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Spatial Thinking Structures of Women in the Activity of Folding Clothes: A Cognitive Ethnography Study

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Abstract. *This study aims to analyze the structure of women's spatial thinking during the activity of folding clothes, employing a cognitive ethnographic approach. The study focuses on the thought patterns and spatial strategies respondents use to determine techniques for folding, storing, and arranging garments. Data were collected through in-depth interviews with five housewives and analyzed using qualitative methods with a thematic coding approach. The results indicate that folding clothes involves various spatial concepts, such as symmetry, translation, and rotation that implicitly reflect an understanding of geometry in everyday life. Respondents also demonstrated adaptive strategies by adjusting fold sizes according to storage space capacity, aligning with the concept of spatial affordances. Furthermore, the majority of respondents arranged clothes in a pyramidal shape to maintain order and ease of access, a practice linked to Gestalt perception principles. Social and cultural factors also play a significant role, as folding techniques are passed down through generations, supporting the theory of sociocultural cognition. This research contributes to the field of ethnomathematics by revealing the connection between domestic activities and spatial thinking. The findings also have implications for household design, particularly regarding the creation of more efficient storage systems. Further study is needed to explore how spatial skills developed in a domestic context can be optimized within the fields of education and cognitive psychology.*

Keywords: *Spatial Thinking, Cognitive Ethnography, Ethnomathematics*

INTRODUCTION

Spatial thinking is an individual's ability to understand, organize, and manipulate space-based information (Herawati & Hariyani, 2024). This ability involves skills in recognizing patterns, relationships, and changes in spatial representations, both visual and mental (McNeal et al., 2024). In a cognitive context, spatial thinking plays an important role in various aspects of life, from navigation to spatially based problem solving (Nurhanifa et al., 2026). Research by Nopiana et al. (2020) shows that spatial thinking develops through experience and can be improved with appropriate practice.

Spatial thinking plays a crucial role in everyday life, particularly in tasks involving orientation and the manipulation of objects in space (Gittinger &

Wiesche, 2024; Supli & Yan, 2024). Activities such as reading maps, understanding diagrams, and visualizing the rotation of objects are concrete examples of the application of spatial thinking (Taylor & Renshaw, 2023). Spatial thinking ability is a foundation of STEM (Science, Technology, Engineering, and Mathematics) learning and is strongly correlated with academic success in these disciplines (Gagnier et al., 2022; Taylor & Renshaw, 2023). Therefore, a deeper understanding of spatial thinking is important, not only in academic contexts but also in everyday life.

One activity that naturally reflects spatial thinking is folding clothes. This process requires skills in recognizing shapes, symmetry, and the sequence of steps to produce a neat and efficient fold (Daryanti et al., 2024). Women, as a group that has traditionally been more involved in domestic tasks, display distinctive patterns of spatial thinking in this activity. Studies on spatial skills in domestic contexts remain limited, even though activities such as folding clothes require complex spatial analysis. Therefore, this study seeks to explore how women's spatial thinking is structured in everyday activities through a cognitive ethnography approach.

According to Sari & Agustriana (2024), folding clothes is an everyday activity that involves various cognitive aspects, including spatial thinking, visual perception, and motor skills. This process requires an understanding of the shape and dimensions of garments, as well as the ability to predict the desired result of the fold. In practice, individuals must apply basic geometric concepts, such as symmetry and transformation, to produce efficient and uniform folds (Hidayat et al., 2024). This activity involves not only technical skills but also complex cognitive strategies in organizing space and the sequence of actions.

In the context of spatial thinking, the activity of folding clothes can be understood as a mental process that reflects an individual's ability to organize visual and motor representations. Women, who have traditionally performed this task more often, have broader experience in developing efficient spatial strategies. Research by Wu & Sun (2020) shows that domestic activities, including folding clothes, implicitly contribute to the improvement of spatial skills. Therefore, understanding how women manage spatial information in this task can provide new

insights into the structure of spatial thinking that develops through everyday experience.

