(Meta)Cognition in Comprehension: Understanding Multimodal Processing

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This qualitative and interdisciplinary study experiments with the emerging digital hypertexts, composed in multimodal/ multi-sequential representational form, in order to understand the intricacies of cognitive and metacognitive processing of content language. This research attempts to find out how this phenomenon is connected to language, and how multimodal text facilitates meaning making and understanding. Since understanding the digital language of hypertexts is a new phenomenon in the Pakistani educational context, therefore the present study attempts to explore the relevant, intricate cognitive and metacognitive patterns as the non-native readers navigate through the interactive hyperlinked language for meaning making. Thus, applying qualitative approach, the focus is on understanding the process rather than the product.

Keywords: Psycholinguistics, Cognitive patterns; Multimodality; Comprehension

Organization and presentation of textual patterns have changed to a great extent in the recent times. The impressions and implications of this change are quite conspicuous where academic texts and research dissertations are displayed onscreen challenging the tradition of the print culture, and thus take reading/comprehension beyond this localized and static linear medium strategy. Digital environments allow the space to display hypertext (digitized language with embedded links, images, audio and video clips) on one page simultaneously, that apparently seems more inviting and interactive as compared to the printed linear page.

Since brain processes are the foci of language comprehension; therefore, any change, at representational level, would directly impinge upon the way brain deciphers it. Kerckhove (2002) considers that technological changes have an implication on the mind, and so, on the language use because language is a reflection of the mental processes. Thus, the phenomena manifest an interrelation of cognition and language.

As an onscreen virtual text, hypertext is multilinear/ multimodal and allows the readers to move through the composition of "graphic, digitised speech, audio recordings, pictures, animation, film clips," as Verezub et al (2008) note quoting Conklin, a hypertext theorist.

Smith (2001) cites Horn (1989) who claims that the hypertext reading process is multifaceted, involving multilevel, multimodal reading strategies and practices. This is what makes digital reading, at once, more demanding and may be, more readily comprehensible, and also more challenging than the traditional static printed text. It is the reader who prepares his/her way for the travel through the digital hypertext and chooses which hyperlinks to click and what 'hotspots' should be preferably traveled than the others. S/he can treat this text in a linear fashion as well as a multilinear fashion. All this calls for the exploration of this emerging phenomenon.

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Present study focuses on the impacts and processes of meaning making and comprehension when students of English Studies interact with the digital hypertext on the screen. And in this context, the mental processes of knowing the aspects as perception, awareness, reasoning and understanding as explanation of cognition have been studied.

Working with the postgraduate students, who were comfortably familiar with the taught language, and could express themselves effectively through printed form of language representation, this study was designed to experiment with digital hypertext and see how its representational characteristics of hyperlinked text, images and clips on the same page could enhance/sharpen the cognitive faculties. The emerging substitute of hypertextual form of representation stands as a potential opportunity for the Pakistani students to improve their cognitive understanding and even explore new comprehension competence strategies.

Research Question

This qualitative study attempts to explore:

What cognitive and metacognitive abilities are involved in meaning making in the use of multimodal hypertext?

Literature Review

Involvement of Cognitive Factors

Investigating the phenomenon of digital hypertext and the underlying process would remain incomprehensible as well as incomplete if studied without relevant cognitive factors. The purpose is to explore how brain makes sense of this fragmented textual medium, and how observing cognitive processing might benefit in enriched meaning making.

Digital hypertext is appreciated for its associative patterns that seem to act the way cognitive processes work (cf. Spiro, 1990; Foltz, 1993, 1996; Dryden, 1994; Hoffmann, 2010). However, some critics do not favor this proposition because of the lack of valid empirical evidence (cf. Carusi, 2006). Thus, the discussion causes an obvious contestation among various theorists. Foltz (1993, 1996) argues that associative retrieval paths of hypertext are similar to the performance of human memory and may improve our ability to interact with online information. Hypertext is constructed in a way that, according to Dryden (1994), “simulates the mind's associative processes” and in this way, presents an electronic platform, where the reader’s “literate thinking” is constructed, performed and recorded.

