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ORIGINAL ARTICLE

Measuring categorisation in pre-school children: new toolkit, new insights

Kay Owen[a], Christopher Barnes[b], Thomas Hunt[b], David Sheffield[b]

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[a]Institute of Education, Department of Education and Childhood, University of Derby, Derby, UK;

[b]College of Health, Psychology and Social Care; School of Psychology, University of Derby, Derby, UK.

Corresponding author
k.owen3@derby.ac.uk

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Abstract

Introduction: whilst recent years have witnessed considerable research into infant categorisation, its development during the pre-school period has garnered far less interest and innovation.

Objective: this paper documents the development of a valid and reliable new toolkit for measuring categorisation in children, designed to allow fine-grained differentiation through four short tasks.

Methods: the paper outlines how a pilot study with 55 children reduced confounding variables, ruled out several explanations for performance variations and enabled procedural refinements. It then documents a study conducted with 190 children aged 30-60 months.

Results: this more sophisticated testing mechanism challenges previously accepted developmental norms and suggests both sex and socio-economic status (and their interaction) influence categorisational abilities in pre-schoolers.

Conclusion: the results indicate that preschool children’s ability to categorise varies markedly, with implications for their capacity to access formal education.

Keywords: categorisation, preschool children, development, measurement, sex differences, socio-economic status.

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Authors summary

Why was this study done?
There is limited evidence regarding the development of categorisation during the pre-school period and the factors that might influence development. In part this is due to the lack of a measure designed specifically for this age range.

What did the researchers do and find?
We conducted a pilot study to test out a four-part toolkit with pre-school children. The pilot suggested that the toolkit was reliable and valid, and that children's categorisational abilities were affected by their sex and socioeconomic status. We then conducted a study with 190 children at 4 Preschool units. It was found that girls, and children from high socio-economic backgrounds scored more highly than boys and those from low socio-economic backgrounds, and that there was an interaction between the 2 factors.

What do these findings mean?
Given the importance of categorisation in early learning, these results indicate that boys, and children from low socioeconomic backgrounds, are in a position of disadvantage prior to starting school. It also illustrates the importance of using appropriate testing mechanisms with child participants.

INTRODUCTION

Categorisation enables items, actions, and occurrences to be compartmentalised according to their defining attributes or properties[1]. During encoding, the conceptual system elaborates and interprets that which is perceived, prior to jointly storing the perceptual and conceptual information[2]. Attempts at retrieval activate stratified links, consolidating existing connections and enabling access to associated information. Concepts and categories therefore not only reduce cognitive load, they comprise the basic units of semantic memory[3] and expedite every aspect of memory processing[4].

Prior research has demonstrated that rudimentary categorisation emerges as soon as infants are able to perceive and track objects[5] and evolves progressively throughout the pre-school period[6]. Perceptual categorisation, which draws on observable similarity and disparity, tends to appear first[7], meaning physical categorisation cues[8], behavioural norms[9], and structural atypicalities[10] can be recognised even by very young children.

Thematic categorisation, however, involves identification of more complex relational patterns or recognition of an object's less accessible physical properties. It is therefore reliant upon a successful amalgam of biological, cognitive, and experiential factors[11] and so necessarily emerges later and somewhat fitfully. New experiences corroborate and augment known connections, steadily assembling enmeshed conceptual webs[12].

Cognitive categories can be further divided into general (termed "superordinate") categories, for instance "animals"; "basic" categories such as "dogs" and specific or "subordinate" categories like "dachshunds". Basic categories tend to be the most recognisable and are therefore generally held to be the first to emerge[13]. Whilst theorists remain divided as to precise timings, there is a consensus that categorisational abilities flourish exponentially during the third and fourth year of life, becoming relatively sophisticated by the time the child starts school[14].

Measuring categorisation in children

Researchers have developed many innovative techniques to investigate categorisation in infants[7,15,16], including sequential touching[17], deferred imitation and generalised imitation[7]. Sorting tasks have also been widely used to investigate specific concepts[18] and are considered both reliable and ecologically valid. Research with pre-schoolers, however, has generally either utilised modified and truncated forms of adult tests or relatively simplistic techniques such as match-to-sample tests[19-21]. In these, participants are provided with a category exemplar and a selection of items (often simple drawings) from which to select an appropriate match. As children age, pictures are generally replaced by words, or participants are tested on their ability to generalise a taught concept to other examples[22-24]. However, as with all conditional discrimination tasks, match-to-sample data is shaped by the researcher's interpretation of what evidences accuracy[25]. Furthermore, tests generally produce a dichotomised rather than a stratified response and do little to engage or enthuse young participants. We therefore sought to develop a new test that would be both child-friendly and scientifically rigorous.