Spatial thinking has been a widely researched topic across various disciplines, including cognitive psychology, education, and neuroscience. Research by Gagnier et al. (2022) and Taylor & Renshaw (2023) has previously shown that spatial ability plays an important role in academic and professional success, especially in STEM (Science, Technology, Engineering, and Mathematics) fields. A study by Bokhove & Redhead (2026) revealed that spatial thinking training can improve individuals' cognitive abilities in various domains, including mental rotation and spatial mapping. In addition, McNeal et al. (2024) showed in their research that spatial thinking develops not only through explicit experience, such as academic training, but also through everyday activities that involve manipulating objects in space.

In the context of gender differences, several studies indicate variation in spatial ability between men and women. Research by Jost & Jansen (2024) shows that men tend to have an advantage in spatial tasks based on mental rotation, while women excel in spatial tasks based on navigation and the organization of objects in space. This study reinforces the argument that the experiences and types of activities carried out daily contribute to the development of spatial thinking. In this regard, activities such as folding clothes, which are generally performed more often by women, may be one factor that shapes the structure of spatial thinking in a unique way.

Although many studies have discussed spatial thinking in academic and professional contexts, research on how domestic activities contribute to the development of spatial skills remains limited. A study by Herawati & Hariyani (2024) shows that individuals who frequently engage in activities requiring spatial thinking tend to have better spatial abilities than those who rarely do. However, that study focused mostly on activities such as video games or sports, and has not extensively explored household activities as a factor contributing to spatial thinking. Therefore, research on how women use spatial strategies in folding clothes can offer a new perspective in cognitive and gender studies.

Research on spatial thinking in women has shown that the experiences and types of activities carried out daily play an important role in shaping spatial skills. A study by Jost & Jansen (2024) found that although men tend to show an advantage in mental rotation tasks, women have an advantage in tasks involving spatial strategies based on orientation and object organization. This suggests that spatial ability is not only an innate factor but is also influenced by experience gained through everyday activities, including domestic ones. Thus, understanding how women use spatial thinking in everyday contexts is important to analyze further.

Several studies have highlighted how certain activities can improve spatial thinking in women. For example, a study by Jost & Jansen (2024) showed that women who engage in activities involving object manipulation, such as sewing or cooking, tend to have better spatial thinking than those who rarely do such activities. These activities involve complex spatial processing, such as estimating size, arranging components in space, and understanding spatial relationships between objects. Folding clothes, a common everyday activity, has similar characteristics and potentially plays a role in developing spatial skills.

However, although there is evidence that domestic activities contribute to spatial skills, research on this relationship remains limited. Most existing studies focus on the influence of education and explicit training on spatial ability, while the contribution of everyday activities to cognitive development has received little attention. Therefore, understanding how women develop and apply spatial strategies in activities such as folding clothes can provide new insights into the structure of spatial thinking. This study will not only enrich cognitive research but can also contribute to designing more inclusive experience-based learning strategies for women in STEM and other disciplines.

The cognitive ethnography approach has been used in various studies to understand how individuals process information in the context of everyday life. This method allows researchers to explore the thought patterns and cognitive strategies that emerge in interaction with the surrounding environment. Hyun et al. (2020) state that cognition resides not only in the individual's mind but is also distributed across the social and cultural environment. Thus, cognitive ethnography

is an appropriate tool for analyzing how spatial thinking develops through everyday activities, including domestic activities such as folding clothes.

Previous research using the cognitive ethnography approach has revealed various patterns of spatial thinking in space-based tasks. For example, a study by Wu & Sun (2020) showed that in activities such as assembling furniture or arranging groceries, individuals use environment-based spatial strategies to optimize work efficiency. In this context, folding clothes also requires complex spatial skills, such as recognizing symmetry, understanding the sequence of steps, and adjusting the shape of the fold based on the type of fabric. By using a cognitive ethnography approach, this study can reveal how women develop and apply spatial strategies in this activity.

Although many studies have highlighted spatial thinking in educational and professional contexts, few have discussed how spatial thinking is applied in domestic activities. Cognitive ethnography studies can fill this gap by providing a deeper understanding of how individuals build structures of spatial thinking in everyday life. By examining how women fold clothes systematically, this study can identify thought patterns that are often unconscious yet relevant in various fields, including education, ergonomic design, and the development of spatial skills in broader contexts.

In addition, studies on gender differences in spatial thinking generally highlight men's advantage in mental rotation tasks (Lee et al., 2020) and women's advantage in landmark-based navigation or the organization of objects in space (Jost & Jansen, 2024). However, research has not specifically examined how women's spatial skills are formed through domestic activities. Existing studies more often discuss activities such as sewing or cooking as part of the development of spatial thinking, whereas folding clothes, which also requires high spatial skills, has rarely been the object of scientific study.