Brody (2000, p. 142) comments at the phenomena that hypertexts possess “no body, only mind,” suggesting the difference of processing of printed language at the cognitive level, which also alluding to the virtual nature of the digital hypertext rejecting the notion of physicality (cf. Chartier, 2004; Kerckhove, 2002; Morris, 2016; Myrberg & Wiberg, 2015; Roche, 2004; Roschke & Radach, 2016). In this connection, Yang (2006) observes that, the reading strategies reflect cognitive patterns of the readers during the reading process for meaning construction (p. 314).

Hypertext poses itself as a challenge to comprehending the presented content properly. It demands an active processing at the cognitive levels. Parr (2001) predicts that students with “more sophisticated understanding of print texts” would be in a better position “to respond to the cognitive challenge which hypertext presents” (p. 238). However, these challenges need to be identified so that the students/readers might be trained to avoid potential hiccups because during the knowledge construction process cognitive strategies change dynamically (Chiazzese et al, 2006, p. 440).

The cognitive interactions working with digital hypertext cannot be taken for granted since researchers construe that it also increases the cognitive load on the reader (e.g. Cullingford, 2013; Hinesley, 2007; Portela, 2007; Joly & Martins, 2008). This cognitive load is because of the "excess of information and inability to choose and to discriminate" (Eco, 2003, p. 20) from the various available options in a hypertext reading environment. Theorists like Joly et al (2005) and Spiro (1990), however, observe that cognitive challenges vary with regard to printed and digital hypertexts. So, the demand on the part of the reader is to make informed decisions.

Protopsaltis and Bouki (2004) urge the theorists to consider cognitive dimensions of hypertext reading. However, they inform that a sound observation of cognitive processes regarding hyper textual reading would enable a researcher to see how the meaning making patterns, in actual, emerge.

Involvement of Metacognition

Engagement with hypertext involves a reader at cognitive level since the reader chooses the options to define reading trajectory. On many occasions, the reader thinks through his/her opted choices to confirm whether his/her navigation satisfies the pre-ordained reading goals. It is very much a conscious process; however, for some critics, a reader might not be cognizant of these happenings (cf. Chiazzese et al, 2006; Lee, 2006). This reflection about one's cognitive actions indicates the involvement of metacognitive processes in hypertextual comprehension. Boyce (2001) cautions alertness and metacognitive control during the navigational interaction. He notes that reading emerges as a different experience where mind and body about the interactive mental operations and cautions "work together to execute autonomous choices, engaging, disengaging and re-engaging, reading in a different fashion, absorbed (lost?) but in control" (p. 130).

Meaning making procedures, at the surface level, involve readers' mental faculties to make out the textual contents in its entirety. At an advance level, the critical understanding of the text renders it necessary to engage metacognitive abilities of the reader to which Yang (2006) names comprehension monitoring strategies (also cf. Flavell, 1981; Cheng, 1998). McEneaney (2003) urges the readers to shift their focus from the "navigational details far enough to see the broader dispositions and foundational metacognitive skills that people bring to reading and learning in hypertext" (p. 7). It would thus, serve the purpose to understand the nature of the digital textuality.

For cognitive understanding of the language comprehensibility of digital hypertext, it is incumbent upon the researchers to deeply familiarize themselves with the processual happenings; observing how readers make sense of multi-textual representations replacing the conception of monomodal verbal texts. Studying metacognition might reveal the inner mechanisms inciting readers to make choices preferring one hyperlink option over the other resulting in making a better sense of the comprehension competence. Hence, this processual activity is important as the "individual significance is at stake," and also integral to the making of meanings.

Method

Qualitative Methods

Present study applies qualitative paradigm and integrates different methods during the research processes (Bazeley, 2010; Halcomb & Andrew, 2009; Hussein, 2015; Taylor, Bogdan & DeVault, 2015; Teddlie & Tashakkori, 2003). The study is phenomenological in nature which elicits subjective responses from the participants that are analyzed qualitatively. For Sydenstricker-Neto (1997) this design is preferable as it is "likely to increase the quality of final results and to provide a more comprehensive understanding of analyzed phenomena" (para, 1). Thus, these methods complement each other by "adding more depth to the information."

