primed by what facial expressions and labels they see prior. Pochedly, Widen and Russell (2012) had children label a facial expression after priming them with an angry face or a sick face which led to the children labelling the face as either angry or disgusted (Pochedly, Widen & Russell, 2012). Another way in which context has been examined is through situational context in the form of causes and consequences in a story. Children ages 3-7 are more likely to perceive emotions based on all of the information available which includes the use of the situational environment in which the emotion is present (Widen, 2013).

Present Studies
Prior research has shown that children tend to initially understand emotions based on valence, supporting the psychological constructionist view of emotions. While the psychological constructionist model has placed great emphasis on the importance of language in emotion development, little research has examined how children acquire emotion knowledge. Based on previous research it is evident that children, 3 to 5 years of age, are in the process of learning about the emotion categories relevant to their culture (Widen, 2013). We thus used this age group to examine how young children understand different presentations of novel words as emotion words.

Building off of developmental linguistics research on novel verb and abstract adjective acquisition and emotional development work suggesting the importance of language and context in novel word learning, we conducted a set of two studies. Here, we manipulated the syntactical structure in which a novel word is presented (Study 1 and Study 2) as well as the presence and absence of situational context (Study 2). We examined under what circumstances, and at which age, a child is more likely to interpret a novel word as an emotion concept, rather than a physical state or action.

Study 1 assesses the exclusive role of syntax in children’s inferences that novel words refer to emotions. In this study, children are presented with novel words in different syntactical restrictions. These syntactical restrictions, which refers to the number of possible meanings of a novel word based on verb manipulation in a sentence, are based on children’s verb learning literature (Gleitman, 1990; Naigles, 1988; Becker & Estigarribia, 2013). Study 2 additionally assessed the role of contextual information in story form on novel word learning. The same syntactical structures in Study 1 were used in combination with the contextual information.
It is hypothesized that children who are older will be more accurate in understanding a novel word as an emotion across both Study 1 and Study 2, regardless of restriction level. For Study 1, it is hypothesized that children presented with the most restrictive syntax will be more likely to choose an emotion. We predict that in general, children in Study 2 will choose an emotion more often than those in Study 1 due to the presence of environmental context. Our over-arching hypothesis is that when older children are presented with the most restrictive syntax along with environmental context they will be most likely to pick an emotion to represent the novel word.

**Study 1: The Role of Syntax on a Child’s Emotion Word Understanding**

To examine the role of syntactical structure on emotion word learning, children aged 3-5 saw videos of two puppets having a conversation. The conversation introduced a novel word within one of three syntactical presentations which varied based on three different restriction levels. Restriction level refers to how many possible meanings of the novel word exist based on the verb manipulation. The children then chose which image the word referred to by selecting between an example of a physical state, an emotion, or an action. We hypothesized a 3-way interaction such that children would be more likely to choose the emotion image with increasing age and more restrictive syntactical presentations.

**Method**

**Participants.** One hundred and forty children ($M_{age} = 3.77, SD = .83; 73$ female) were recruited from the Durham Life and Science Museum with consent of their parents or guardians. All participation was voluntary and the parent or child could discontinue at any time. 4 children were not within our age range and were thus not included. Additionally 16 children failed our eligibility check, did not want to continue, were bilingual or had a learning disability, leaving the
final sample to be 120 children between 3 and 5 years of age ($M_{\text{age}} = 3.84, SD = .75$; 64 female): 44 3-year olds (25 female), 51 4-year olds (27 female), and 25 5-year olds (12 female). Parents and/or legal guardians completed a packet of questionnaires on their child’s home life and development. The majority of parents reported themselves as Caucasian or White (67.5%), with smaller percentages describing themselves as Asian (0.8%), African American or Black (1.7%), multiracial (10.8%) and other (1.7%).