This research gap shows the need for more in-depth studies on how women's spatial thinking develops in everyday activities using a cognitive ethnography approach. By understanding the patterns of spatial thinking that emerge when folding clothes, this study can enrich the literature on spatial cognition and provide

implications for developing more inclusive learning strategies. In addition, the results of this study can also contribute to an understanding of how everyday experiences can influence spatial skills in various aspects of life, including education and space-based work.

Furthermore, this study aims to fill the gap in the literature concerning spatial thinking in domestic activities. Most previous studies have emphasized the influence of education and explicit training on improving spatial skills, while the contribution of everyday activities to cognitive development has been under-researched. By using a cognitive ethnography approach, this study is expected to provide new insights into how spatial thinking is constructed in natural contexts, and how routine activities such as folding clothes can function as a form of unconscious cognitive training. The results of this study are expected to make theoretical and practical contributions to cognitive studies and education. Theoretically, this study will enrich understanding of the distribution of cognition in everyday activities, particularly in spatial contexts. Practically, the findings can be used to develop more inclusive learning strategies, especially in teaching spatial concepts to women in STEM fields. In addition, this study can serve as a basis for further research on how domestic activities contribute to the improvement of cognitive skills relevant to daily life and professional careers.

RESEARCH METHODS

This study uses a qualitative approach with a cognitive ethnography research type. This approach was chosen to explore the structure of women's spatial thinking in the activity of folding clothes based on their experiences, habits, and the strategies they use in organizing everyday clothing. Cognitive ethnography allows researchers to understand how individuals in a social group form, interpret, and apply spatial concepts in domestic activities. Thus, this study focuses on exploring spatial thinking that is internalized in the practice of folding clothes.

The subjects of this study were five women who have experience in arranging and folding clothes in their respective households. Subjects were selected using purposive sampling, that is, selection based on certain criteria in line with the

research objectives. The criteria used in selecting the research subjects were: (1) adult women who actively fold clothes in their daily lives, (2) have experience organizing clothing in a household setting, and (3) are willing to be interviewed and provide information about their clothes-folding habits. The profiles of the five subjects, hereafter referred to as Respondent 1 to Respondent 5, are presented in Table 1. The research location was within the subjects' households, so the data obtained reflect the actual practices they carry out in everyday life.

Table 1. Profile of Research Subjects

Subject	Age (years)	Marital Status	Occupation	Highest Education
Respondent 1	29	Married	Housewife	Senior high school
Respondent 2	34	Married	Housewife	Senior high school
Respondent 3	42	Married	Housewife	Bachelor's degree (S1)
Respondent 4	45	Married	Housewife	Diploma (D3)
Respondent 5	54	Married	Housewife	Senior high school

Data in this study were collected through several main techniques, namely:
In-depth Interview: Interviews were conducted in a semi-structured manner to obtain deeper information about the clothes-folding strategies used by the subjects. Several aspects explored in the interviews included: (1) Techniques for folding clothes by type, (2) Considerations in adjusting folds to the storage space, (3) Patterns of arranging clothes after folding, and (4) Reasons and habits that shape the clothes-folding pattern.
Participatory Observation: The researchers also conducted participatory observation by directly observing how the subjects fold clothes in their own homes. The purpose of this observation was to verify the data obtained from the interviews and to identify spatial patterns or strategies that the subjects themselves might not be aware of.
Documentation: Documentation took the form of notes, photographs, and sketches of clothing folds made by the subjects. These data were used as supporting material for the analysis to understand the spatial representations used in the activity of folding clothes.

The data obtained from interviews, observation, and documentation were analyzed using thematic analysis. The steps in the data analysis were: (1) Data Transcription: Interview data were transcribed verbatim to obtain a complete picture of the information provided by the subjects, (2) Data Coding: Thematic codes were assigned based on the answer patterns and clothes-folding strategies that emerged from the interviews and observations, (3) Theme Identification: Thematic codes were grouped into main categories reflecting patterns of spatial thinking in folding clothes, and (4) Data Interpretation: An in-depth analysis of the findings to understand how women use spatial thinking in arranging clothes.