A researcher needs to be very careful while choosing the appropriate methods to understand the intricacies of (meta)cognitive abilities because of the distinct change in the nature of the texts, and the supporting media that help in displaying them. Gocsik (2009) observes that, "our students are engaging in increasingly diverse discourses, delivered to them by increasingly varied media … where information is constructed via text, hypertext, video, and audio" (para, 1). Thus, taking care of this emerging phenomenon, Concurrent Think-Aloud (CTA), Semi-Structured Interviews (SSI), Retrospective and Reflexive Think-Aloud (RRTA) were applied to produce authentic and valid data for qualitative analysis.

The assigned text was Hamlet on the Ramparts which can be accessed at http://shea.mit.edu/ramparts/readingroom/seg3-index.htm. It comprises verbal text along with links to images and visuals, and thus, apparently seems to differ with the traditional linear printed text in constructional patterns, presentation and interaction.

Tenadvanced level non-native participants were engaged for this research. They were postgraduate university students and their ages ranged from 22-30 years. Camtasia Video Capture software was used to record the details of the interaction of the assigned hypertext by the participants. After thescreening process, the participants were given training and instructions about the nature of multimodalhypertext and the expected liberty that a reader is speculatedto experience in the selection of the text, images and visual links.

This multi-representational digital hypertext constitutes the actual text with links, images and video clips, so, the purpose was to understand and assess the interactional nature and cognitive processing of the participants in the new reading environments for meaning making.

Concurrent Think Aloud (CTA)

After the instruction session, the responses of the participants were recorded for 30 minutes in the CTA session. It was done using the screen recording software.

Semi-Structured Interviews (SSI)

Participants were engaged for Semi-Structured Interviews (SSI) after CTA. Their interview responses were recorded and saved for subsequent transcription for data analysis.

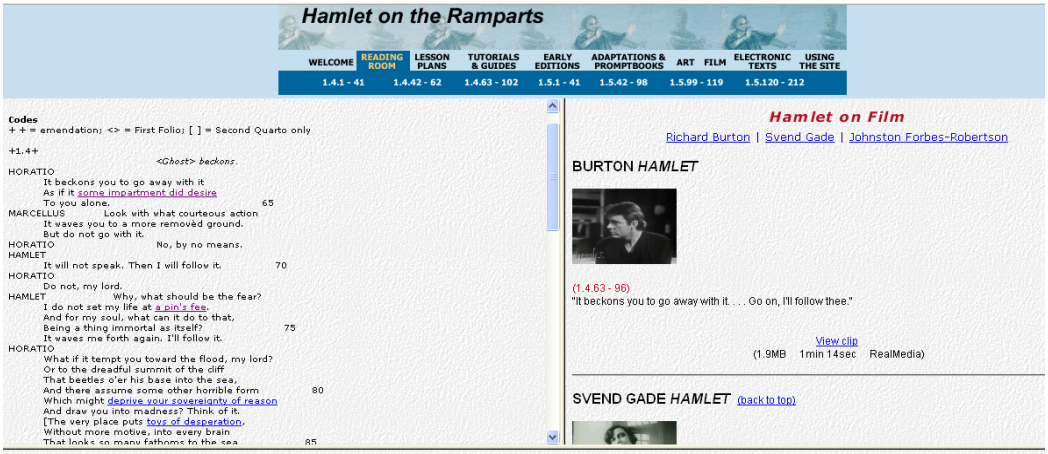

Figure 2. Hamlet on the Ramparts, digital hypertext with hyperlinked language and video clips

Retrospective and Reflexive Think Aloud (RRTA)

After administering CTA and SSI, participants were engaged in Retrospective and reflexive think- aloud protocol. It was applied to understand and elaborate their cognitive processes as they traversed through a multimodal digital hypertext for comprehension purpose.

Data Analysis

After the data was collected using Concurrent Thinking Aloud (CTA), Semi-Structured Interviews (SSI), Retrospective and Reflexive Think Aloud (RRTA), it was put to analysis for validly assessing the nature of the phenomena. Since there are many methods involved in this experiment, so great care was required to avoid the overlapping of the data. Nevertheless, for studying the new phenomena, authentic data for analysis can be gathered administering variety of methods (as stated above) that is also a recommended approach in qualitative studies (Brinkman, 2014; Cho, 2014; Morse, 2003; Morse & Niehaus 2009; Tashakkori & Teddlie, 2003).

