

Extracting UX Elements Based on Reading Stages: A Case Study

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Abstract: The market for digital reading is swiftly expanding with a healthy variety of applications and platforms being introduced to the consumer. However, navigating such diversity in applications in any one platform may prevent the reader from experiencing the immersive reading. In this paper, we aim to extract UX elements of each reading stage for the seamless digital reading. We discovered that affective, cognitive, and participatory immersion helps the reader achieve flow in digital reading. It is also observed that multimodal inputs and outputs are helpful for immersion by increasing interest, accessibility, recognition, and expression of the readers. While previous research focuses on the stages of digital reading like approaching, evaluating, understanding, sharing, and creation, this paper is more concerned on comparisons of different design of applications: Instar paper, Pocket, and Readability, following the same reading stages and purposes. Based on the analysis of these apps, we propose UX elements which should be included in designing an e-reader.

Key words: *Digital reading, Immersion, Flow, Multimodality, UX elements*

1. Introduction

Information technology (IT) alters the tools for reading and subsequently the reader's behavior. Recently, reading behavior is not limited to consuming text, but extends to multi-modality behavior such as hearing and touching. The stages of reading in digital environment become increasingly different from traditional text reading. For example, readers may read articles in digital environment through web browser and share their opinions on it through social network services (SNS) and blogs. However, such activities are currently done through many different applications in order to achieve different goals, which sometimes is not very pleasant experience to the readers. The experience of switching different applications may also hinder the readers from flow of reading as well. Thus, in the previous research, we suggested a digital reading ecosystem which is a framework for the seamless reading in the digital environment including reading steps and multimodal elements that should be considered in each stage. It was found out that the reading process consists of approaching, evaluating, collecting, understanding, sharing, and creating.

In this paper, we aim to extract more specific UX elements of each reading stage to build a reading application, and also suggest ideas to improve immersion. In the literature review, we identify the characteristics of digital reading, flow, and multimodality and then conduct a case study of Instapaper, Pocket and Readability for iPad. They are similar reading apps which have same purpose and include most reading stages except creating. We analyze the pros and cons of these applications, extract the features of multimodal input and output, and find out the lack in each reading stage.

2. Literature Survey

2.1 Digital Reading

Reading is involved with the whole schema in one's mind that is triggered by reading a text. That is, reading is not only about obtaining information from the text, but also about the interactions of contents with the reader's experience (Hong, 2004). Kim(2000) pointed out that reading a text should be considered as a process of recognizing oneself as a member of society who shares the thoughts obtained from reading a text with others. Choi(2008) also said that reading before modern times is an interaction with other members in a society where one's own interpretation can be added or modified in the contents. Then, reading in digital information era can be then extended to include various communication tools, where the opinions are shared (Kim, 2000). That is, reading through digital media is adding spontaneity, complexity, easiness, and diversity to the traditional view on reading as individual and thought process. Therefore, reading stage is not limited to reading texts and is extended to interpretation and creation of knowledge that may also be involved with sharing opinions with others. For this reason, Hayles (2005) said that reading through digital media includes reading, seeing, hearing, speaking, writing, and even the movement. Therefore, all the references above support the argument from the previous research (Kang and Eune 2012) that digital reading consists of analog reading and multimodality.

2.2 Flow & Immersion in digital reading

Csikszentmihalyi(2004) defines that flow is a status where one is fully involved such that he/she is not concerned with anything else but the current work. Douglas & Hargadon(2000) said that flow in hypertext reading is achieved by feeling that immersion and engagement are easily conducted. Immersion in this context refers to the state where one is fully absorbed with the schema changes of familiar story. Engagement refers to changing or integrating the conflicting schemas from outside of the text. Mangen(2008) classified immersion into two; one is phenomenal immersion from cognitive imagination of virtual world and the other technological immersion from the virtual world provided by a physical device. Lee & Brophy(1996) classified immersion into three; affective immersion that are related to interest and motivation, cognitive immersion that are related to intensity of concentration, and participatory immersion that are related to amount of participation. Based on these definitions, we classified flow in digital reading into cognitive immersion, affective immersion, and participatory immersion as Figure 1.