Within any sample of pre-school children, considerable variations in linguistic competencies, motor skills, disposition and interests are to be expected. We therefore sought to develop a test free from potential linguistic confounds, that would be accessible to children of widely ranging abilities. Given their conspicuous success with infants, sorting tasks appeared feasible. Mandler's[26] assertion that picture cards provoke antipathy amongst participants, thus masking comprehension and constraining performance, further informed our decision to pilot tasks using both images and objects.

Study 1: pilot

METHODS

Design and Participants

Fifty-five children (Cohort1, n = 29, 14m, 15f; Cohort 2, n = 26, 13m, 13f) aged 30-50 months completed a battery of four free-categorisation tests (i.e. the criteria for categorisation was not specified by the researcher) in order to explore their categorisational abilities. One task called for the children to categorise objects, the others required cards to be classified according to the (i) colour, (ii) shape or (iii) image printed on them. Participants were drawn from two different cohorts in the Midlands, U.K: a Nursery in a deprived area and a Nursery in a middle-class area. Every test was conducted individually by the lead researcher at a table in a quiet area of the Nursery. Children were not provided with any training prior to the task or given any instructions other than those detailed below. The researcher offered encouragement and praise but no specific feedback. It was hoped to discover what criterion children use when categorising and whether any variations were apparent between groups. Cohort 1 was an area of high unemployment (88% of national average) with adults typically classified as skilled manual or unskilled, but with a small number of white-collar workers[27]. Participants were primarily from Britain's lowest three social and economic groups. Cohort 2 was drawn predominantly from the two highest social groups, with adults generally qualified to a high level and the typical employment type being professional or white-collar workers.

Measures

The toolkit developed and reported here comprises four specific categorisation matching tasks – Shape, Colour, 2D (image) and 3D (object).

Shape task - Fourteen 10cm x 10cm white cards; seven with a red triangle mounted on them at different angles and seven with a red square.

Colour task - Fifteen 10cm x 10cm white cards; five with a 7cm x 7cm pink square; five with a 7cm x 7cm blue square and five with a 7cm x 7cm square divided equally between pink and blue.

2D (Image) categorisation task - An artist was employed to produce an initial pool of 73 separate images. Each of the items belonged to a basic category recognisable to most children of this age (e.g. bird) but comprised both familiar (crow) and unfamiliar (crested lark) category members. Each picture was subject to an "image recognition trial" by an opportunity sample of at least 16 participants aged 30-48 months. Trials involved showing children a batch of cards, each bearing an individual image, and inviting them to name them or to explain their use. Thus, both "car" and (for instance) "Grandad drives us to the shops" were taken as evidencing recognition. Twenty-seven images were used in the test. These comprised 25 that were recognised by all children in recognition trials, together with two additional cards that had been recognised by the majority of children and that greatly enhanced categorisation possibility. All images were mounted on a 10cm x 10cm white card. See the picture stimuli examples below.

Figure 1: Stimuli for 2D (Image) categorisation task

3D (Object) categorisation task - Twenty-seven children's play items, matched as closely as possible to the 2D images were used. All items were appropriately sized to allow for easy manipulation.

Procedures

Shape task

The shape component compromised seven individual cards with triangles and seven with squares, all in a uniform colour. Children were told they would need to "sort out which cards go together". The researcher held the pack of 14 cards ready to show the participant individually. The researcher placed the first card, with a triangle on it, face up on the table between herself and the participant saying, "Look at what I've got", The second card showed a square. The researcher said, "Look at what I've got, Where shall we put it?". Most children indicated a place next to the triangle, thus forming a new pile. If a child indicated that the square should be placed on top of the triangle, the researcher asked, in a neutral voice, "Do they go together?". The remaining cards were shown individually to the participant who was allowed either to place them where they wished or to point to where they wished the researcher to place them. Children were allowed to move cards if they wished to.