**Stimuli and materials.**

**Language Manipulation.** Syntactical structure is manipulated by the specific verb utilized in the sentence, which restricts the number of potential meanings a novel word can have. The least restrictive structure is be + adjective. Novel words introduced in this structure can be one of many types of words, such as an action (i.e., is running), state of being (i.e., is hot or cold), a characteristic (i.e., is tall) or an emotion (i.e., is happy). A second and more restrictive structure is feels + adjective. Here a novel word may be a state of being (i.e., feels hot or cold) or an emotion (i.e., feels happy), but cannot be an action (i.e., feels running). Lastly, the most restrictive structure is feels + adjective + about, this restricts the novel word to an emotion (i.e., feels happy about the cake). Table 1 illustrates the syntactical manipulation described above.

**Warm up, experimental & filler videos.** Children are presented with the novel words and syntactical structures in videos. The videos consist of two animal hand puppets talking.

Prior to the experimental videos, children view three warm up videos to introduce the general task to the child and ensure that they understand and are able to complete the task. There are no novel words in the warm up videos, nor is the syntactical structure manipulated. All warm up videos utilize the structure be + action word. Specifically, the child hears the puppets talking
about an alien who likes pizza, an alien who is tired and an alien who is jumping up and down.

Following each individual video the child completes an image selection task.

The experimental videos introduce a novel word in one of the three syntactical conditions throughout the experimental trials. Just as in the warm up videos, the child views two puppets in conversation, however, they now introduce the language manipulation and a novel word with no additional contextual information. Each child only hears one syntactical manipulation for the four experimental trials, in randomized order. Those in the be + novel word condition, often referred to as is condition, hear: binty, daxy, strupy, and moky. Those in feels and feels about condition are introduced to: joomy, gorpy, reksy, and tropy. A typical conversation heard by the child is:

Puppet 1: I know an alien who [syntax condition] binty.

Puppet 2: Really? You know an alien who [syntax condition] binty?

Puppet 1: Yes! I know an alien who [syntax condition] binty!

Puppet 2: Oh! You know an alien who [syntax condition] binty.

Each experimental video trial alternates with a filler video trial. There are a total of three filler videos. The filler videos were created to follow the same format as the experimental videos except that the alien word presented ends in –ing and always with is. These filler videos were included to serve as attention checks, to ensure children are completing the task accurately and to the best of their ability and to break up the more difficult experimental trials.

**Image Selection Task.** Following each video, the child completes an image selection task. For this, they are randomly presented with three images of a cartoon alien, one representing an emotion, an action and a physical state. The possible emotions are: happy, sad, mad, afraid, disgusted, surprised and excited; action: sleeping, falling, sitting, jumping, walking running and
cartwheeling; and physical state/state of being: itchy, cold, hungry/thirsty, burnt, hurt sick and hot. Children are instructed to point to the image that they believe depicts the novel word (in warm up trials, they are asked to point to the action).

**Questionnaire.** A parent questionnaire asks about the child’s overall language development and family language history as well as family income, guardian information and demographics. There is also a section in which the parents indicate how many words their child spontaneously produces in the following categories: animals, descriptive words, helping verbs and time, body parts, and emotion words. These questions are meant to help screen any ineligible children due to language or learning impairments (or advantages). Questions were also asked about their general time at the museum and view on the relationship between research and the community. Items will not be further discussed.

**Procedure.** Researchers approached the parents of children who looked to be within the desired age range at a local museum. Researchers described that the study would involve watching videos about aliens and answering some questions. To prevent demand characteristics, there was no mention that the study was assessing emotion learning.

Interested parents/guardians and children were brought to the testing location and parents/guardians were given the informed consent form to sign, while the child was acquainted with the experimenter and set up. Verbal assent was obtained from the child to complete the task. The parents were handed the parent questionnaire to complete while the child completed the task on Qualtrics via laptop. Throughout the duration of the experiment, a single experimenter interacted with the child, while another research assistant recorded the answers and any anomalies in a session log.
The child’s age and gender were put into a Qualtrics survey which then randomly assigned the child to a syntactical structure (is, feels or feels about). The child completed the three warm up videos and if they passed, by answering correctly on two out of the three trials, they went onto the experimental and filler trials. Prior to the start of the experimental trials, researchers asked the child if they would like to continue and help them figure out what some “alien words” are.