For the purpose of data analysis and interpretation, themes were identified from the research questions and tentative categories were developed. These categories were based on the works of Block (1986), Anderson et al (2001), Protopsaltis & Bouki (2005), and Seidman (2006). While transcribing the recorded responses, these identified categories were further refined during the preliminary analysis and put under relevant themes (for identified categories under the themes of **Cognition** and **Metacognition** see Annexure).

Concurrent Think Aloud (CTA)

The participants were provided relevant information and training about the assigned hypertext reading. The given digital text comprises digitized language with 56 embedded hyperlinks for meanings, 94 images and 3 visuals. Each of the participants was engaged individually for 30 minutes and s/he had to produce concurrent verbal responses. These concurrent or retrospective verbal responses are the thoughts that, “wander or rush through the minds of readers, the searches and struggles for meaning, the reflections and associations, are hidden from the outside observer. Yet, this struggle and search for control are the core of reading comprehension” (Block, 1986, p. 463). To keep an exact record of the participants’ interaction, a time-log-sheet was also created. Below is a detailed analysis of the identified themes and categories.

Cognition

Different categories related to the theme of cognition were identified from the Concurrent Think Aloud (CTA) responses of the participants. Since the assigned text was a multimodal digital hypertext, therefore, the participants, while interacting with the hypertext, compared one representational mode with the other modes which is one of the cognitive processes (Anderson et al., 2001). With the emergence of digital hypertexts, cognition has been a subject of debate among the cognitive theorists. Chartier (2004) notes that hypertext representations composed in the digital environment "show the importance of the transformation of cognitive operations," and therefore, demand a careful understanding on the part of the reader.

One of the participants, SK found out the difference between the two representational modes, images and video. However, she noted that the variation of colors, costumes and time reflected through different modalities might cause enrichment of meanings as well (Pt. 9, 12:13). Another participant AI, compared the visual and image description and how they complemented the meanings of the textual language, and thus, the effect also enhanced the conceptual boundary of reading. The participant found the image creating more horrifying effect than the visual, and concluded that it was because of the difference of the modalities and pattern of representation. The presentation of the Ghost is not spooky in the visual whereas in pictures you may even feel the effect of chillness (Pt. 30, 07:15). However, ZI asserted that the element of disagreement could be clearly noted within images mode, and pointed out that, "the picture 5, it is a color, colored picture, others were black-n-white (scrolling down the bar), so I think there is no proper connection" (Pt. 24, 18:00). These contradictions seem to confuse his understanding as he noted that, "the color of images are change … from these picture we can't depict that whether it is night time, day time, so they may hinder, you know, the process of getting the meaning" (Pt. 24, 17:12).

Participant FS was comparing the reaction and expressions of Hamlet in the visual with the reaction of the people he had observed in his own culture. It nonetheless, seems more probable that the difference was because of 'what he had imagined,' and 'what he actually watched' on screen. This is how digital text can encourage experiential cognition (Forester, 2000). FS pointed out "I was not expecting that he might be SHOUTING like that. The emotions should have been there but I think that he is shouting" (Pt. 31, 17:33).

Thus, the participants, mainly, expressed their understanding about the comparison of different textual representations and they explained these differences as well. The participants even compared different representational modes of the assigned multimodal hypertext and observed that the visual mode was preferable because of its strong effect. Some of the participants, after making a comparison, classified the digital hypertext as exciting and interesting representation.

Metacognition

Since the assigned digital hypertext is multimodal, therefore, the participants were very alert as to what mode they were interacting with. They were critically monitoring their own thoughts and activities in the CTA session which according to Baker and Brown (1984) and Protopsaltis and Bouki (2005), are metacognitive processes of the readers.

One of the participants, SK clicked the image section in order to see the representation of the textual content. While monitoring her activities, in this context, she said, "I am clicking the ART portion. I would like to see what everything looks like" (Pt. 9, 04:53). However, some of the participants did not

find the images that much contributing to the hypertext readers' understanding. In AR's view, the digitized textual language and the visuals are preferable than the images available with the assigned reading. Thus, the application of these cognitive strategies (in case of hypertext) also requires close monitoring of one's activities (Chiazzese et al., 2006). The reason for this preference is the enriched comprehension that a reader achieves because of these different representational modes. The hyperlinked clips tell "much more" as they increase and enhance the reader's cognitive skill (Pt. 22, 17:30).