To ensure the trustworthiness of the data, this study applied several validation techniques, namely: (1) Technique Triangulation: Using more than one data collection method (interviews, observation, and documentation) to strengthen the research findings, (2) Member Checking: Confirming the interview results with the subjects to ensure the accuracy of data interpretation, and (3) Thick Description: Presenting the data richly and in depth so that the research findings can be examined by other researchers.

RESULTS AND DISCUSSION

Based on the transcripts of the five respondents, the answers can be grouped using thematic codes that represent patterns of spatial thinking in folding clothes. The following is the thematic grouping based on the interviews.

1. Category: Folding Techniques by Garment Type (FTG)

In everyday life, folding clothes serves not only to tidy up and save storage space but also reflects patterns of spatial thinking that develop within a particular culture. Each type of garment has a different folding technique to ensure storage efficiency and to maintain the shape and quality of the fabric. This category was found in all subjects, namely Respondents 1, 2, 3, 4, and 5. The following table presents the various clothes-folding techniques by garment type, taking into account the folding patterns commonly used in everyday life:

Table 2. Folding by Type of Garment

Type of Garment	Pattern
Short-sleeved T-shirt	Fold the sleeves inward (left and right), then fold from the bottom up, forming a rectangle.
Long-sleeved T-shirt	Fold the sleeves inward, pull the sleeves downward so they lie flat, then fold from the bottom up, forming a rectangle.
Short-sleeved shirt	Button up, fold the arms inward, fold the left and right sides to the center, then fold from the bottom up.
Long-sleeved shirt	Button up, fold the arms downward, fold the left and right sides to the center, then fold from the bottom up.
Long trousers	Fold in three or four, depending on the length of the trousers.
Shorts	Fold in half.
Sarong (sarung)	Fold lengthwise several times, then fold in three to make it smaller. Some people also fold the left and right sides first before folding in three.
Bed sheet	Fold lengthwise several times, then fold into a rectangle. It can also be folded from the left and right sides before being folded several times.

2. Category: Storage Space Considerations (SSC)

Clothes-folding strategies are determined not only by the type of garment but also by the capacity of the available storage space. When storage space is limited, individuals tend to adjust the size of their folds so that more clothes can be arranged neatly and efficiently. Conversely, when storage space is ample, they are freer to fold without having to reduce the size of the folds. This category was found in Respondents 2, 3, 4, and 5. The following table shows the variation in folding strategies based on the storage considerations expressed by the respondents:

Table 3. Folding Based on Storage Space Considerations

Storage Strategy	Explanation
Folding smaller when storage space is limited	Respondents 3, 4, and 5 adjust the size of their folds to the storage capacity so that more clothes fit.
Regular folds when storage space is ample	Respondents 2 and 4 stated that when storage space is ample, they do not make the folds smaller.

3. Category: Clothing Arrangement Patterns (CAP)

In addition to folding techniques and storage space considerations, the way clothes are arranged also affects how easily clothes can be retrieved and how neat

the folds stay. Some individuals choose a tiered, pyramid-like pattern, in which larger garments are placed at the bottom and smaller ones on top. This pattern is considered to help maintain the stability of the pile and to make it easier to take out clothes without disturbing the other folds. This category was found in Respondents 2, 3, 4, and 5. The following table shows the clothing arrangement patterns commonly used by the respondents in this study:

Table 4. Folding Based on Clothing Arrangement Patterns

Arrangement Pattern	Explanation
Pyramid-like arrangement	Respondents 2, 3, 4, and 5 stated that they place clothes in a tiered pattern, from largest at the bottom to smallest on top.
Arrangement that makes retrieval easier	Respondents 2, 4, and 5 considered the pyramid arrangement to make retrieval easier without disturbing the other folds.

4. Category: Reasons and Habits in Folding Clothes (RHF)

Every individual has certain habits in folding clothes, which are often influenced by experience, efficiency, and practical everyday needs. Most respondents fold clothes in a way they have used for a long time, indicating that habit plays an important role in determining the folding technique used. In addition, efficiency and neatness are the main reasons for some respondents, because neat folds not only save space but also make it easier to find the clothes needed. This category was found in all subjects, namely Respondents 1, 2, 3, 4, and 5. The following table presents the various reasons and habits that influence how respondents fold clothes:

Table 5. Folding Based on Reasons and Habits in Folding Clothes

Reasons & Habits	Explanation

Long-standing habit	All respondents stated that they fold clothes this way because they are used to it.
Efficiency and neatness	Respondents 3, 4, and 5 regarded this method as the most efficient and neat.
Easier to find clothes	Respondents 3 and 5 stated that neatly arranged clothes are easier to find.