The child watched seven videos in total. Four experimental videos and three filler videos alternating in order. After each trial video, the child completed an image selection task. The child was prompted by both the video and the experimenter to point to the image which they thought showed the alien word. The child was asked to touch the screen to ensure clarity in their choice and then the experimenter selected the answer, which was recorded by both the computer and the research assistant. If the child was unsure or hesitant, the researcher prompted them up to 3 times before continuing to the next trial. Research assistants also took note of anything the participant said or did as well as any distractions surrounding the child. Once completed the child was rewarded with a hand stamp and temporary tattoo.

**Results**

To examine differences in image choice type between and within participants, mean proportions of each image choice was calculated based on the number of trials they were presented with. 12 participants had their mean proportions calculated out of 2 or 3 instead of 4 due to computer errors that did not record their responses on one or two of the 4 total trials.

To examine the impact of age and syntax condition on image choice, a 3 (syntax condition: is, feels, feels about) x 3 (age: 3, 4, 5) x 3 (image choice: emotion, action, physical state) mixed model analysis of variance (ANOVA) was conducted with image choice as a within
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subjects factor. A second ANCOVA was conducted with gender and warm up performance as covariates. Results from the ANCOVA generally replicate the ANOVA. We therefore present the ANCOVA findings as it is more conservative.

Unlike our predictions, we did not find a 3-way interaction between syntax condition, age, and image choice. However, an interaction between image choice and age is found, $F(4, 218) = 2.61, p = .04, \eta^2 = 0.05$, see Table 2). 5 year olds picked an emotion image ($M = 0.43; SD = 0.05; 95\% CI [0.33, 0.53]$) significantly more than 3 year olds ($M = 0.32; SD = 0.4; 95\% CI [0.25, 0.40]$) and 4 year olds ($M = 0.32; SD = 0.04; 95\% CI [0.26, 0.39]$), although there is no difference between 3 and 4 year olds. Within age ranges, we find that 3 year olds pick state images ($M = 0.38; SD = 0.04; 95\% CI [0.31, 0.45]$) significantly more than action images ($M = 0.20; SD = 0.03; 95\% CI [0.22, 0.34]$), however there is no significant difference in the likelihood they chose emotion images compared to action or state images. 4 year olds pick state images ($M = 0.45; SD = 0.3; 95\% CI [0.38, 0.51]$) significantly more than action images ($M = 0.22; SD = 0.03; 95\% CI [0.17, 0.28]$) as well as emotion images. 4 year olds also picked emotion images more than action images. Lastly, 5 year olds picked action images ($M = 0.11; SD = 0.04; 95\% CI [0.03, 0.19]$) significantly less than state images ($M = 0.46; SD = 0.05; 95\% CI [0.37, 0.56]$) and emotion images, however, there was no significant difference between emotion and state images (Figure 1). There were no main effects nor other 2-way interactions.

Discussion

Although the predicted 3-way interaction between image choice, age and syntactical structure was not observed, we did find a significant age and image choice interaction. Five year olds chose the emotion image more frequently than 3 and 4 year olds, who were somewhat more likely to choose state images. There was, however, no impact of the syntactical condition on
children’s choice of the image, nor did syntactical condition interact with age, or did syntactical condition, age, and image choice interact.

Our findings suggest that children generally did not select the action image, and this is consistent with literature stating that at this age children should be able to distinguish verbs from other parts of speech (Naigles, 1988). While, older children are more likely to pick an emotion image it still comes in second to state images. Since there was no significant interaction between image choice and syntax condition it seems that the image choice difference is more heavily based on cognitive development rather than the syntactic structure via language itself. However, the question remains of what will occur when syntactical differences are combined with environmental context.

**Study 2: Language-Context**

To examine the role of environmental context in conjunction with syntactical structure on emotion word learning, children saw cartoon videos which provided environmental context in the form of a story. Each video was formatted to tell a short story which alluded to an emotion. The videos presented a novel word in one of the same three syntactical restrictions as in Study 1. As in Study 1, we hypothesized a 3-way interaction such that in the presence of contextual information, children would be more likely to choose the emotion image with increasing age and more restrictive syntactical presentations.