Colour task

The colour-matching component comprised 15 individual cards with five pink (or yellow), five blue (or green) and five coloured squares that were split between pink and blue (or yellow and green). The two sets were used interchangeably. Children were told they would need to "sort out which cards go together". The researcher held the pack of 15 cards and showed them individually to the participant. The researcher said, "Look at what I've got!" and placed the pink (yellow) card face up on the table between herself and the participant. The procedure was then repeated with the blue (green) card. The researcher asked, "Where should I put this one?". Most children indicated a place next to the first card. The card was then placed face up on the table, thus forming a separate pile. If the child pointed on top of the first card, the researcher said, in a neutral voice, "Do they go together?" Cards were placed without comment wherever participants wished them to go. Children were allowed to move cards if they wished to.

2D (Image) categorisation task

The set of 27 2D picture cards were shown to children as a pack and they were told that the cards showed "some of the same sort of thing, and some things that go together." They were told that the purpose of the activity was to find the things that were the same or went together. The researcher turned over the first card and said, "What's this?" and then, after affirming the participant's response (for instance, "Yes, an apple"), placed the card face up on the table. The researcher then showed the child the second card and again asked, "What's this?". After the child had named it the researcher asked, "The (first card) and the (second card), do they go together?". When the child responded in the negative, the researcher placed the card face up next to the first one. The fifth card always offered a clear perceptual match to an earlier card (for instance a beach ball and a football). If the child recognised the link, the researcher moved the relevant cards to the top of the table and placed them next to each other, ensuring that each image was still visible and that there was space to add further cards if the participant wished to extend the category. A clear thematic link followed rapidly after this (for instance a banana and an apple) and the cards were then placed together as before at the top of the table. The researcher regularly asked, "Can you see any things that go together?" It might be things that are the same, or things that you just think go together". Once all cards had been placed on the table, the participant was asked whether they felt they had found all of the things that went together. No fixed time limit was placed on the process; the researcher relied on cues from the participant that they felt they had completed the task. A note was made of the approximate time taken in order that the same length of time could be allocated to the object-sorting task. Each "core" item had five potential matches – one prototypical clear perceptual match; one basic level categorical match with lesser perceptual similarities; one atypical basic level categorical match; one common thematic link and one less frequently cited thematic link.

3D (Object) categorisation task

Participants were shown the box with its lid on and told that some of the items inside were "the same sort of thing" or "things that go together". The lid was then removed, and items placed individually on the table. The participant was invited to name each item and to look for other objects which were the same or which went with it – as in the 2D task. A note was made of the approximate time taken in order that the same length of time could be allocated to the card-sorting task.

RESULTS

Shape task

Of the 55 children, 47 (87%) were able to categorise the shape cards. Chi-squared tests showed significantly more girls than boys were able to categorise on the basis of shape, X2 (1) = 9.71, $p < .01$, w = .42. No significant difference was found between cohorts, X2 (1) = 0.50, p = 0.48, w < .01.

Colour task

Only one participant was unable to match the single-coloured cards. However, the split-colours card evoked a range of responses; some children created a new category pile for the split cards; some appeared to change categorisation criteria and placed all solid colours in one pile and all split colours in another; some participants gave all split cards to their favourite single colour, and a few participants rearranged all cards into a pattern with matching colours touching. Due to the confusion caused by this element of the test, it was removed from the follow-up study. Chi-squared tests showed no sex difference in the ability to categorise on the basis of shape, X2 (1) = 3.07, p = .08, w < .01. Similarly, no significant difference was found between cohorts, X2 (1) = 0.16, p = .69, w < .01.

Picture Identification

Image recognition and naming was generally high with 86.5% of children achieving over 93% accuracy (M = 25.7 images). A two-way ANOVA was conducted to investigate whether identification scores varied according to the participant's sex and cohort. There was no significant main effect of sex, F (1, 48) = 3.87, p = .06, η^2 = .07, or cohort, F (1, 48) =2.32, p =.14, η^2 = .04, nor was there a significant interaction between sex and cohort, F (1, 48) = 1.52, p = .22, η^2 = .03.

2D (Image) categorisation task

Figure 2 shows the mean number of categories children identified from the images. A 2 (sex) x 2 (cohort) ANOVA demonstrated a significant main effect of sex, F (1, 50) = 9.66, p =.003 η^2 = .14, with girls performing better than boys. Children from Cohort 2 created more categories than the children from Cohort 1 but this result just failed to reach significance, F (1, 53) = 3.93, p = .053, η^2 = .06. There was a significant interaction between sex and cohort, F (1, 53) = 7.51, p = .009, .01 η^2= .11, whereby no sex difference existed in cohort 1 but girls outperformed boys in the higher socio-economic group.

