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Good for Children, Good for All?

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Abstract. In this work, we reason how focusing on Information Retrieval (IR) for children and involving them in participatory studies would benefit the IR community. The Child Computer Interaction (CCI) community has embraced the child as a protagonist as their main philosophy, regarding children as informants, co-designers, and evaluators, *not just users*. Leveraging prior literature, we posit that putting children in the centre of the IR world and giving them an active role could enable the IR community to break free from the preexisting bias derived from interpretations inferred from past use by adult users and the still dominant system-oriented approach. This shift would allow researchers to revisit complex foundational concepts that greatly influence the use of IR tools as part of socio-technical systems in different domains. In doing so, IR practitioners could provide more inclusive, and supportive information access experiences to children and other understudied user groups alike in different contexts.

Keywords: Children · Mental models · Relevance · Information Access

1 Is IR Good for All?

Information Retrieval (**IR**) has proven its enduring value as a research area. It has adapted to the demands of the constantly evolving digital ecosystem and continues to capture the attention of researchers and industry practitioners alike. This is evident in the broad spectrum of contributions the community has put forward-ranging from innovative strategies for efficient indexing and successfully managing the volume and speed of data growth to the development of neural-based models for retrieval and ranking in the era of AI [39,53]. Moreover, we have seen the emergence of IR models that leverage Large Language Models (**LLMs**) and contributions that respond to new means of interacting with IR

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systems, such as clarifying questions or conversational search [26,52,72,81]. Over time, contributions in IR have broadened in their scope to focus on its applicability in specific domains (e.g., finance, legal, enterprise, and medical) [28,68]. IR has also taken a deeper look at issues of fairness and biases of IR algorithms [23]. Additionally, it has explored how users interact with IR systems in different contexts, leading to research that examines cognitive biases during the information-seeking process and study and addresses, among others, issues of filter bubbles and echo chambers caused by search and recommendation systems [21,73].

Most IR research thus far, including models, methods, and even theory, has been primarily characterised by a system-driven approach and the study of interactions generated by adult users. To illustrate this point, consider the TREC tracks, CLEF labs, or well-known datasets like MS Marco that serve as means to identify new research directions and assess the performance of new strategies. The majority target or are based on mature populations. Although IR relies upon user studies to gather new samples, these tend once again to encompass more mature users—often computer scientists or more technically-savvy individuals on crowd-sourcing platforms. Further, these studies often elicit user-system interactions in somewhat *artificial environments* [80].

We question whether IR, in its current form, meets the needs of *heterogeneous searchers*. In our pursuit of a more inclusive IR, we advocate for a radical change in approach: involving real users actively in shaping new models that consider the various ways in which users seek information, whether through pulling or being pushed content as a result of asking, querying, and browsing. This also involves considering the real-world settings in which content is retrieved. To gain insights and knowledge from a diverse range of real users, it is essential to expand the scope beyond the commonly studied mature user demographic. This includes exploring populations that are often overlooked (i.e., understudied user groups [63]), each with unique needs, constraints, and expectations. We propose starting from a particularly promising group of users: **children**. Children are free from bias caused by previous experiences or exposure to technology and, more importantly, their skills, attitudes, and expectations evolve over time. By studying children in different contexts, where their searches may be guided by educational requirements or for pleasure, we aim to gather foundational knowledge to inform future IR research and development under the proposed paradigm shift.

IR researchers sought to broaden IR research by exploring IR systems specific to children. An example of this is Yahooligans! [59], which launched in 1996 and was one of the first large commercial IR systems for children. Since then, we have seen several attempts that from diverse perspectives seek to answer: *how to grow Child IR?* Researchers have identified a range of barriers (summarised in the SWIRL 2012 report [3]) and have proposed a small set of potential solutions [e.g. 19,20,27,47]. Most of these solutions, however, are grounded on Human-Computer Interaction (**HCI**) and Child-Computer Interaction (**CCI**) paradigms and methods that do not necessarily follow IR standards. The preliminary explo-

ration of the many challenges related to Child IR, including interfaces, relevance determination, diverse contexts, and ethics, has contributed to an extent to the growth of this particular area. At present, however, there are no de facto standards. Furthermore, there is a perception within the IR community that solutions for children represent a 'downgrade' compared to those for adults [49]. Paraphrasing Bilal [11], children are not simply *short users*, they are *unique users*. This is why the IR community could and should learn from children [49].