**Method**

**Participants.** One hundred and forty seven children ($M_{age} = 3.85, SD = .94; 60$ female) were recruited from the Durham Life and Science Museum with consent of their parents or guardians. All participation was voluntary and the parent or child could discontinue at any time. 10 children were not within our age range and were thus not included. Additionally 24 children
failed our eligibility check, did not want to continue, were bilingual or had a learning disability, leaving the final sample to be 113 children between 3 and 5 years of age ($M_{age} = 4.04, SD = .77$; 45 female). 31 3-year olds (8 female), 46 4-year olds (26 female), and 36 5-year olds (11 female). Parents and/or legal guardians completed a packet of questionnaires on their child’s home life and development. The majority of parents described themselves as Caucasian or White (70.8%), with smaller percentages describing themselves as Asian (0.9%), African American or Black (0.9%), Hispanic or Latino (0.9%) or multiracial (12.4%) and other (2.7%).

**Stimuli and Materials.**

*Language manipulation.* Each novel word is presented in the same three syntactical structure manipulations as in Study 1: be, feels and feels about. In contrast to Study 1, there is a story accompanying the novel word presentation. Each story alludes to a known human emotion that children within this age-range typically understand or are learning: happy, sad, mad, excited, disgusted, surprised and scared. Rather than using the emotion word, a “novel” alien word is used. The seven novel (alien) words are: binty, daxy, gorpy, joomy, moky, reksy, and tropy. Each word is randomly assigned to each emotion.

*Warm up & experimental videos.* Rather than presenting videos with hand puppets, all videos contain a cartoon with an alien and accompanying audio. Each video is 20-30 seconds long and consist of an alien acting out a story which is narrated through a voiceover.

Three warm up videos are presented first, which are the same as those in Study 1 except the aliens discussed have names. Following the video, they are presented with the image selection task to see if they are able to understand and complete the task correctly. In order to continue, they must correctly answer at least 2 trials.
In Study 2 there are no filler videos, only experimental videos. There are four alien characters which the videos could be about: Palooza or Chromia for females and Wazu or Xylobean for males. There is a gender separation to prevent gender biases from effecting how the child interprets the novel word. Each child is presented with only one of these aliens for all experimental trials. There are seven experimental videos to go along with each unique emotion word. The videos were created using goanimate.com, published to YouTube and embedded into the Qualtrics survey. The happy video was always presented first with the remaining six presented in randomized order. This is to be consistent with previous literature on emotion tasks, as well as to ensure the child is not presented negative stimuli right away and unmotivated to continue (Widen, 2013). At the end of each video the child is presented with a statement following this pattern: “Now Palooza [alien] is [syntax condition] binty [novel word]. What do you think binty [novel word] means?”

**Image selection task.** Each child is presented with the same image selection task from Study 1, which has the alien from the video performing an action, presented in a physical state and displaying the correct emotion. Children are instructed to select the image that exemplifies what the novel word is.

**Questionnaire.** The same questionnaire is given to the parents as was utilized in Study 1.

**Procedure.** Recruitment and procedure mostly followed that of Study 1. Key differences are that children viewed 7 experimental cartoon videos and no filler videos. Additionally, the child was assigned to an alien, Wazu or Xylobean for males and Palooza or Chromia for females.

**Results**

To examine the differences in choice type between and within participants, mean proportions of each image choice was calculated based on the number of trials they were
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presented with. 1 participant had mean proportions calculated out of 6 instead of 7 due to computer errors.

To examine the impact of age and syntax condition on image choice, a 3 (syntax condition: is, feels, feels about) x 3 (age: 3, 4, 5) x 3 (image choice: emotion, action, physical state) mixed model analysis of variance (ANOVA) was conducted with image choice as a within subjects factor. A second ANCOVA was conducted with gender and warm up performance as covariates. Results from the ANCOVA generally replicate the ANOVA. We therefore present the ANCOVA findings as it is more conservative.