ZI observed some inconsistencies among the representational modes, especially images while identifying important aspects of textual structure. His response reflected his ability to identify anomalies in representational modes which is a metacognitive process (cf. Baker and Brown, 1984). Therefore, just to avoid confusion, he was more interested in the hyperlinked language of the text and the visuals, and expressed this difference as such, "the quality of the picture, they are not … of a good quality … The images are not very clear. There is no uniformity in colors and, and, and the paintings in pictures" (Pt. 24, 18:52).

Participant HN commented on the details of the image texts, in which he found great information that enhanced his understanding of the textual language (Pt. 25, 28:37). FS, while monitoring his ongoing activities, noted that images as text are a source of multiple layers of meanings. The images, for him, have interpretational resemblance with a text as the two are apparently silent, but can be interpreted in many ways (Pt. 31, 22:28). HN also evaluated the quality of the visuals as well as the purpose they serve to improve the understanding of the participants through the colors, background, music, and character presentation (Pt. 25, 09:33). It is in consistence with what Gould et al (1987) state as reported by Dillon (1992) that, "The better the image quality is, the more reading from screen resembles reading from paper and hence the performance differences disappear." Thus it may also provide guidelines for the academic web designers as well.

Availability of meaning links in the given text has decreased the burden from participant FS' mind; however, it resultantly stopped his imagination from its functioning to draw out the meanings from the context. FS takes it as the demerit of the text as he "would have been reading it more intensely more acutely in order to find the different meanings" otherwise. It informs that how critically he was monitoring his own activities while interacting with the digital hypertext (Pt. 31, 12:40).

Taking corrective action, AR wishes to see the images because he finds the movie has missed some scene and images would enrich his reading. He pointed out that, "Some scenes are not available in the movie, I think, so I want to check the ART as well it would help me to understand the whole situation" (Pt. 22, 12:47).

Thus, during the Concurrent Think Aloud responses, the participants mainly reflected on their ability to monitor their ongoing interaction with the digital hypertext. Regarding this theme, they identified inconsistencies (as already pointed out) in different representational modes and how they enriched meaning making process. The participants were able to identify the hypertext structure and its organizational pattern, and having done so, they manifested their metacognitive abilities.

Semi-Structured Interview (SSI)

The participants were engaged for Semi-Structured Interviews (SSI) after CTA. 10 interviews were recorded using Jet Audio software. The recorded audio data was afterward transcribed. After preliminary analysis, categories related to the following identified themes were found for further analysis.

Cognition

The participants compared their experience of interaction of digital hypertext with the interaction of other digital texts and the print-based texts. According to Anderson et al (2001), this comparison refers to the theme of cognition. HR notes that the main differences are on the basis of representation (links, images, visuals) and multisequential interaction (Pt. 16, 01:42); and therefore, these differences also impact the ways a reader interacts with the text. HN disclosed that:

> book is in the hand of the reader but it doesn't communicate as much as computer does or as much as digital text does. The mouse allows you to touch it. Then it goes to the links. It's just like the mouse allows the reader to dig more deeper as compared to the book is. So the images, they take you in a better way in the real world of the book. But the book alone, it cannot. And what is the best part is the visuals, by watching visuals you move with the characters. You watch there every single moment which, for a book, it's almost near to impossible. (Pt. 25, 08:03)

However FS, while making a comparison, informs that the print-based text is portable and easy to interact with than the digital textual representations. So the basic understanding of the reader is based on her/his past experiences with that specific mode. He further argued:

> when you are having a book in your hand, you can read it when you are sitting … when you are travelling … when you are lying in the bed and even you can take it to the wash room and you can read it there but the problem with this [digital] type of format is that you have to sit in a chair and you have to focus on a computer screen and this is the only option, you cannot lie down, you cannot make yourself at ease as far as your sitting posture is concerned. (Pt. 31, 07:10)

Participant AR found this digital hypertext different from the traditional text because of the potential ability of the reader to explore different representational modes concurrently. He preferred this because he could check the video and read the text as well and at the same time(Pt. 22, 01:07).He further noted that digital hypertext is different even from the monomodal online texts because there, "the visuals and the images were not available … but this time it is more facilitating" (Pt. 22, 01:52). Therefore, participants AR considers a multimodal hypertext advantageous than the other texts. Thus, the participants regarding the theme of cognition, mainly, compared their digital hypertext interaction and reading experiences with their experience of other textual representations.