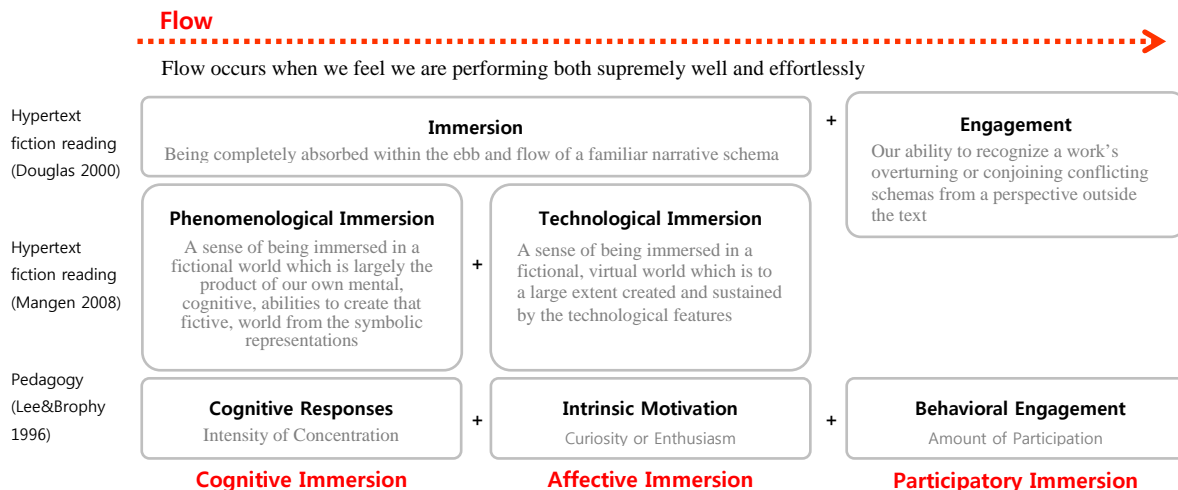


Figure 1. Flow of Digital Reading

2.3 Multimodality

Multimodality especially refers to the form where some or all of five senses of human (visual, auditory, olfactory, palate, and taste sensing) and computer interaction tools (mouse, keyboard, etc.) are involved simultaneously. Oviatt and Cohen (2000) argued that multimodal input supports the benefits of increased system accessibility, improved performance of recognition-based systems, and increased expressive power for diverse users. The benefits of multimodal output are synergy, increased bandwidth of information transfer, improving the mapping between communication medium and content, attention management. Dale (1969) argued that modalities have a significant impact on effective learning styles. He claimed that the learning phenomenon is achieved at the highest level both by what we say and do and that all other sayings, reading, and hearing while seeing activities alone are less effective than these modalities. Thus we argue that the benefits of multimodality will help the flow of digital reading.

Table 1. Input & Output of Multimodality

Input	Accessibility	Improved performance of recognition-based systems	Improved Expressive Power
Output	Attention management	Increased Bandwidth	Improved Mapping

2.4 Correlation between Multimodality & Immersion in digital reading

Multimodality by various modes of visual, auditory, and touch sensing triggers interests of readers to motivate positive attitudes toward content and comprehension. Active reading by underlining and adding personal opinion and sharing these opinions in reading through participation motivates and increases comprehension in more instances than passive reading. We matched the benefits of Multi-modality mentioned above to the types of immersion.