As in Study 1, there is a significant 2-way interaction between image choice and age, $F(3.73, 170.83) = 8.29, p < 0.01, \eta^2 = 0.14$ (Table 3). 4 year olds picked emotion images ($M = 0.50; SD = 0.03, 95\% CI [0.44, 0.57]$) significantly more than 3 year olds ($M = 0.35; SD = 0.04, 95\% CI [0.28, 0.43]$). 5 year olds picked emotion images ($M = 0.64; SD = 0.4, 95\% CI [0.56, 0.72]$) significantly more than both 3 and 4 year olds (Figure 2).

Within ages, we find that 3 year olds significantly picked action images ($M = 0.24; SD = 0.03, 95\% CI [0.19, 0.29]$) less than state ($M = 0.41; SD = 0.04, 95\% CI [0.34, 0.48]$) and emotion images, but there was no difference between state and emotion image choice. 4 year olds picked emotion images significantly more than both state ($M = 0.33; SD = 0.03, 95\% CI [0.27, 0.39]$) and action ($M = 0.16; SD = 0.02, 95\% CI [0.12, 0.21]$). 5 year olds also picked emotion images more than action ($M = 0.11; SD = 0.3, 95\% CI [0.06, 0.17]$) and state ($M = 0.25; SD = 0.04, 95\% CI [0.17, 0.32]$) images.

The 2-way interaction was modified by the predicted 3-way interaction between image choice, age and syntactical structure, $F(7.47, 190.38) = 2.49, p = 0.02, \eta^2 = .09$ (Table 3). 5 year olds in the feels about condition significantly picked emotion images ($M = 0.73, SD = 0.10, 95%$
EMOTION IN CHILDREN

CI [0.55, 0.92]) more than 4 year olds in the feels about condition \( (M = 0.52, SD = 0.05, 95\% \text{ CI} [0.43, 0.61]) \) as well as 3 year olds in the feels about condition \( (M = 0.38, SD = 0.07, 95\% \text{ CI} [0.25, 0.55]) \). In the feels about condition there was no significant differences between 3 and 4 year olds picking emotion images. 5 year olds significantly chose an emotion image in the is condition \( (M =0.66, SD = 0.06, 95\% \text{ CI} [0.55, 0.78]) \) more than 3 year olds \( (M =0.31, SD = 0.06, 95\% \text{ CI} [0.19, 0.43]) \) and 4 year olds \( (M =0.37, SD = 0.07, 95\% \text{ CI} [0.23, 0.51]) \). There was no significant difference between 3 and 4 year olds in the is condition. Interestingly, 4 year olds significantly chose emotion images the more in the feels about condition \( (M =0.62, SD = 0.06, 95\% \text{ CI} [0.51, 0.74]) \) than both 3 year olds \( (M =0.37, SD = 0.08, 95\% \text{ CI} [0.22, 0.52]) \) and 5 year olds \( (M =0.52, SD = 0.05, 95\% \text{ CI} [0.42, 0.62]) \). 4 year olds in the feels category significantly picked emotion images more than 4 year olds in the is or feels about categories. 5 year olds significantly picked emotion images more than 3 year olds in the feels category (Figure 3).

Within ages, we find that 5 year olds in the feels about condition significantly picked emotion images more than in the feels condition \( (M = 0.52, SD = 0.05, 95\% \text{ CI} [0.42, 0.62]) \). While emotion images were picked more in the feels about condition it was not chosen significantly more than in the is condition \( (M = 0.66, SD = 0.60, 95\% \text{ CI} [0.55, 0.78]) \). 4 year olds significantly choose emotion images less in the is condition \( (M = 0.37, SD = 0.70, 95\% \text{ CI} [0.23, 0.51]) \) than in the feels about and feels \( (M = 0.62, SD = 0.06, 95\% \text{ CI} [0.51, 0.74]) \). There is no significant difference between emotion image choice in 4 year olds in the feels and feels about conditions, though 4 year olds choose emotion images more in the feels condition. There are no significant differences in emotion image selection between 3 year olds in the is \( (M = 0.31, \)
SD = 0.06, 95% CI [0.19, 0.43]), feels (M = 0.37, SD = 0.08, 95% CI [0.22, 0.59]), and feels about conditions