Metacognition

Related to the metacognitive theme, many response categories were identified where the participants talked about their metacognitive understanding of the interactive processes regarding digital hypertext. One of the participants, SK along with other assertions, also noted that the representational modes as visuals and images, other than the hyperlinked verbal language, sought more attention. She informed that she would "love to see the pictures rather than going for, the, rather,

monotonous work of just read the plain words" though she might lose "the basic idea behind the reading" (Pt. 9, 06:28).

Regarding the category of identification of textual structure, the participants were asked questions in the SSI session about the phenomenon of conceptual boundary of reading regarding the digital hypertext. Participant HR noted that the digital text had manageable boundary that was broader than the print-based traditional text boundary. ZI, another research subject, informed that his conceptual reading boundary was defined by his devised reading strategies. In his SSI session, he disclosed:

> when I was reading the text so simultaneously I was forming the meaning as well because I was reading the dialogue of one character then the other, then the third one. Now, when I was reading the dialogue and when I was conceiving the meaning there was curiosity in my mind now to look at the picture as well that how they are formed, how the painter has painted them and after that definitely I went for the movie version to know how they acted out this dialogue, how they spoke these, how the, the intensity level, how much they were involved in, aa, saying these dialogues because with the help of dialogues we do not conceive, you know, the emotions behind these dialogues. So, I, that's why, I rather, set the boundary of reading text first then seeing the picture and then watching the movie. (Pt. 24, 07:15)

While speaking about the digital hypertext boundary, HN informed that 'new' digital text's boundary denotes liberty and freedom for the user. It thus, does not "extend the boundary," but actually provides you "better opportunity to explore those boundaries, to understand those boundaries" (Pt. 25, 09:25). Comparing the reading boundaries, he further said that, unlike the digital hypertext, the print-based text restricts the user's interaction because it "captures your mind" (Pt. 25, 09:31).

Comparing the conceptual boundary of reading, under the category of identification of textual structure, participant ZS noted that the digital hypertext boundary was wider than the print-based textual boundary. The participant enjoyed this freedom and felt independent enough to explore the text on his own. In his SSI session, he informed:

> when the book is in your hand, one is really limited to the only what is written in that book … and for example, if you need some help you can have a dictionary or thesaurus with you so that's really a limited boundary for yourself. But in this [digital] scenario, the way we deal it, in this we have some extended boundary. You are more free to navigate … whenever I was not understanding or getting the meaning of the text, I can have another source from where, quench my thirst for further meanings so, for example, from the clip or from that image. So the liberty here is, there was a liberty and there was also some limit also. I must say that this limit was not like the limit which we have in reading the book text, that was a more four, five steps ahead of that. (Pt. 26, 09:02)

Difference in the description evoked questions in the participant's mind, and thus, the conceptual boundary of reading was enhanced because of the richness of textual details and the change of meanings due to the impact of medium. In participant AI's response, this metacognitive process was reflected as he compared that the text he "read yesterday, the situation, the image that I

got, the action was different from what I see in the play is also very contradictory, the movie that I saw, it was contradictory…" (Pt.30, 02:00).

Regarding the theme of metacognition, the participants mainly expressed their understanding about digital hypertext while they were monitoring their ongoing interaction with the multimodal representation of digital hypertext. They also identified the distinctive features of hypertext structure and in identifying their conceptual boundary of reading, their metacognitive ability and potential was observed.

Retrospective and Reflexive Think Aloud (RRTA)

Cues were identified for the participants' retrospection and reflection. For this purpose, a cue-sheet was developed and this session was also audio recorded using a software Jet Audio. The collected data was subsequently transcribed as was done in the previous sessions. The data was analysed at preliminary level to identify the categories related to the themes. 9 sessions were conducted for this session. The participants retrospected and reflected on what they had previously expressed in the two sessions: CTA and SSI, including their interactional patterns while they were engaged with the assigned digital hypertext in the CTA sessions.