2 Why Start from Child IR?

As a growing Internet user group, children turn to the Web daily for information access [31,36], which is why empowering them from early on so that they can best take advantage of information retrieval tools that serve as a conduit to access information is a must. This first requires exploring how this user group perceives information retrieval tools and identifying the necessary elements for children to actively engage and contribute to research and development. Simultaneously, understanding how the IR community (and beyond) should adapt to a methodological shift while drawing on the collective knowledge amassed as a research community thus far is crucial.

We leverage the efforts of the CCI community on *participatory* studies to better understand children's needs and mental models. On the same line, we take into account the *sociological* factors, such as the impact of peers and adults on children's use of IR, as well as the *ethical* implications of the child as protagonist. Through these lenses, we zoom on some specific concepts inherent to IR for children—some already under study, such as the concept of relevance, the role of trust, or the significance of emotions in the information-seeking process—and the tools and frameworks being used for these explorations hint at the impact findings can have on mainstream IR research. In so doing, we unveil details of the methodological shift advocate.

The reflections and discussions that follow are meant to serve as a starting point and inspire future research agendas. Although we mention children in a more 'theoretical' sense, IR researchers and practitioners must acknowledge that in 'practice' there is a need to move past the broad definition of children, i.e., away from the 'one-size-fits-all' mentality. Instead, we should consider how children's in-development skills and ideas will require different strategies in how to involve children as research partners at different stages of their lives. For instance, the use of drawings might be a better approach for 9 to 11-year-olds, whereas the think-aloud process might help researchers elicit insights from younger audiences and surveys or diary studies could be better suited to involve teenagers [8,45,78].

Relevance. As remarked by Blair [12], relevance is an "ineffable concept," indeed a concept difficult to define objectively as it refers to how retrieved content appropriately fulfils a specific information need; its interpretation varies depending on the origin of the information need and how it can be satisfied [9]. Looking at children's understanding of the concept of relevance from early on, and how

that understanding can evolve as they grow, can help researchers and practitioners better model the concept of relevance in practice. Children searching in the classroom could provide a well-defined framework that naturally aligns with the concept of *situational* relevance, particularly the *motivational/affective* "inherent characteristics of relevance behaviour" [14]. In this case, the former looks at the usefulness of retrieved materials in relation to the tasks assigned by teachers; whereas the latter considers the goals and motivations behind searching for learning. Teachers could naturally assess usefulness, but motivational/affective relevance is more complex to study when young searchers are involved, making it an interesting area to be further investigated.

Focusing on children in the classroom, and to elicit their perception of relevance, researchers involved children in a collaborative exercise and asked them to draw icons to be used for tagging useful content for their peers [45]. The analysis of children's feedback, as in the themes emerging from the drawings and from the answers to a survey run to elicit their point of view on the exercise, helped authors understand how children interpret relevance when discriminating among results guided by their information need triggered by the teacher's assignments. In a related work [2], the authors analysed children's behaviour when interacting with an emoji-enhanced search engine result page where icons were used to elicit three shades of relevance: negative, neutral and positive. While the focus of the study was on how to improve the quality of the overall search experience, the way children embraced naturally the shades of relevance and the impact these proved to have on more effective search performance signals the promise of how such a study could help better understand the concept of relevance and its interpretations in the classroom and beyond.