Discussion

The 3-way interaction suggests that 5 year olds are able to significantly differentiate between the image choices in all verb conditions but as predicted are most likely to pick an emotion in the feels about condition. 4 year olds significantly choose an emotion image over a state or action image in the feels and feels about condition, equally. Interestingly, more 4 year olds chose an emotion image in the feels condition than the feels about condition and 5-year olds chose emotion images more in the is condition than feels condition. 3 year olds are only able to significantly differentiate an action from a state or an emotion. There was no significant difference in how they chose an emotion or a state regardless of verb condition. Though it is interesting to note that the only time they chose emotions more than a state was in the feels about condition, although this is not significant. Overall, children chose emotion images significantly more than state and action images in this study, suggesting that the inclusion of context plays a large role in how children differentiate emotion words.

Comparative Analysis of Study 1 and Study 2.

Due to the nature of both studies, we are able to directly compare them to examine the impact of syntax alone against syntax and context. A 2(context: present or absent) x 3 (syntax condition: is, feels or feels about) x 3 (age: 3, 4, or 5) x 3 (image choice: emotion, action, state) mixed model ANOVA was conducted. A second ANCOVA was conducted with gender and

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1 This can be further seen by a significant main effect of image choice in the ANOVA. There was no main effect shown in the ANCOVA, however looking at pair wise comparisons there are significant differences between the means, F(1.87, 190.38) = 1.57, p = .21, η² = 0.02. Emotion images (M = 0.50, SD = 0.2, p < 0.01) were selected significantly more than both action images (M = 0.17, SD = 0.1, p > 0.01) and state images (M = 0.33, SD = 0.29, p < 0.01). State images were selected significantly more than action images as was seen in Study 1.
warm up performance as covariates. Results generally replicate the ANOVA and therefore are presented as it is more conservative$^2$.

There was a 3-way interaction between image choice, age and overall study, $F(4, 426) = 2.81, p = 0.03, \eta^2 = .03$ (Table 4). 5 year olds chose emotion images, ($M = 0.64, SD = 0.04, 95\% CI [0.56, 0.73]$) significantly more when context was present than both 3 year olds, ($M = 0.37, SD = 0.04, 95\% CI [0.28, 0.45]$) and 4 year olds, ($M = 0.50, SD = 0.04, 95\% CI [0.43, 0.57]$). 5 year olds also significantly chose an emotion image more when context was present than 5 year olds, ($M = 0.42, SD = 0.05, 95\% CI [0.33, 0.52]$), 4 year olds, ($M = 0.32, SD = 0.03, 95\% CI [0.25, 0.38]$) and 3 year olds, ($M = 0.32, SD = 0.04, 95\% CI [0.25, 0.39]$) when context was absent. 4 year olds significantly selected emotion images more when context was present than when it was absent. There was no significant difference in how 3 year olds picked an emotion image when context was present v. absent. 3 year olds picked state images more than emotion images when context was both present and absent (Figure 4).

There is a significant 2-way interaction between image choice and age, $F(4, 426) = 6.91, p > 0.01, \eta^2 = 0.06$ (Table 4), as was seen in study 1. 5 year olds significantly picked emotion images, ($M = 0.53, SD = 0.03, 95\% CI [0.47, 0.60]$) more than 4 year olds, ($M = 0.41, SD = 0.24, 95\% CI [0.36, 0.46]$) and 3 year olds, ($M = 0.34, SD = 0.03, 95\% CI [0.29, 0.40]$). 4 year olds also significantly picked emotion images more than 3 year olds. There was no significant difference in how 3 year olds chose emotion images and state images, ($M = 0.39, SD = 0.03, 95\% CI [0.34, 0.44]$). 4 year olds also did not significantly differentiate between emotion images and state images ($M = 0.39, SD = 0.02, 95\% CI [0.35, 0.44]$). 5 year olds significantly chose

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$^2$ The ANOVA showed a main effect in image choice, $F(2, 430) = 48.73, p > 0.01, \eta^2 = 0.19$, and an interaction between image choice, age and verb condition, $F(8, 430) = 2.08, p = 0.04, \eta^2 = 0.04$ but the addition of covariates resulted in a marginal effect.
emotion images over state images ($M = 0.36, SD = 0.03, 95\% CI [0.30, 0.42]$) and action images ($M = 0.11, SD = 0.03, 95\% CI [0.06, 0.16]$, see Figure 5).

