

## Using the Empathy Map Instrument to Analyze Human-Computer Interaction in Web Search Interfaces Among Libyan Children

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## استخدام أداة خريطة التعاطف لتحليل التفاعل بين الإنسان والحاسوب في واجهات البحث على الويب لدى الأطفال في ليبيا

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### Abstract:

Children, due to their developmental stage, often face cognitive, physical, and experiential limitations that affect their interaction with computer interfaces. Their use of technology is influenced by factors such as limited reading skills, reduced attention span, and a lack of familiarity with digital tools. These challenges necessitate the application of both qualitative and quantitative research methods to understand their unique interaction patterns. This study employed the Empathy Map tool as a qualitative analysis technique to explore the attitudes, behaviors, and challenges experienced by children when interacting with web search interfaces. The study sample consisted of 15 children aged between 6 and 10 years, comprising 7 girls and 8 boys. Age was the sole variable considered in the analysis. A usability test was conducted in which each participant was asked to complete two search tasks using Google and Bing search engines independently. Data collection was carried out through observation and detailed note-taking. The findings derived from the Empathy Map tool provided insights into the children's thought processes, emotions, and behavioral tendencies during web search interactions, specifically with Google and Bing interfaces. The study highlights the need for child-friendly design considerations in search engine interfaces to improve accessibility and usability for younger users.

**Keywords:** Human-Computer Interaction, Children, Empathy Mapping, Web Search Google Interface, Web Search Bing Interface.

## الملخص

يواجه الأطفال، نظرًا لمرحلتهم النمائية، قيودًا معرفية وجسدية وتجريبية تؤثر على تفاعلهم مع واجهات الحاسوب. ويتأثر استخدامهم للتقنية بعوامل متعددة مثل محدودية مهارات القراءة، وقصر مدى الانتباه، ونقص الإلمام بالأدوات الرقمية. وتستلزم هذه التحديات توظيف مناهج بحثية نوعية وكمية لفهم أنماط تفاعلهم الفريدة. وقد استخدمت هذه الدراسة أداة خريطة التعاطف (*Empathy Map*) كمنهجية تحليل نوعي لاستكشاف اتجاهات الأطفال وسلوكياتهم والتحديات التي يواجهونها أثناء تفاعلهم مع واجهات البحث على الويب. تكونت عينة الدراسة من 15 طفلًا تتراوح أعمارهم بين 6 و10 سنوات، منهم 7 إناث و8 ذكور، وكان العمر المتغير الوحيد الذي أخذ في الاعتبار ضمن التحليل. تم إجراء اختبار قابلية الاستخدام، حيث طلب من كل مشارك إكمال مهمتي بحث باستخدام محركي البحث *Google* و *Bing* بشكل مستقل. وُجمعت البيانات من خلال الملاحظة وتدوين الملاحظات التفصيلية. وأسفرت النتائج المستخلصة باستخدام أداة خريطة التعاطف عن تقديم رؤى معمقة حول العمليات الذهنية، والانفعالات، والميول السلوكية للأطفال أثناء تفاعلهم مع واجهات البحث على الويب، وتحديدًا واجهتي *Google* و *Bing*. وتسلط هذه الدراسة الضوء على الحاجة إلى إدماج اعتبارات التصميم الملائم للأطفال في واجهات محركات البحث، بما يسهم في تحسين سهولة الوصول وقابلية الاستخدام للفئة العمرية الأصغر.

**الكلمات المفتاحية:** التفاعل بين الإنسان والحاسوب، الأطفال، خريطة التعاطف، واجهة البحث على الويب لمحرك *Google*، واجهة البحث على الويب لمحرك *Bing*.

## Introduction

Child development involves a series of ongoing changes in physical, cognitive, emotional, and social abilities. These developmental changes significantly influence how children interact with and adapt to digital technologies [1,2]. In the field of Human–Computer Interaction (HCI), much of the existing research has focused predominantly on adults and young adults, often overlooking younger users such as children. As noted by [3], many HCI studies, including those claiming to address children, primarily leverage methods adapted from adult contexts, with children frequently treated as passive testers rather than active participants. Convenience sampling also persists: most user studies rely on university students aged 19–26, creating a significant age bias toward adults [4].

However, understanding how children engage with digital interfaces, particularly search engines, is critical for designing inclusive, age-appropriate technologies. Children often face distinct challenges in using computers due to limited reading comprehension, shorter attention spans, and lack of digital literacy [5]. Therefore, research methods tailored to capture the cognitive and emotional experiences of children are essential for accurately assessing usability and accessibility.