Research Partners, not Spectators. The previous examples show how putting users at the centre of research and having them play an active role in the team is conducive to interesting insights while enabling researchers to define otherwise ineffable concepts. The child as the protagonist is a well-established principle in CCI [38], and there are available techniques to help researchers run effective studies in a collaborative setting. Looking at the CCI literature, we find several instances of children interacting with IR systems, often via innovative interfaces such as vocal agents and robots. These contributions mainly target the design of original and better—more usable—interactions and produce useful guidelines for peers to use. These guidelines, however, do not directly address the IR research community–they neither use the proper terminology nor adopt a rigorous TREC-like methodology. Further scrutiny shows the potential of their findings for informing the design of IR systems that are not only more usable but also, more useful in providing more relevant results to users at large. A good example is a work describing how children interact with vocal assistants via spoken queries and aiming at providing guidelines for the design of more usable agents [79]. While highlighting the importance of personification to support a good user experience, researchers also reported on the different categories of query reformulation children and their adults in the loop adopted in an attempt to overcome the poor performance of the underlying IR system. These

categories, ranging from *Off Course* - where users change their questions to find something the system can answer to *Stating Context* and *Expanding* pronouns, offer a picture of the gap between the *mental models* [13] of searchers and the system, a very valuable contribution for the IR community.

Child-IR System Interaction. Vocal agents and how these can be designed to cater to children are the focus of the work presented in [47]. The authors involved children as active informants by having them solve school-related search tasks in a Wizard of Oz set-up [32]. The tasks were produced in collaboration with teachers who assessed their complexity. Children could interact with a traditional GUI or a vocal assistant to support their search experience. Overall, satisfaction was the same across both interfaces. However, efficiency varied, with children spending less time per search when interacting with the vocal assistant. This finding helps elicit searchers' mental models and better understand how their behaviour changes according to the expectations raised by the system and how this can implicitly trigger browsing and exploring, all important activities to support the search as learning (**SAL**) experience [66]. Looking further into how to co-design a search agent to help children with their homework [48], the authors uncovered the impact of familiarity with technology in general and the importance of search experience on children's expectations and preferences, providing a glimpse into different mental models and their influence on the acceptance and use of new functionalities supporting searchers.

Search Roles. Foss et al. [29] introduced the concept of search roles—the range of skills and aptitudes exhibited when searching—children play when seeking information for pleasure. They did so by leveraging interviews and observations. A recent study [44] adopted a quantitative approach based on search logs and teachers' observations to probe whether these roles could be observed in the classroom. The authors (i) discerned most of the original roles and new ones inherent to the learning context and (ii) identified gaps in how to study the remaining roles. From the reported experiences, which include initial exploration of applicability into adolescents and adults [22,29,30,43,44], it seems feasible to merge qualitative and quantitative inquiries into formal methodologies that can distil natural search roles–search personas–as tools to model more accurate representations of searchers and guide the design of better systems.

Search as Learning. Information-seeking is the "process, in which humans purposefully engage to change their state of knowledge" [56]. Following this line of thinking, researchers in the early 2000 s focused on the SAL paradigm, which discusses *learning to search* while *searching to learn* [34,66]. Exploring SAL aligns naturally with children from whom learning is a way of life. Involving teachers and/or parents playing the role of the more knowledgeable other [24] creates a rich environment to gauge the knowledge gain triggered by search activities [67]. In fact, it is somehow easier to account for children's prior knowledge than adults'; assessing progress and changes in their original knowledge state is more straightforward. Additionally, the development of search skills can be more directly monitored as children tend to start from basics to low profi-

ciency in search, making them more likely to be free from prejudices, biases and expectations.

Emotions. Contributing to a better understanding of what makes a search result more appealing and clickable for children is the work by Landoni et al. [51] that builds on a study on adult users [41]. The studies reflect on the impact of emotions in attracting searchers' attention to search results. In both cases, results charged with positive emotions were more attractive than neutral ones. When considering children's search behaviour, negatively charged results seemed to equally attract their attention and trigger a more active engagement with the search process. The direct involvement of the children, together with the active role of their teacher in the classroom, was conducive to rich exchanges with peers and contributed to a better understanding of the complex role emotions can play if mediated by all the stakeholders. Studies that take inventory of the influence of emotions on search behaviour would pave the way for the design of IR systems that provide better and more engaging search experiences.