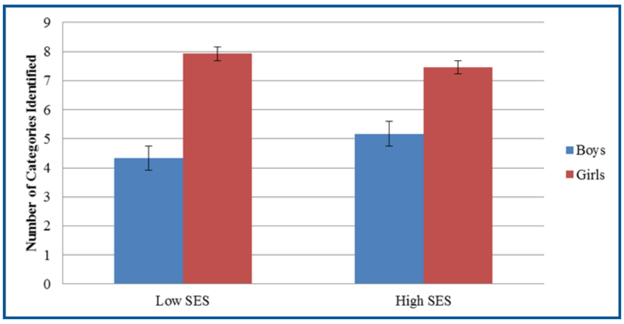

Figure 2: Mean number of categories identified from 2D (picture) images by sex and cohort

3D (Object) categorisation task

Figure 3 shows the number of categories children recognised when using 3D objects. A 2 (sex) x 2 (cohort) ANOVA was performed. This indicated that girls identified significantly more categories from 3D objects than boys, F (1, 49) = 12.59, p = .001, η^2= .20. However, no significant difference was found between cohorts, F (1, 49) < .01, p = 1.00, η^2 < .01, and there was no significant interaction between sex and cohort with regard to 3D categorisation, F (1, 49) = .37, p = .55, η^2 < .01.

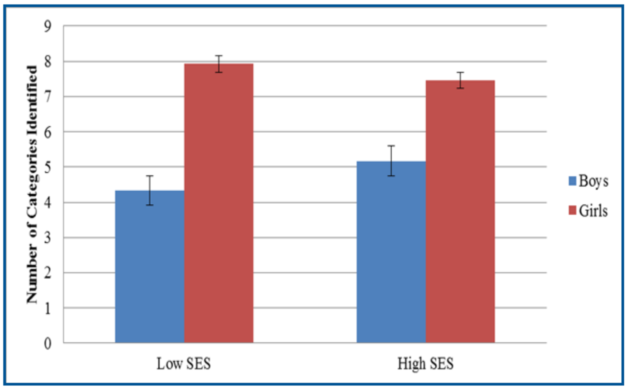

Figure 3: Mean number of categories identified from 3D objects by sex and cohort

Study 2

METHODS

All materials and timing protocols were as reported in Study 1. The only procedural modification was the removal of the split-coloured card which children found confusing.

Participants

One-Hundred and Ninety participants were recruited from four different Early Years settings in the East Midlands of England. These participants ranged in age from 30 to 60 months. Each of the settings was classified as predominantly White British, (i.e. with a White British population between 96.6-98.2%27). The parents / carers of all participants were issued with a written explanation of the research and provided informed consent prior to testing taking place. Children with a known learning impairment or pervasive developmental disorder (n = 16) were welcomed to play the games but, as this study sought to investigate typical developmental trajectories, their data were not included in the analysis. One hundred and eighty-two participants completed the full battery of tests and had their responses analysed. Data were collected from four sites (Cohorts 1-4) but for analytic purposes data were collapsed into two; Cohorts 1 and 3 (Group-1 - Low SES) and Cohorts 2 and 4 (Group-2 - High SES). Descriptive information about the sample is shown in table 1.

Table 1: Breakdown of participants by cohort, sex and mean age

Cohort	Males	Females	Total	% of Sample	Age Range in months	Mean Age (s.d.)	NID Rank*
1	32	43	75	39.5	37 - 49	43.4 (3.42)	2.800
2	26	18	44	23.2	30 - 50	39.5 (4.82)	30.657
3	25	23	48	25.3	36 - 49	42.1 (3.9)	1.043
4	7	8	15	7.9	30 - 50	42.4 (6.3)	29.964
5	6	2	8	4.2	54 - 60	56.4 (2.7)	29.964
Total	96	94	190	100	30 - 60	42.64 (5.24)	

*NID = National Indices of Deprivation (2019). Area ranking according to multiple indices of deprivation with 1 being the most deprived and 32,482 being the least deprived.

RESULTS

Shape and Colour task

One hundred and ninety participants completed the tests. Consistent with the findings from Study 1, the majority (84.2%) of children were able to correctly categorise all of the cards on the basis of shape.