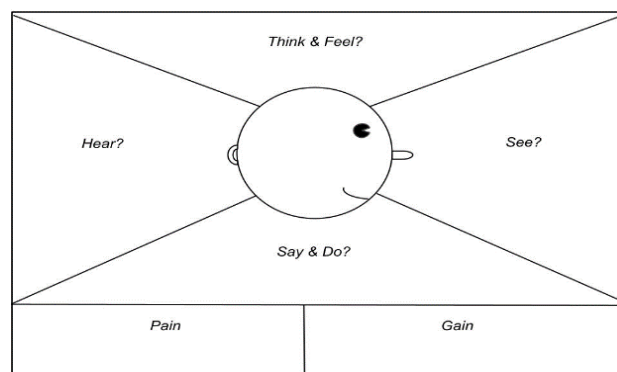
In this context, the present study utilizes the Empathy Mapping tool to examine children's interactions with search engine interfaces. Empathy mapping, a visualization method capturing what users say, think, feel, and do, helps researchers understand users' needs and experiences [6]. This method enables researchers to interpret what the child user is saying, doing, seeing, hearing, feeling, and thinking while performing search tasks. By applying Empathy Mapping, the study aims to identify key usability issues and provide guidance for creating more efficient and kid-friendly web search interfaces.

## Empathy Mapping

Empathy Mapping is a user-centered design tool that helps researchers and designers gain deeper insight into a user's needs, behaviors, and emotional responses. Unlike traditional demographic profiling, Empathy Mapping explores the user's perspective by focusing on their real-time experiences and motivations during interactions with a product or interface [6,7,8].

In the context of Human–Computer Interaction (HCI), Empathy Mapping serves to analyze how users physically, emotionally, cognitively, and socially engage with a system. For child users, this involves capturing their expressions, reactions, frustrations, and moments of joy while navigating digital tools, data that can reveal critical design insights and help tailor interfaces to developmental needs. The primary objective of Empathy Mapping is to build empathy with a specific user group, in this case, children, to better understand their decision-making processes, attention patterns, and interaction preferences [9,10] originally proposed that Empathy Maps should address four key areas: what the user hears, thinks and feels, sees, and says and does [11,12], later expanded the model by incorporating "Pain" and "Gain" zones, which highlight the difficulties users encounter and the benefits they perceive from the interaction [13].

Figure 1 illustrates this extended Empathy Map structure, which was used in this study to analyze children's experiences with Google and Bing search engines. The insights gained from this approach contribute to developing more intuitive, accessible, and entertaining.



**Figure 1: The Template of the Empathy Map [12].**

### The 5W Questions

The 5W framework (Who, What, When, Where, Why) is an essential tool for structuring search tasks, particularly in studies related to Human-Computer Interaction (HCI) and Web Search Interfaces. It is widely used for the following reasons:

#### 1. Encouraging Exploration and Comprehension:

The 5W questions stimulate children's cognitive development by encouraging them to seek both factual and conceptual information. Studies have shown that such questions enhance children's critical thinking and understanding of the world around them [14].

#### 2. Facilitating Natural Search Behavior:

According to research, children often begin search queries using 5W question types, particularly "What," "Where," and "Who" [15]. These question types align with how children naturally inquire about their environment, making them an intuitive fit for search tasks.

#### 3. Supporting Cognitive Structuring:

The simplicity of the 5W framework helps to break down complex questions into smaller, manageable pieces, aiding children in navigating and processing information more effectively. This approach creates cognitive scaffolding, especially when interacting with digital information [16].

#### 4. Improving Usability Observations:

In web search interface studies, 5W tasks allow evaluators to track how users locate factual versus conceptual information, observe how they interact with search filters, and assess engagement with features like search snippets, images, or videos [17]. For instance, when asking a "What" question, children may be more inclined to seek definitions, whereas a "Where" question may prompt them to focus on locations or maps.

#### 5. Cross-Cultural and Linguistic Applicability:

The simplicity and universality of the 5W questions make them adaptable across cultures and languages. This is particularly valuable in multi-lingual environments like Libya, where children may be engaging with search tasks in both Arabic and English. The framework helps bridge linguistic differences and provides valuable insights into children's search behavior in diverse cultural settings.

#### A. Measuring Empathy and Empathy Mapping

Measuring empathy and empathy mapping involves a variety of observational and data collection methods, each tailored to the user's context. When designing for children, empathy becomes a critical skill, it requires stepping into the child's cognitive and emotional world without imposing adult assumptions [18].

In Human-Computer Interaction (HCI), Empathy Mapping is particularly useful for capturing users' thoughts, feelings, and behaviors during interaction with digital interfaces. It provides insights into children's real-time experiences, including what they say, do, see, hear, feel, think, and struggle with, while using technology [9,19]. The application of empathy mapping in this study was led by the following important questions:

- What the children say: What do children express about using Google and Bing search interfaces?
- What do the children do: How do they carry out the given search tasks?
- What the children see: What usability issues do they notice during interaction?
- What do the children hear: What do they perceive through auditory feedback or verbal guidance?
- What the children feel: How do they emotionally respond to completing search tasks?

