Title TBD

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Abstract

Keywords:

Introduction

The artifacts of everyday life reflect our routines, aspirations, relationships, and much more. In particular, the objects that we regularly pick up and handle—a coffee cup, a laptop, a baby bottle—offer a window into the physical, social, and cultural contexts that shape our understanding of the world. In this paper, we take a glimpse into everyday life at its beginnings by exploring home object handling from early infancy until age four. We discuss the implications of the findings for models of word learning.

Object handling and word learning

For young learners, objects and their associated activities form a critical source of input for social learning, including the ways in which children are exposed to language about those objects (see (**herzberg2021exuberant?**) for an overview of object play and motor learning). More generally, hands (and what they are handling) can be reliable indicators of what someone is doing and talking about during object play, facilitating children's ability to map word forms onto their meanings in and across real-time interaction (e.g., **yu2013joint?**; **yurovsky2013statistical?**). Present, attended-to objects also influence the babble of children with stable consonants (**laing2020babble?**). And caregivers' tendency to use nouns referring to objects in the here-and-now positively predicts their children's early word comprehension (**bergelson2017nature?**).

How frequently do children encounter held objects? Hands—others' and their own—are in good supply in young children's view of the world, especially after early infancy (**fausey2016faces?**; **jayaraman2017faces?**; but see **long2020detecting?**), topping out at visible presence ˜30% of the time. Infants own object handling is also relatively frequent: Herzberg and colleagues (**herzberg2021exuberant?**) find that infants handle objects ˜60% of the time during at-home play, Yu and colleagues (**yu2013joint?**) find ˜70% when including joint handling with adults in US in-lab object play, and (**casillasURdaylong?**) find ˜15 and ˜17% object handling in day-long photo streams in a Papuan and a Mayan community, respectively. Note, however, that the likelihood of talk about objects that are being handled in the here and now—a flagship feature of contingent caregiver talk (e.g., **mcgillion2013supporting?**)—fluctuates across high and low activity periods of interaction (**bergelson2019day?**).

In sum, prior work points to the immense potential of children's object-centric interactions for their word learning, but little work has yet begun to examine the types of objects children typically interact with at home and how object handling changes across age and varies across cultural contexts (**herzberg2021exuberant?**).

Object handling across age and culture

This object-centered input changes enormously across the first few years due to both maturational constraints and culture-specific caregiving practices. In early infancy, children have little ability to hold things or to control their posture, primarily experiencing objects through what others bring near to them (faces may make up a much greater proportion of their social input at this point; fauseyREF). However, later gains in manual dexterity and gross motor skill (e.g., sitting, crawling, walking) increasingly widen their ability to seek, reach, and grab a diversity of objects in their environment and give them greater control over what they handle, how, and for how long (REFS).

Separately, early access to objects is shaped by culture-specific practices for carrying children, keeping them safe and warm, and scaffolding the development of locally valued capacities (e.g., word learning in many US families, walking in Kenyan Kipsigis families, (**super1976environmental?**)), which may slightly alter the course of motor development (see (**adolph2010motor?**) for an overview).

The array of objects available to children will also vary crossculturally, including: (a) objects spread via globalization (e.g., plastic bags), (b) objects that have a basic functional role that is similar across contexts (e.g., spoon-like things for eating), and (c) objects are specific to people and places (e.g., the gourd and bombilla for drinking mate in much of South America, stemming from Indigenous Guaraní and Tupí tradition). Take, for example, middle-class US family homes, which have been noted for their large quantities of possessions ("clutter"), much of which is designed specifically for children (e.g., toys and books (**arnold2017life?**)). We might infer based on this distribution of objects that much of what children do and talk about at home is tailored to what particularly interests them and thus children's worlds, in this sense,

look very different from adults'. Recent work by Herzberg and colleagues (**herzberg2021exuberant?**) underscores this point with infancy data; 13–23-month-olds spent nearly 70% of their time in object play with toys or a mix of toys and non-toys, with ˜100% of infants playing with children's books and stuffed animals and a total of 32 toy types appearing in $\geq 25\%$ of infants' play. Non-toy play was also common, but still appeared to predominantly include infant-specific objects (e.g., sippy cups, baby spoons, high chairs, pacifiers). We would expect many of these items to be rare in other parts of the world, with much greater overlap between objects for infants and objects for adults (e.g., (**karasik2018not?**)).

Method

Corpus

We analyze daylong photo streams from child-worn cameras in two rural, small-scale subsistence farming communities: Rossel Papuan and Tseltal Mayan. While these horticulturalist communities are comparable, differences in the organization of daily life as well as the availability of certain types of objects (e.g., synthetic materials after market integration for the Tseltal context but not Rossel) allow for cross-cultural comparison. Daylong photo streams consist of images captured every 15 (Rossel) to 30 (Tseltal) seconds over the course of 8 (Rossel) to 9 (Tseltal) hours at home. Children wore a recording vest equipped with a camera (Narrative Clip 1) and miniature fisheye lens (Photojojo Super Fisheye) that provided a 180° view of the environment (Narrative Clip 1). For younger infants who were not yet walking, the camera was instead worn by the primary caregiver. Here, we analyze the subset of photos known to feature child object handling based on prior work with the same data sets (**casillas2021crosscultural?**).