Trust. People tend to trust search engines; they perceive them as platforms that provide accurate and reliable information; they also deem higher-ranked search results as more credible [16,35,71]. Research thus far has shown that children do favour higher-ranked results [33,75], yet it is unclear if this is due to their trust in the system that offers them access to information. Although children tend to naturally start from a position of trust as they are still developing their critical ability, recent studies highlight that they do not trust suggested search results if they cannot identify the source [64]. In other studies, they associate the concept of trust with that of privacy and a safe environment [1]. Understanding what 'trust' really means for children would help better understand the dynamics with adults, even if it is another direction that will benefit from methodological approaches that make children protagonists, as in participatory design.

Accessibility and Inclusion. IR systems are "powerful intermediaries" [74] to information, and thus resources children are exposed to can "influence how they see the world" [65]. The development of children's cognitive and motor skills, along with their cultural background and social context, invite scrutiny of factors that, from their perspective, affect the search experience. Fostering accessibility and inclusion cannot begin with a "stereotype" child searcher. This instead requires simultaneously accounting for factors like text complexity, legibility, and readability together with cross-cultural conditions [4,18,57], which is a complex, and certainly human-driven undertaking. The influence of the adults in the loop: educators, parents, older siblings, acting as role models [29] needs to be considered as they can pass on to children their positive or negative experiences with a long-lasting impact on their future attitude towards the use of IR.

Ethics and Regulations. Ethical implications of IR systems on children are carefully scrutinised to strike a balance between the right to information access [6] while avoiding exposure to unsuitable content, such as fake news and information pollution, to name a few [46,50,55]. This echoes UNICEF's recommen-

dations for policymakers and civil society (including academics) regarding protecting children "from the harms of mis/disinformation" [37] while building and strengthening among children (and ultimately all individuals) the ability to "navigate and evaluate digital information environments" [37]. Careful attention is paid to the rights of children, and there are many initiatives at the European level [17,60,61], to include and give them an active role when looking at solutions to provide a safe and rich information space for children to learn and grow. Such a setting could provide a valuable paradigm for other similarly vulnerable user groups.

3 Is Child IR Good for All?

The PuppyIR project (2009-2012) enabled core IR researchers to allocate resources to study and build an open-source IR environment that would better serve children [7]. Outcomes from this project revealed the challenges involved in taking IR concepts from theory to practice when children are the main stakeholders [e.g. 40,54]. Our discussion shows that advances inspired by PuppyIR and other seminal works have indeed contributed towards advancing Child IR [e.g. 10,25,33,58]. Nevertheless, for the next iteration of Child IR research to be truly meaningful and impactful, there is a need for a paradigm shift. For this—and inspired by the limited existing works already aiming to put children (of all ages) at the centre [27,45,47,75,79]—we have outlined how core IR concepts must be revisited from the eyes of a child user and their context, ***rather than adapted***. We posit that doing so will put the human at the centre—starting with children—and model individuals, rather than 'users', better respond to their needs and requirements, and, support the IR community when facing AI, ethical and policy challenges [5,69,70,76].

Digital humanism calls to "shape technologies in accordance with human values and needs, instead of allowing technologies to shape humans," [77]. This is crucial in the era of AI. A step in this direction is the principle of Human-driven IR, which is already gaining momentum [15,42,62]. We contribute to this discussion by endorsing a paradigm shift that prioritises equity in online information access, moving away from the one-size-fits-all approach. Researchers and practitioners should collaborate across disciplines to not only develop Child IR but also expand knowledge and extend technological advances to ***stakeholders with specific search needs poorly served by IR systems***. By focusing on children as a starting user group, we are confident that it will be possible to outline a blueprint of sorts to expand the understanding of other understudied user groups and of human values and needs that should drive technology design. Using the same lenses (participatory, sociological, and ethical), we suggest considering: (i) *other user groups*, e.g. low-literate adults, (ii) *broader contexts*, e.g. museums and libraries, (iii) *different information needs*, e.g., beyond those coupled with learning in the classroom context, and (iv) even other *information access tools*, e.g. recommendation, question-answering systems, social media platforms, and LLM-based models like ChatGPT that are so in vogue.

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