- What the children think: What thoughts do they express about the utility of search engines in their learning or daily lives?
- What the children find painful: What parts of the interface or tasks cause frustration or confusion them?
- What the children gain: What benefits or satisfaction do they experience from using search engines?

## The Study

### Study Objective

The objective of this study was to observe and analyze the interaction between children and commonly used web search interfaces, specifically Google and Bing. Using the Empathy Mapping tool, the study aimed to reveal what children say, do, see, hear, feel, and think during their search experiences. These insights are intended to assist developers and designers in identifying usability challenges and improving interface accessibility for younger users.

### B. Participants

The study included 15 children aged between 6 and 10 years. Age was the sole selection criterion, as the study was not focused on socio-demographic characteristics. Of the 15 participants, 7 (46.7%) were girls and 8 (53.3%) were boys. On average, the children had been using search engines for 2 to 3 years, primarily for schoolwork and general information searching. About 67% of participants indicated that search engines were helpful and made finding information more convenient and fun.

### C. Technology Setup

During the test sessions, all participants used the Windows 10 operating system. Nine children used the Google search interface on the Chrome browser, while six used the Bing interface via Mozilla Firefox. All computers had a uniform hardware configuration, using 15-inch monitors with a resolution of 1024 × 768 pixels to ensure consistency.

### D. Observation and Note-Taking

Participants were observed while performing their search tasks, and detailed notes were taken to record their behaviors, reactions, and issues encountered. Observation and note-taking were selected as flexible and effective qualitative data collection methods, allowing researchers to identify interaction issues as they occurred in real time [20]. This approach helped associate specific reactions—such as confusion or frustration, with elements of the user interface.

### E. Usability Test

Usability tests were conducted through individual one-on-one sessions. Each child completed two search tasks, one using Google and one using Bing. Due to the difficulty of gathering a sufficient number of children at the same time, the sessions were conducted at different times and in various locations, such as homes and schools, to ensure broader participation and provide a suitable environment for each session. Each session was monitored and recorded by the researcher through direct observation. To observe how children interact with search interfaces, we developed the following search tasks using the 5W question framework. These tasks were designed to be both engaging and educational: The developed questions are shown in tables 1 and 2.

**Table (1): Search Task Sets 1.**

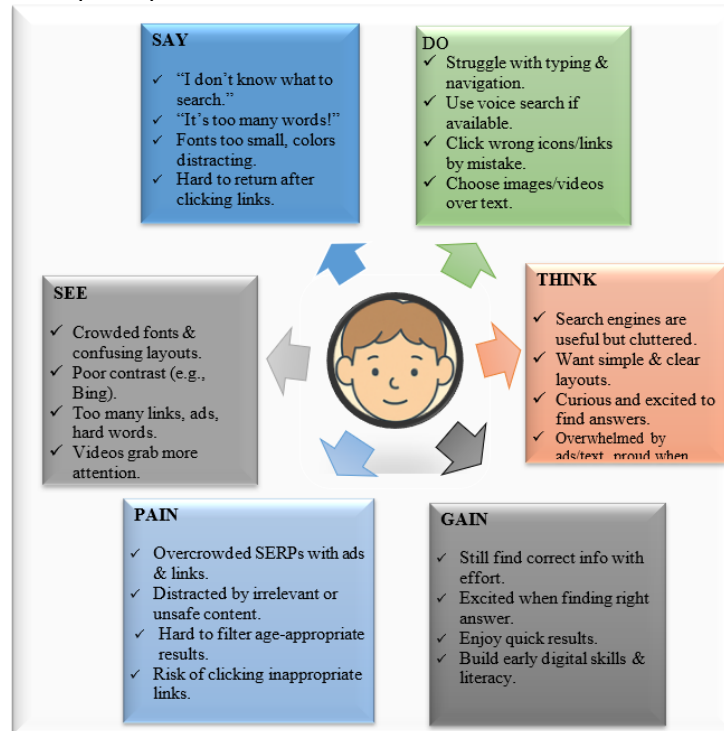
SN.	Task (English)	المهمة (بالعربية)
1	What is the capital of Tunis?	ما هي عاصمة تونس؟
2	Who is the fastest animal on land?	من هو أسرع حيوان على اليابسة؟
3	When do penguins sleep?	متى تنام طيور البطريق؟
4	Where do lions live?	أين تعيش الأسود؟
5	Why do we brush our teeth?	لماذا نفرش أسناننا؟