These data include 56 children (Rossel: 27, Tseltal: 27) ranging in age from 0 to 48 months (M_{Rossel} = 21.5, $M_{Tseltal}$ = 22.7). For each child, a range of 1 to 653 photos were annotated (M_{Rossel} = 21.5, $M_{Tseltal}$ = 22.7).

Manual annotation

We annotated photos with IMCO (version 2; `https://github.com/kennedycasey/ImCo2`), an open-source program adapted for efficient coding of photo streams. Annotators provided labels for the handled object(s) present in each photo and selected among predefined categories characterize each type of object in the image. Categories included food, tools, toys, immovable objects, natural objects, and miscellaneous synthetic objects (see Table 1 for example objects from each category).

Reliability

XX% of photo streams were double coded. Reliability annotations were equally spread across sites and ages. At the category level, annotators agreed on XX.X% of decisions (Rossel: XX.X%, Tseltal: XX.X%). At the object label level, annotators agreed on XX.X% of decisions (Rossel: XX.X%). Additionally, to avoid unnecessary data loss, all excluded photos were checked by a second annotator and re-included for analysis if objects were identifiable.

Object Category	Rossel	Tseltal
Synthetic	rope, shirt, plastic bottle	shirt, chair, pants
Food	coconut, betelnut, tuber	guava, tortilla, apple
Tool	knife, bowl, spoon	bowl, cup, bottle
Toy	ball, book, plastic toy	book, toy truck, baby doll
Natural	stick, rock, leaf	stick, leaf, tree
Immovable	veranda, ladder, railing	door, fence, table

Table 1: Objects handled by the most children across categories and sites.

Results

Overall frequency statistics

Children handled an average of 21.16 unique objects per day (median = 20, SD = 15.2, range = 1–59), with no significant differences across sites (M_{Rossel} = 18.93, $M_{Tseltal}$ = 23.24, W = 350, p = 0.501). Only 20.83% of objects were present in both communities, but several shared objects were among the most frequently handled by children in both sites. In fact, among the top 25 most common objects, 11 were shared across sites.

The frequency of object categories was similarly divided across sites (Figure 1A). The top objects for each category are shown in Table 1. Children primarily handled miscellaneous synthetic objects (e.g., rope, guitar, shirt, etc.; M_{Rossel} = 32.01% of handling, $M_{Tseltal}$ = 37.5%) and food (M_{Rossel} = 28.58%, $M_{Tseltal}$ = 36.21%). For 45 of 56 children, the top category was either synthetic objects or food. Two-tailed Wilcoxon tests revealed only one significant category-level difference between sites: children's handling of large or immovable objects (e.g., veranda, ladder, railing, etc.), where Rossel children handled these objects more frequently than Tseltal children (M_{Rossel} = 7.73%, $M_{Tseltal}$ = 3.31%, adjusted p = 0.038, ps for all other categories > 0.05), but these objects were still the least frequently handled in both sites.

During any given hour, children handled 5.26 objects from 2.79 different categories, on average (median = 4.5 objects, SD = 3.92, range = 1–18). A linear mixed-effects model with fixed effects of site, each of 6 object categories, and their interaction showed a significant main effect of the synthetic object category (β = 0.52, SE = 0.2, t = 2.59, p = 0.01) as well as an interaction between site and the synthetic object category (β = 1.11, SE = 0.29, t = 3.88, p = < 0.001) such that children handled more unique synthetic objects per hour than any other object category, and this effect was stronger for Tseltal children than for Rossel children (ps > 0.05 for all other main effects and interaction terms; Figure 1B).

Time of day effects

Children's overall rate of object handling was largely consistent across the day. The number of unique handled objects per hour was not linearly related to time of day (β = -0.02, SE = 0.11, t = -0.16, p = 0.874), and there was no two-way

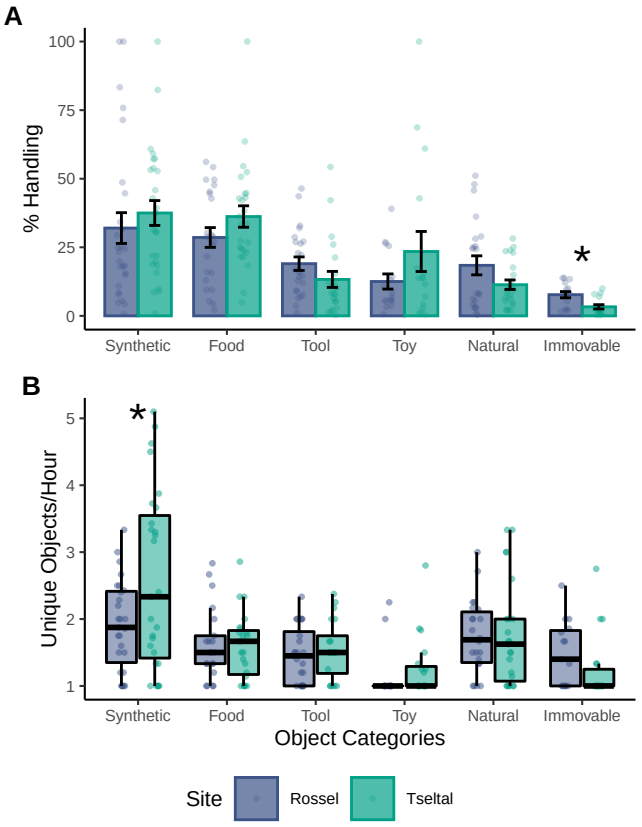

Figure 1: (A) Overall frequency of handling by object category. Points reflect percentages for individual children. (B) Count of unique objects handled per hour by object category. Points reflect means for individual children across all hours of recording.