There is a significant 2-way interaction between image choice and overall study $F(2, 426) = 13.61, p > 0.01, \eta^2 = .06$ (Table 4). Emotion images were picked significantly more when context was present, ($M = 0.35, SD = 0.02, 95\% CI [0.31, 0.40]$) than absent, ($M = 0.62, SD = 0.06, 95\% CI [0.51, 0.74]$). State images were chosen significantly more when context was absent, ($M = 0.43, SD = 0.02, 95\% CI [0.39, 0.48]$) than when it was present, ($M = 0.33, SD = 0.02, 95\% CI [0.28, 0.37]$). When context was absent, state images were significantly chosen more than emotion images. When context was present, emotion images were significantly chosen more than state images. Overall, emotion images were chosen the most when context was present (Figure 6).

**General Discussion**

The goal of these investigations were to explore the role of language, context and age in a child’s understanding of novel words as emotion words. The role of language was examined through the different restrictions of syntactical structure. The role of physical context was examined through the presence or absence of a story. Developmental factors were examined by studying age as a between subjects variable.

It was hypothesized that for Study 1 that syntactical structure would influence how images were chosen, specifically that more restrictive syntactical structures would facilitate perceiving a novel word as an emotion over a state or action. This was not supported. While the children did not pick images at random it was not caused by the syntactical structure. The significance was found in how children tended not to pick action images rather than how often they picked an emotion image. This trend follows relevant developmental literature which states
that at the age of 3 children are able to differentiate a verb from other parts of speech (Naigles, 1988) The interaction between age and image choice in Study 1 supports the hypothesis that with age, children are more likely to perceive a novel word as an emotion word, however the lack of an interaction with verb condition suggests that this may be due to general cognitive development, not the specific syntactic restrictions. We do find that 5 year olds were significantly more likely to choose an emotion image over 4 and 3 year olds. Importantly, however, we find that state images are chosen more than emotion images overall. Which suggests that there may be another source of information that is needed for novel words to be acquired as emotion words. Based off of other emotion and language development work, it is possible that context is needed for additional scaffolding, which is what Study 2 explored.

In Study 2, it was hypothesized again that syntactical structure would influence how images were chosen and this was true. The 3-way interaction between image choice and age and syntactical structure better matched our hypothesis since 5 year olds chose emotion images more than did 3 and 4 year olds. Overall, the 5 year olds who had the most restricted syntax (feels about) choose an emotion image the most. However, it was not true that the most restrictive syntax always resulted in an emotion image choice. 4 year olds picked emotion images the most in the middle restriction level (feels). It also did not seem to drive image choice selection for 3 year olds, aside from differentiating action images from state and emotion. This may be because 3-year-olds are relatively insensitive to linguistic context.

Lastly, our direct comparison of Study 1 and Study 2 allows us to further examine the role of syntax versus the role of syntax and environmental context. As hypothesized, the combination of syntax and context leads to an increased likelihood and understanding of novel words as emotion words. Importantly, we still observed an image choice and age interaction,
which coincides with the literature showing increased performance in emotion perception with age, likely occurring in joint with cognitive development (Ridgeway Waters, & Kuczaj, 1985). Importantly, however, syntactical structure does not provide important cues. There was a marginal interaction present in the ANOVA but disappeared with the addition of covariates. It seems that the presence of context plays a much larger role than language in whether or not a child understands a novel word to be an emotion or not.

There were a few clear limitations to this study. There were many potential distractions for the children since the experiment was conducted in an open part of a museum. There were also a handful of technical difficulties which included images for the image selection task not loading as well as a slow load time on videos, during which time the child’s enthusiasm and attention were lost. There is also the possibility that the illustrations which were used did not depict the emotions as a child would expect, as well as the possibility that certain images may have been more interesting or appealing to the children and they would base their choice on that rather than based on what the question asked.