A series of Chi-Square Tests were conducted in order to assess whether there was a significant association between the variables. These showed significantly more girls than boys were able to categorise on the basis of shape, X2 (1, 182) = 11.23, p = .001, w < .01. No significant difference was found between cohorts, X2 (1, 182) = 0.22, p =0.64, w < .01. Significantly more girls than boys were able to categorise cards on the basis of colour, X2 (1, 182) = 7.18, p =.007, w < .01. With regard to colour categorisation, no significant difference was found between cohorts, X2 (1, 182) = 0.44, p = 0.51, w < .01.

Table 2: Categories created and items used by modality

	Range	Mean	SD
Categories created using images	0 - 14	3.23	3.18
Cards used to create categories	0 - 43	7.61	8.16
Categories created using toys	0 - 18	6.40	3.25
Toys used to create categories	0 - 42	17.16	8.85

Note: If an item was re-categorised by a participant, this was counted as an extra item. Tus a bus classified with a car as “things with wheels” and with a doll ad a beach ball as “going to the coast/seaside” would be counted as two items. Any scores over 27 necessarily indicate some re-classification.

2D (Image) categorisation task

A 2 (sex) x 2 (cohort) ANOVA demonstrated a main effect of sex, with girls performing better than boys in the number of categories created, $F(1, 178) = 15.74$ $p < .001$ $\eta^2 = .07$, and the number of images used to create categories, $F(1, 178) = 15.59$ $p < .001$ $\eta^2 = .07$. There was also a significant main effect of cohort, with group 2 (higher SES performing better than group 1 (lower SES) in the number of categories created, $F(1, 178) = 18.75$ $p < .001$ $\eta^2 = .09$, and the number of images used to create categories, $F(1, 178) = 18.15$ $p < .001$ $\eta^2 = .08$. In addition, there was a significant interaction between sex and cohort for the number of categories created, $F(1, 178) = 17.30$, $p < .001$ $\eta^2 = .08$, and also for the number of cards used to create categories, $F(1, 178) = 14.27$, $p < .001$ $\eta^2 = .07$: no sex differences were observed in cohort 1, whereas girls outperformed boys in the higher socio-economic group.

3D (Object) categorisation task

A 2 (sex) x 2 (cohort) ANOVA demonstrated a main effect of sex, with girls performing better than boys in the number of categories created, $F(1, 176) = 18.74$, $p < .001$ $\eta^2 = .10$, and the number of objects used to create categories, $F(1, 176) = 23.51$, $p < .001$ $\eta^2 = .12$. There was, however, no significant main effect of cohort in the number of categories created, $F(1, 176) = 0.87$, $p = .35$, $\eta^2 < .01$, or in the number of objects used to create categories, $F(1, 176) = 3.31$ $p = .07$, $\eta^2 = .02$. There was a significant interaction between sex and cohort for the number of categories created, $F(1, 176) = 5.78$, $p = .02$, $\eta^2 = .03$, and also for the number of objects used to create categories, $F(1, 176) = 8.18$, $p = .005$, $\eta^2 = .04$: no sex differences were observed in cohort 1, whereas girls outperformed boys in the higher socio-economic group.

DISCUSSION

Initial analysis of the most commonly occurring 2D categories can be taken to evidence support for both the "exemplar" explanation of categorisation[28,29], and the assertion that basic level categorisation precedes the use of subordinate or superordinate categories[1]. Most participants selected regularly encountered items such as balls and birds. It was also notable that children from suburban cohorts frequently created an "in the park" category, whilst the children from lower socio-economic groups, both of which were in built-up areas, failed to do so. Conversely, children from more socially disadvantaged groups were more likely to recognise a link between the bus and the queue at the bus stop. The most popular superordinate category, and the category that attracted the most items for inclusion was "food", which each participant had regular exposure to. Children did, therefore, give the appearance of drawing on both episodic and semantic information[30] in order to formulate their categories. Furthermore, those items which had been amenable to deep-level processing through self-referencing[31] and to binal storage appeared to have been more accessible to recall. However, as all images had been specifically selected for their familiarity and typicality, it was questioned whether this had served to direct potential responses. Conclusions regarding the role of episodic memory and the use of exemplars in this test are therefore tentative.