interaction between time of day and site (β = 0.01, *SE* = 0.14, *t* = 0.1, *p* = 0.923).

However, we did find differences in children's rates of holding for specific object categories across the day. We ran individual linear mixed-effects models, which included fixed effects of site, hour of the day, and their interaction, for each of 6 categories. Synthetic objects were marginally more common during the afternoon hours (β = 0.02, *SE* = 0.01, *t* = 1.71, *p* = 0.09), and food items were handled with significantly greater frequency during the morning hours (β = -0.03, *SE* = 0.01, *t* = -2.76, *p* = 0.006; Figure 2). No other main effects or two-way interactions reached statistical significance (all *p*s > 0.05).

Age effects

Children's overall rate of object handling increased marginally with age (Figure 3A). That is, older children handled more unique objects per hour (β = 0.07, *SE* = 0.03, *t* = 1.99, *p* = 0.05). Additionally, with increasing age, children handled more objects from different categories per hour (β = 0.03, *SE* = 0.01, *t* = 2.6, *p* = 0.011). These effects were consistent across sites; we found no main effects of site

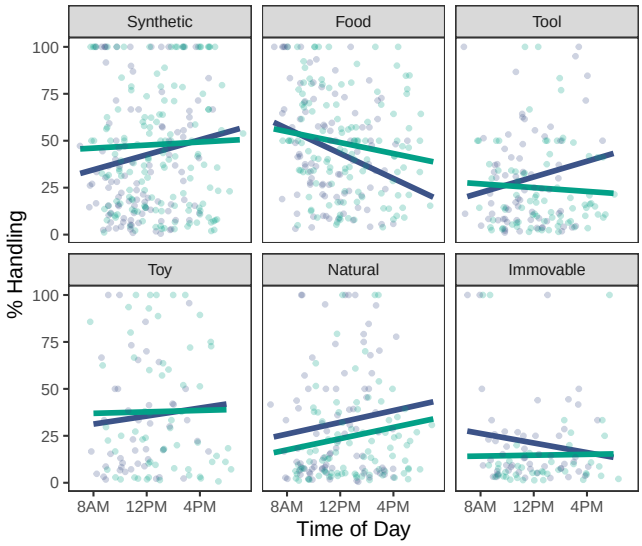

Figure 2: Frequency of handling by object category across different times of day. Individual points show raw percentages for each child, and lines reflect model-predicted percentages.

or interactions between site and age (all *p*s > 0.05).

Discussion

References

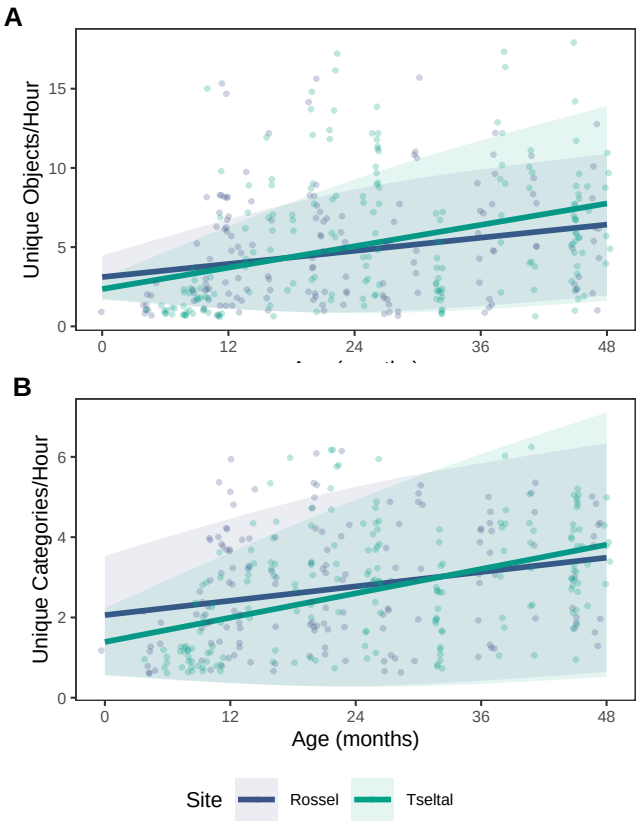

Figure 3: (A) Unique objects and (B) object categories handled per hour as a function of age. Points reflect raw hourly counts for each child, and lines reflect model predictions with shaded standard error regions.