This study has shown great promise in understanding what contributes a child’s emotion word acquisition but it also leaves much to be explored. For example, 4 year olds chose emotion words the most in the presence of context and in the feels condition. One reason for this could be that feels about is not the syntax they use to refer to emotions at this age. The English language allows for emotions to be expressed and learned through many avenues. Is, feels and feels about are not the only grammatical structures which can be utilized. In the future it would be beneficial to examine the manner in which emotion words are presented to children in their daily life.

Along with making sure the syntactical structures used match how emotions are referred to in daily life, it is also important to replicate this study without the use of cartoons and puppets.
The children witnessed either puppets or cartoon aliens speaking, and while this may be indicative of how children understand emotions in this situation it may not be translatable to real life. It is important to recreate this study using real people and real interactions that one may have as well as have children complete the image selection task with pictures of humans rather than alien drawings.
REFERENCES


Table 1

This is a visual representation of the syntactical manipulations. Be + Adj. is the least restrictive because an action, physical state or an emotion can be referred to. Feels + Adj. + about is the most restrictive because only an emotion can properly be applied to the syntactical structure. Here, yes represents whether or not the part of speech would correctly be applied to the syntactical structure while ensure grammatical integrity.

<table>
<thead>
<tr>
<th></th>
<th>Be + Adj.</th>
<th>Feels + Adj.</th>
<th>Feels + Adj. + about</th>
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<tbody>
<tr>
<td>Action</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Ex. jumping, running</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical state</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Ex. cold, hurt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotion</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Ex. happy, surprised</td>
<td></td>
<td></td>
<td></td>
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</table>
Table 2

<table>
<thead>
<tr>
<th></th>
<th>df</th>
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<td>0.28</td>
<td>0.01</td>
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<td>0.04</td>
<td>0.05</td>
</tr>
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<td>Image Choice &amp; Syntaxical Structure</td>
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</tr>
<tr>
<td>Image Choice, Age &amp; Syntaxical Structure</td>
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<td>1.20</td>
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<td>0.04</td>
</tr>
<tr>
<td>Image Choice &amp; Gender</td>
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<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Image Choice &amp; Warm up performance</td>
<td>2</td>
<td>3.03</td>
<td>0.05</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Summary of ANCOVAs for image choice, age, syntactical structure and covariates in Study 1. Degree of freedom for error was 218.
### Table 3

Summary of ANCOVAs for image choice, age, syntactical structure and covariates in Study 2. Degree of freedom for error was 190.38.

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<th>F</th>
<th>p</th>
<th>$\eta^2$</th>
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<tr>
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<td>0.01</td>
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</table>
Table 4

Summary of ANCOVAs for image choice, age, syntactical structure, overall study and covariates comparing Study 1 and Study 2. Degree of freedom for error was 426.

<table>
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<tr>
<th></th>
<th>df</th>
<th>( F )</th>
<th>( p )</th>
<th>( \eta^2 )</th>
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</thead>
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<td>0.06</td>
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<td>2.06</td>
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<td>0.02</td>
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<tr>
<td>Image Choice, Age &amp; Syntactical Structure</td>
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<tr>
<td>Image Choice &amp; Overall Study</td>
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<td>0.03</td>
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<td>1.22</td>
<td>0.30</td>
<td>0.01</td>
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<tr>
<td>Image Choice, Age, Syntactical Structure &amp; Overall Study</td>
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<td>1.39</td>
<td>0.20</td>
<td>0.03</td>
</tr>
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<td>2</td>
<td>6.26</td>
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Figure 1. Image choice and age interaction in Study 1. Error bars represent standard errors.
Figure 2. Image choice and age interaction in Study 2. Error bars represent standard errors.
Figure 3. Image choice, age and syntactical structure interaction in Study 2. Error bars represent standard errors.
Figure 4. Image choice, age and overall study interaction in comparative analysis of Study 1 and Study 2. Error bars represent standard error.
Figure 5. Image choice age interaction in comparative analysis of Study 1 and Study 2. Error bars represent standard error.
Figure 6. Image choice and overall study interaction in comparative analysis of Study 1 and Study 2. Error bars are standard errors.