Folding Techniques by Garment Type (FTG)

The interviews found that all respondents (Respondents 1, 2, 3, 4, and 5) had almost uniform patterns of folding clothes, namely maintaining a rectangular shape to make storage easier. This technique indicates a spatial-geometric pattern of thinking, in which the subjects intuitively apply the principles of symmetry, rotation, and translation in the folding process. This pattern reflects not only orderliness in storage but also how geometric concepts are used naturally in everyday activities without conscious awareness.

According to Bednarz & Lee (2011) and Hyun et al. (2020), in their theory of cognitive development, spatial thinking ability develops from childhood and becomes more complex with accumulated experience. In this context, the women who served as respondents showed the use of spatial skills in everyday activities, even though they did not recognize them as formal mathematical concepts. This indicates that spatial skills develop not only in academic environments but also through direct experience in domestic tasks that involve organizing objects in space (Lewis Presser et al., 2025; Lufri et al., 2021).

In addition, research by Ishikawa & Newcombe (2021) and Hawes & Ansari (2020) on spatial cognition shows that humans tend to represent objects as simpler and more practical mental imagery. This is consistent with the finding that the respondents chose a rectangular shape when folding clothes because it is easier to stack and access. By choosing a more structured shape, they indirectly optimize storage and space efficiency, which shows a relationship between spatial thinking skills and everyday practice.

The implication is that spatial thinking is not limited to academic contexts but also plays a role in household activities such as folding and arranging clothes. This process involves an understanding of shape, size, and order in space, which shows

that applied geometric concepts are used naturally in everyday life. The folding techniques chosen by individuals tend to prioritize order and efficiency, both in terms of storage and ease of access, thereby reflecting how spatial principles help optimize the management of space and objects in the domestic environment.

Storage Space Considerations (SSC)

Most respondents (Respondents 2, 3, 4, and 5) considered storage capacity when deciding how to fold clothes. Those with limited space (Respondents 3, 4, and 5) tended to fold clothes smaller to save space, while those with ample space (Respondents 2 and 4) folded in the standard way without needing to adjust the size of the folds. This pattern indicates an adaptive strategy in space utilization that the respondents carried out intuitively.

Research by Lewis Presser et al. (2025) shows that humans naturally adjust their spatial strategies to the context and needs of the environment. In this case, the housewives applied spatial adaptation strategies in folding clothes to optimize storage space. This adaptation is not merely a habit but part of spatial thinking ability that develops through everyday experience.

In addition, the concept of Spatial Affordances explains that humans intuitively understand how space can be used effectively (Mohammadi & Koutamanis, 2025). Thus, the decision to fold smaller or larger is a form of utilizing environmental affordances in the context of clothing storage. This shows that spatial skills are related not only to academic or technical activities but are also present in domestic activities that are often considered simple.

The implication is that women's spatial skills are not only mechanical but also adaptive, adjusting to environmental conditions and practical needs. This ability is reflected in the way they organize and adjust folding patterns based on storage capacity, showing that spatial strategies develop through everyday experience and needs. This adaptation serves not only to increase storage efficiency but also reflects flexibility in thinking and solving problems related to space management.

In addition, this ability can be linked to space-organizing strategies in interior design and household management, which demand efficiency in the use of space.

The same principle of arranging clothes optimally can be applied on a larger scale, such as arranging furniture, storing belongings, and designing home layouts. With good spatial understanding, individuals can create environments that are more comfortable, functional, and aesthetic, so this skill is relevant not only in domestic contexts but also in related professional fields.

Clothing Arrangement Patterns (CAP)

The majority of respondents (Respondents 2, 3, 4, and 5) arranged clothes in a pyramid shape, with larger garments placed at the bottom and smaller ones on top. This strategy was used to keep the pile stable and to make it easier to take out clothes without disturbing the other folds. Thus, this arrangement pattern is not merely a habit but also reflects effective spatial thinking in optimizing storage and the accessibility of clothes.