**Table (2): Search Task Sets 2.**

SN.	Task (English)	المهمة (بالعربية)
1	What is the largest ocean in the world?	ما هو أكبر محيط في العالم؟
2	Who was invented the telephone?	من اخترع الهاتف؟
3	When is the first day of school in Libya?	متى يبدأ العام الدراسي في ليبيا؟
4	Where can penguins be found?	أين تعيش طيور البطريق؟
5	Why do stars shine?	لماذا تلمع النجوم؟

## The Study Result

Using the Empathy Mapping tool, Figure 2 shows the essential findings of note-taking on an empathy map, Figure 3 shows the children completing search tasks during the experiment, and the following key findings were derived from participants' interactions:



**Figure 2: Study Result on An Empathy Map.**



**Figure 3: The Children Participants Performed Search Tasks During the Experimental Time.**

- **SAY:** Children often expressed that search engines were useful but sometimes difficult to use. Several noted that typing queries was tiring, editing text was confusing, and that the font on results pages was too small. Some mentioned that Bing's color scheme was distracting and made it hard to focus. Others found it difficult to return to the search page after clicking links. For example, Yasin say, 8 years old, "I don't know what to search" and "It's too many words!".
- **DO:** Children faced challenges with typing, navigating, and recognizing icons (such as text, voice, and image search) and often use voice search (if available). They often clicked the wrong icons or links by accident and often select images or videos instead of reading the text. Many seemed unsure and a bit nervous, especially when they were not sure if they had done the right thing. For example: Abdallah, 9 years old, were observed to click the first link without reading it carefully and often select images or videos instead of reading the text.
- **SEE:** Participants reported issues with closely spaced fonts, confusing layouts, and poorly contrasted background colors particularly on Bing. They preferred simple structures with larger fonts, high contrast, and clearly labeled buttons. In addition, they saw a plain, text-heavy interface and videos (YouTube), which draw more attention.



For example: Mohammed, 10 years old, said "The search results is with unfamiliar links, ads, and hard words ".

- **THINK:** Most children saw search engines as useful tools, but some described them as "too full of links and words" or "hard to read." They preferred simple and clear layouts, showing only the most important features. Children were observed to:
  - Be curious and excited to find answers quickly.
  - Feel confused or overwhelmed when there's too much text, clutter, or ads.
  - Feel proud, smart, and independent when they successfully find the information they're looking for.
- **PAIN:** Children struggled with crowded search engine results pages (SERPs). The volume of text, advertisements, and unrelated links distracted their attention and made it difficult to focus on the correct results. The layout complexity was a major usability pain point. Children were observed to:
  - Hard to filter results for age-appropriate content.
  - Distraction from unrelated and unsafe content.
  - Frustration from complex layouts and irrelevant results.
  - Risk of clicking inappropriate links or ads.
- **GAIN:** although children faced some challenges, most were able to find the right information during the search tasks. They showed excitement when they found the correct page or image and enjoyed how quickly they could get answers with just a few clicks. This shows that search engines can support children's curiosity and learning when used effectively. Through these tasks, children:
  - Learned basic skills in using search engines.
  - Got quick access to information (even if they could not always tell if it was true or not).
  - Were introduced to online reading and browsing, helping build early digital literacy.

## The Conclusion

This study employed Empathy Mapping as an analytical tool to investigate the interaction between children and web search user interfaces, with a particular emphasis on their emotional and behavioral responses. By capturing the multifaceted aspects of children's experiences, namely, what they say, do, see, hear, feel, and think, the study identified critical usability challenges that hinder effective interaction. These challenges included issues related to interface complexity, text readability, icon clarity, and navigation intuitiveness. The incorporation of 5W tasks in web search interface studies provides a structured and comprehensive approach to examining children's interactions with digital information. These tasks allow for the identification of the search features most frequently utilized by children, shedding light on how they process and engage with search results. By focusing on basic, age-appropriate, and relevant questions, the study further evaluates the extent to which popular search engines, such as Google and Bing, meet the accessibility and usability requirements of young users.

A fundamental understanding of emotional and cognitive responses is essential when designing interfaces for younger audiences. The developmental stages of children significantly influence their interactions with digital platforms, necessitating the consideration of their cognitive and emotional needs. The findings of this study underscore the importance of creating search interfaces that are simplified, visually accessible, and intuitively navigable, specifically tailored to accommodate the diverse needs of children. Finally, this research highlights the significant role of empathy-driven evaluation tools, such as Empathy Mapping, in the Human-Computer Interaction (HCI) design process. By adopting such tools, designers can enhance the inclusivity and usability of digital platforms, ensuring that interfaces are effectively optimized for all user groups, especially those with specific developmental requirements.

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