Most children selected basic level categories, primarily birds and balls. However, whilst this could be regarded as evidence that basic level categorisation is the first of the hierarchical levels to emerge[1] it could equally be regarded as a simple matching of visually similar items[32]. For instance, the common crow and the rare, crested lark were the most common match, followed by the football and the beach ball. It is highly unlikely that any participant based their criteria on their personal experience or physiological understanding of crested larks. It would seem more feasible that the phenetic similarities between these category members had fostered recognition of equivalence[33]; especially as they shared key distinguishing features[34] and conceptual coherence[24]. Additionally, the superordinate category members on offer (the dog could, for instance, have been added to create a superordinate "animal" category) were physiologically dissimilar and so a clear understanding of their biology was required in order to create the grouping. Hence, basic level categories that can be formed on the evidence of physical similarities are very clearly "right", whereas subordinate and superordinate categories often necessitate a degree of specialist knowledge which the child may not yet possess or may not have sufficient confidence to propose to an adult[35]. The frequent clustering of food items did, however, provide clear evidence that three-year-olds are able to form superordinate categories. Familiarity and certitude appeared to be key factors here.

With this test format and selection of images, physical similarity amongst basic level categories appeared to be the most secure, accessible format for categorisation. This would fit with previous research findings that categories emerge in accordance with the extent of cognitive effort[36] and the amount of specialist information they require[37].

The results from Study 2 thus raised an abundance of questions regarding the role of visual and aural cues, the emergence of hierarchical levels and the importance of typicality. As has been previously noted, there is widespread agreement amongst theoreticians that categorisation begins with perceptual similarities[23,38] and develops to incorporate progressively greater abstraction[39], with the shift towards conceptual categorisation occurring when children are aged around six- to seven-years-old[38,40]. Whilst many have suggested that young children lack the world knowledge to classify on anything other than perceptual qualities[41] there was evidence of many three- to four-year-old participants (primarily girls), forming thematic links. Furthermore, their categories were not biologically grounded and required considerable cognitive effort, both of which are generally associated with older children[40]. Whilst there has been some previous evidence of preschool children utilising thematic criteria, it has generally been in response to instruction or researcher manipulation[42,43].

Two children diagnosed with selective mutism volunteered as participants in Study 1. One participant with a severe and persistent Specific Language Impairment participated enthusiastically and scored highly in each of the tests. Each setting had some children who spoke little or no English. Without exception, these children were able to successfully complete the tasks. It was therefore apparent that the test was accessible to pre-school children with little or no productive language and that it provided a measure of understanding and cognitive ability, which is often otherwise difficult to gauge. It also further contributes to the debate concerning the importance of language in categorisational ability[44]. It must be recognised, however, that it is possible children employed sub-vocalisation[45], or drew on received information[37] when completing the tasks. The development of their categorisational abilities may therefore have had a linguistic component that was influential but not apparent. These results merely demonstrate that a shared language is unnecessary when conducting this test battery.

Approximately 15% of the sample was unable to categorise on the basis of shape or colour. Undoubtedly, the inclusion of the split-coloured card confused a proportion of the participants, but even with this variable removed, the figure remained higher than would have been anticipated. When subject to analysis, it was clear that the majority of those who struggled with colour and shape were males. Even though some allowance was needed for the fact that the male participants from Cohorts 2 and 4 who encountered difficulties were predominantly under three-years-of-age, this did not fully address the issue, as girls of this age in these cohorts successfully completed the tasks.

The other particularly striking feature was the finding that virtually every child performed better when the task involved objects than when it involved images and this trend was most apparent amongst boys and amongst the more disadvantaged communities. These findings regarding modality are consistent with previous research[46], thus strengthening the assertion that objects provide a more sensitive measure of categorisational ability than pictures when working with the very young[26]. This is a particular issue for male participants and those from low SES cohorts. As many theories regarding the development of categorisation during the pre-school period are predicated on the use of image based match-to-sample tasks[14], it brings into question conclusions regarding the age at which key abilities emerge. It appears highly possible that the use of images in tests had masked participant's conceptual understanding. It should be noted, however, that our research with children aged five to six years (not reported here) suggests that once a child's understanding of categorisation is secure (generally around the time of their fifth birthday)[44] the gulf between the two modalities lessens. These older participants and some of the high-scoring younger children showed little disparity in their scores. It is therefore recommended that whilst categorisation tests using images are appropriate for use with school-aged children, pre-schoolers should use objects whenever possible.