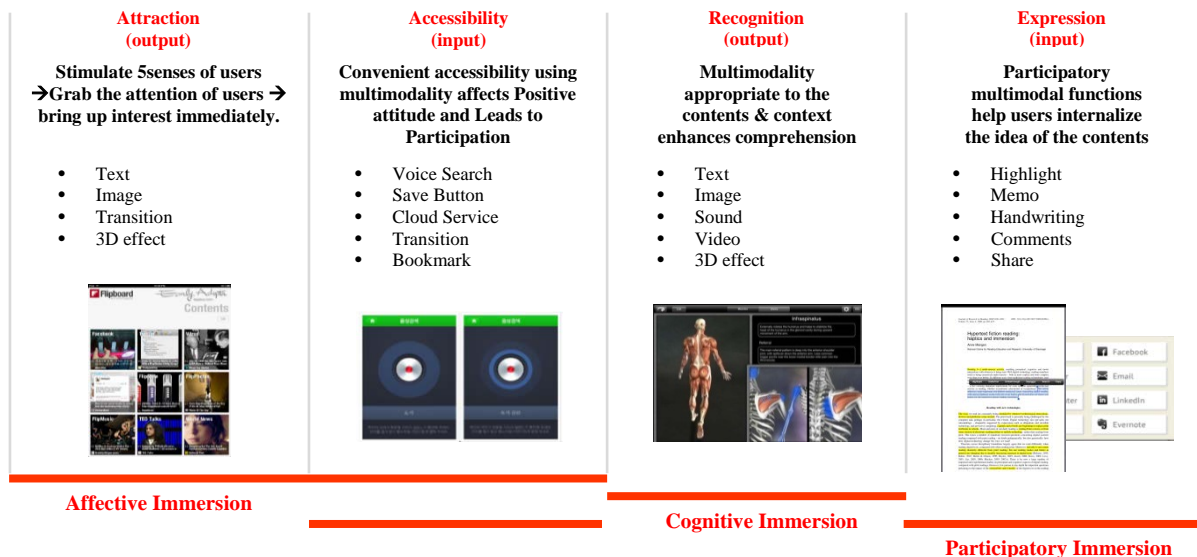


Figure 2. Correlation between multimodality and immersion

2.5 Ecosystem of digital reading

Kang and Eune (2013) studied reading stages for two different contents and observed that the stages are dependent. For example, news reading does not require creating stage as much as other stages such as approaching,

evaluating, understanding, collecting, and sharing. Research paper reading does not require sharing as much as other stages. Collecting tends to be done before reading. In addition, the stages that are gone through after reading are dependent on the contents. Figure 3 shows a digital reading ecosystem where the production and consumption of contents occur flexibly within one service platform. This ecosystem shows the idea that the contents people save, share, and create during the reading can be approachable in a same application. We analyzed three similar reading apps in order to know what multimodal elements are necessary in each stage to create a reading app.

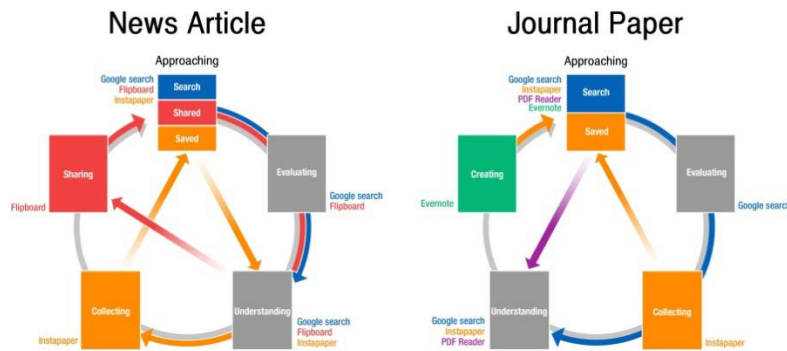


Figure 3. Digital Reading Ecosystem

3. Case Study

In this case study, we derive UX elements and principles that help immersion in digital reading. As Kang and Eune (2013) observed that Instapaper is one of the apps that support reading processes well, we select similar applications like Pocket and Readability for iPad to compare them with Instapaper. All these applications support archiving online contents and different presentation format of them depending on the platforms. We identify the common and specific factors in each reading stage for these applications and also analyze the differences among these. We also identify relative deficiencies from comparison of these apps and provide a design guideline for iPad apps based on these comparisons.

According to the previous research, there are 6 stages of digital reading, whose order depends on the contents type. However we did not consider the collecting stage because it does not always happen inside apps. Below, we summarize our findings for each reading stage.

Approaching: Instapaper offers 5 ways to approach contents: 1)archived from websites, 2)searched, 3)browsed by typing URL, 4)shared by friends, 5)recommended by system. If the reader wants to see new contents, there are 4 other ways to find them. However the app only supports the web contents only. Thus, if readers want to see a pdf or ebook, they should leave the app, which causes interruption in reading. Pocket provides only one way to approach contents, so there is no way to find new contents within the app other than saved contents. Readability supports 4 different ways to approach contents; 1)saved, 2)searched, 3)browsed, 4)recommended. However, it does not provide shared contents that Instapaper supports. When the readers open the app, the reading list is presented by default. If they want to read new content, they can tap the top-reads that provides popular news or read content from longform (Longform.org recommends new and classic non-fictions from the web). Otherwise, they should use a URL or keyword search through the embedded browser in the app.

Even though Instapaper supports various ways to approach contents, it doesn't allow the reader to read contents outside the app such as local iPad storage or a third-party cloud space. This role is assumed by other apps like PDF reader and Goodreader. If it is possible to import content from outside the environment or download books, there is no reason to leave the app to find new contents, which helps seamless reading.