Cognition

The participants, in their RRTA sessions, talked about the nature of difference between the digital hypertextual form of representation and the static linear printed text. Participant HN noted that a digital hypertext is similar as well as dissimilar in many respects with the print-based traditional texts. In the SSI session, he observed that the differences are based on the representational modes; however, in the present session, he noted that the difference lies chiefly, in the interactional pattern- the way a reader explores the text. He explained:

> everything that a book has or can have or a book can offer to a reader is present in this electronic text … presentation of the text which is on the screen and you, if you cannot reach through your, your fingers but you can reach it through your mouse, your hand, so this is a dissimilarity. (Pt. 25, 00:44)

HR explained the difference in terms of the uniqueness of the digital text that provides space, variety and freedom to choose any modality and link on the page (Pt. 16, 00:29). ParticipantZI described the differences of hypertext and the traditional text on the basis of multimodality which is supported with images and video version of the text. This is how it has a huge impact on the understanding and the comprehensibility of the text (Pt. 24, 00:42).

Participant AB did not consider multimodal representation of digital hypertext a form of text in the strict sense of the definition of this term, because, he argued, in the multimodal hypertext medium the reader is not focused on the textual language but on different representational modes/forms. Therefore, it increases cognitive burden of the reader, and through one of his previous responses he disclosed that he could not focus on the assigned hypertext.

Thus, some of the participants, in this session, reflected their cognitive ability when they compared the hypertext structure with other representational modes and the interaction pattern.

Metacognition

One of the participants, AB expressed his understanding about the category of identification of text structure related to the theme of metacognition. He observed that the digital hypertext was multimodal and therefore, the reading boundary also became broader. He further noted that most of the assigned time was consumed on the multimodal options where verbal text becomes a lesser part and on screen a small part of the screen when compared with the interaction of traditional texts (Pt. 23, 11:06). However, he claimed, it keeps you engaged far more and you interact with the given links and thus, comprehend the text in a better way.

Thus, the assertions of the participants reflected their understanding about the identification of digital hypertext structure and its reading boundary which highlighted their metacognitive abilities.

Conclusion and Recommendations

Meaning making activity is based on the cognitive processing of the content language. It was concluded from the analysis of the participants' responses that, while comprehending the digital hypertext language, they reflected many cognitive and metacognitive processes. Most specifically, they classified the textual content (digital hypertext) as *liberatingtext*, *hiddentext*, *mysterytext*, *puzzlingtext*, *spacioustext* etc. (for details, see Annexure). They also compared the presentation of textual language with other representational formats and noted that the interactional differences exist because of the intrinsic structure of hypertext. Thus, the present research fulfilled its purpose as it explored the involvement of different cognitive/metacognitive categories that come into play while reading hypertext language of digital content.

Digital hypertext in its multimodal form, allows the reader to explore the text while navigating it. It has a feel of simultaneity and instantaneity. A digital reader is alert to various options to explore the hypertext for meaningful interaction. S/he is cognizant of the consequences of clicking a wrong link or how to integrate information chunks in a sequence, and thus, making it a metacognitive venture throughout the interactive process. This is why, perhaps, digital hypertext readers sometimes feel excitement mixed with disorientation. It is unlike the traditional text where language is presented sequentially and the reader does not feel any cognitive overload to integrate information from different representational modes. Therefore, the nature of interaction is quite different than that of exploring printed language, and thus, it results in different cognitive patterns for comprehending the hyperlinked language. Nevertheless, such hypertexts would create less cognitive load and disorientation, and thus, enhance the comprehension of the non-native readers. Therefore, it invites the attention of such content developers/designers. Since this study is conducted in non-native environments and the focus of the research was to understand the involvement of intricate cognitive processes while meaning making with digital hypertext. These cognitive processes are recorded, interpreted and analyzed in the light of the participants' interactional patterns/behaviors. New researchers need to look into brain processes using brain imaging patterns.

Annexure

1) **Cognition**
   - i) Classify the text information/content
     - a) Hidden text
     - b) Mystery text
     - c) Exciting text
     - d) Intuitive text

e) Imaginative text
f) Spacious text
g) Boring text
h) Alert text
i) Liberating text
j) Puzzle
k) Maze

ii) Compare the text
iii) Scan the text
iv) Read the text categories
v) Basic Understanding
vi) Conceptual understanding

2) Meta-cognition

i) Identify important aspects of text structure/reading boundary
ii) Clarify reading purpose
iii) Monitor ongoing activities
iv) Self- questioning
v) Taking corrective action and evaluation
vi) Make comments

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