One of the most striking aspects of the analysis was that girls performed better than boys in every instance and often by a considerable margin. This mirrors many previous research findings pertaining to developmental milestones[47-49] and educational attainment[27].

It was noted that, as well as generally recognising more conceptual links, girls also proffered more imaginative abstract categories (one girl suggested that the washing machine, car and ball formed a "go round and round" category and that the ball and dog belonged together in a category of "bouncy things").

By and large, superior performance in the Toolkit Development tests was also associated with socio-economic status, with the girls from the higher SES group achieving the highest scores and boys from the lower SES group achieving the lowest scores. In addition, whilst there were sharp divisions between the performance of children from high and from low socio-economic groups, there was relative cohesion within each demographic band, with children from disadvantaged backgrounds achieving lower scores.

These results mirror research findings regarding the link between deprivation and low academic achievement and are also in keeping with national trends at upper-secondary school level, where middle class girls achieve most highly and working class boys achieve the poorest results of Department for Education, 2022. Whilst conclusions from such a small-scale investigation must necessarily be tentative, this clear gender divide amongst pre-school aged children helps to contextualise boy's poor academic and examination performance later in the school system. It is suggested there are likely to be contiguous factors contributing to this achievement gap[43].

The order in which differing categorisational abilities became apparent was the same for virtually all children, and broadly replicated the findings of other researchers in the field. Colour and shape categorisation emerged first, followed by an ability to categorise objects[26], then images. Given the impact of socio-economic status and sex, it was unsurprising that the image test should show an interaction between the two, rending middle-class girls foremost and leaving working-class boys with magnified and contiguous disadvantages. This polarisation based on social class is reflective of divisions in academic attainment, which are apparent throughout the education system[50-53]. It is well documented that children living in poverty face, not only financial constraints, but a range of other factors which serve to impede their cognitive growth and emotional wellbeing[53,54]. Parental education rates tend to be lower whilst the incidence of lone parenting or young parenting is higher[55]. These factors are often associated with job (and subsequently, financial) insecurity[56]. As a result, children experience greater instability, poorer health and a higher incidence of inadequate living conditions[55]. Children raised in poverty therefore begin school already behind more affluent peers[57].

The studies reported within this paper were conducted with a sample drawn entirely from one relatively small area of England. It would be of interest to test children from beyond the East Midlands and indeed, beyond the UK in order to establish the generalisability of the findings.

The studies reported here demonstrate that the development of categorisational ability is impacted by socio-economic status. However, these findings are based on a dichotomised sample. It is felt that the study could usefully be extended to incorporate participants from a broader demography to establish whether the relationship is linear or clustered – specifically whether proximity to the poverty threshold is a significant factor.

CONCLUSION

This study sought to investigate the importance of sex and socio-economic status in the development of categorisation through use of a new, testing mechanism. The toolkit proved accessible to pre-schoolers of all abilities, including those with little or no functional English. As such, it provided a quick and illuminating insight into preschool children's categorisational abilities. The data drawn from a demographically diverse group, adds further credence to previous assertions regarding a developmental trajectory and provides new insights into the importance of sex and socio-economic status in the development of categorisation.

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Resumo

Introdução: embora nos últimos anos tenha havido pesquisas consideráveis sobre a categorização infantil, seu desenvolvimento durante o período pré-escolar atraiu muito menos interesse e inovação.

Objetivo: este artigo documenta o desenvolvimento de um novo kit de ferramentas válido e confiável para medir a categorização em crianças, projetado para permitir diferenciação refinada por meio de quatro tarefas curtas.

Método: o artigo descreve como um estudo piloto com 55 crianças reduziu variáveis de confusão, descartou várias explicações para variações de desempenho e permitiu refinamentos de procedimentos. Em seguida, documenta um estudo realizado com 190 crianças de 30 a 60 meses.

Resultados: este mecanismo de teste mais sofisticado desafia as normas de desenvolvimento previamente aceitas e sugere que o sexo e o status socioeconômico (e sua interação) influenciam as habilidades de categorização em pré-escolares.

Conclusão: os resultados indicam que a capacidade de categorização dos pré-escolares varia acentuadamente, com implicações na sua capacidade de acesso à educação formal.

Palavras-chave: categorização, crianças pré-escolares, desenvolvimento, medição, diferenças sexuais, situação socioeconômica.