According to Menary & Gillett (2022) and Pitt & Casasanto (2022), in their studies on spatial cognition and mental organization, humans tend to arrange objects in patterns that minimize cognitive and physical effort. The pyramid pattern applied by the respondents shows spatial heuristic thinking, namely the use of simple strategies to solve problems efficiently. By arranging clothes in tiers, individuals can reduce the need to remember the specific location of each item, because the structure naturally makes searching easier.

Furthermore, the Gestalt Principles of Perception theory proposed by Guberman (2017) explains that humans have a tendency to group objects based on structured and harmonious patterns. Arrangement in a pyramid shape can be regarded as a stable form of visual organization, in which clothes are easier to recognize and access. This principle shows that humans instinctively arrange objects in patterns that support the efficiency of perception and interaction with the environment.

The implication is that spatial grouping in everyday life follows heuristic principles, namely making access easier and reducing cognitive load. This arrangement pattern is helpful not only in domestic contexts but can also be applied

in more ergonomic storage design, such as wardrobe layouts designed to improve functionality and user comfort.

Reasons and Habits in Folding Clothes (RHF)

All respondents (Respondents 1, 2, 3, 4, and 5) stated that the clothes-folding patterns they use are the result of long-standing habits. In addition, they regarded this way as the most efficient and neat method for keeping clothes orderly in storage. This habit is not merely a routine but also reflects patterns of thinking that develop through experience and interaction in their social environment.

According to Vygotsky (1978) in the *Sociocultural Theory of Cognitive Development*, human patterns of thinking are shaped by social interaction and cultural experience. In this context, clothes-folding techniques are passed down through generations within the family and become part of the internalization of household culture. Children who are accustomed to seeing how their parents fold clothes will adopt the method without formal instruction, showing how simple spatial skills can develop through observation and repeated practice.

Research by Santos et al. (2025) on cultural cognition also shows that collectivist societies are more likely to maintain habit-based practices than individualist societies, which are more flexible in changing how they work. This explains why the housewives keep using the same clothes-folding method over time. In a social environment that emphasizes orderliness and harmony, this practice is not only about efficiency but also reflects cultural continuity within the household.

The implication is that patterns of spatial thinking in everyday activities are shaped by cultural and social factors. The habit of folding clothes serves not only a practical function but is also a form of intergenerational knowledge transfer. This practice shows how spatial skills develop in a broader context, involving cultural aspects that shape how individuals interact with their environment.

These findings support the theory of sociocultural cognition, in which habits and the social environment shape how individuals process information and complete tasks. Overall, this study reveals that domestic activities such as folding

clothes relate not only to practical efficiency but also reflect spatial thinking skills that develop through experience and cultural influence. The implications of these findings can be applied in education, particularly in ethnomathematics studies, and in household design to create more ergonomic and functional storage systems. In addition, this study opens opportunities for further research on how spatial skills develop in the context of everyday life and how they can be optimized in various fields, such as interior design, household management, and cognitive psychology.

CONCLUSION

The conclusion of this study shows that folding clothes is not merely a mechanical household chore but involves a complex structure of spatial thinking. The respondents intuitively applied geometric concepts such as symmetry, translation, and rotation in the folding process, with a final result that was generally rectangular. In addition, they showed spatial adaptation strategies by adjusting the size of their folds based on the available storage capacity, which reflects the principle of spatial affordances. The pattern of arranging clothes after folding also followed the principle of orderliness, with most respondents choosing a pyramid shape to make access easier and to keep the pile stable. This is consistent with Gestalt perception theory, which explains that humans naturally organize objects in more structured and harmonious patterns. Furthermore, the clothes-folding techniques used by the respondents were generally habits passed down through generations, showing that social and cultural factors also influence patterns of spatial thinking in everyday activities.

Overall, this study reveals that domestic activities such as folding clothes relate not only to practical efficiency but also reflect spatial thinking skills that develop through experience and cultural influence. The implications of these findings can be applied in education, particularly in ethnomathematics studies, and in household design to create more ergonomic and functional storage systems. In addition, this study opens opportunities for further research on how spatial skills develop in the context of everyday life and how they can be optimized in various fields, such as interior design, household management, and cognitive psychology.

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