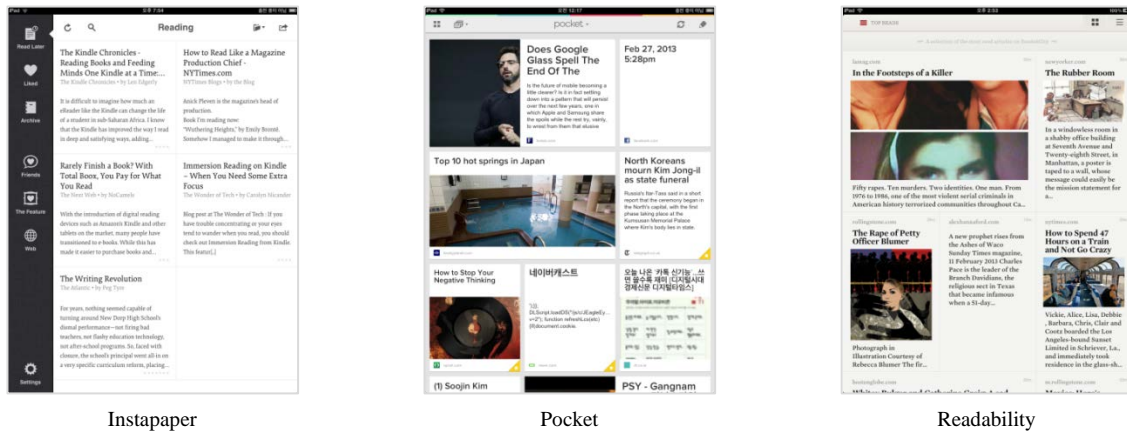


Figure 4

The category of all the apps consists of Reading list(read later), Favorites(liked), and Archive (the name of category is different in each instance). The readers can create folders in Instapaper and add keywords in pocket to organize contents. However, readability does not provide methods for grouping or curating. Pocket allows users to sort contents by content type so that it is easy to navigate saved material.


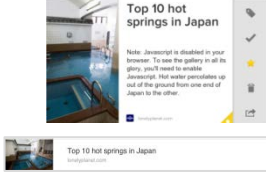



Evaluating: Evaluating is similar to filtering in order to know if the content is what the reader wants and is reliable. The reader decides if the contents are what they want by looking at the title, image, and abstract. They also decide if the contents are reliable by looking at the publisher, the number of sharing of the contents, hits, and stars, and the reviews on the contents. Within the content that is evaluated and collected accordingly, arranging the evaluation related information is important because the reader should re-evaluate and select some of the saved contents. All three applications provide title and preview features which help the reader to choose an article to read, and manage them by supplied tool buttons (e.g. move, delete, share, etc.).

Instapaper has only one template regardless of methods for approaching material, which doesn't include image or color. It is muted like a paper book. The app leads the user to reading rather than seeing, so that it is helpful for the user to be calm before reading body texts. Additionally, the app provides pagination dots and author's name for evaluation, which are not included in other apps. These are important elements in deciding to read knowledge-oriented contents like a research article. Thus, Instapaper is more suitable for serious reading to obtain knowledge. Pocket provides two views, gallery view and list view. Both include images. It is much easier to pay attention than the template with only text. However colors from logo & favorite icon and photo colors are distracting from focusing on the contents. It appears to place priority on getting attention for the affective immersion. Pocket enables the readers to use tag, like, read, and share features in this early reading stage, which suggests that the application is targeting less serious readings where evaluation can be done without reading the body texts.

Readability compromises Instapaper and pocket. In the saved contents (reading lists), only text view are provided. Top reads, the recommended contents (news and magazine articles), shows both image and text view. In the previous research (Kang & Eune 2013), it was proved that users desire images with their news contents. It is a

fast and efficient method to attract users' attention and to assist the users in identifying concepts. For readers who prefer focusing on texts in order not to have prejudice by the images, the list view is provided for cognitive immersion. The app provides different layout depending on the method of approaching content and content types.

Table 2. Templates of Evaluation Stage

Saved			
Recommended (shared)		N/A	
	<ul style="list-style-type: none"> • Cognitive immersion • Suitable to Knowledge • One template 	<ul style="list-style-type: none"> • Affective Immersion • Suitable to Inforamtion • List/gallery view 	<ul style="list-style-type: none"> • Cognitive/Affective Immersion • Suitable to Inforamtion & knowledge. • Two templates depending on approaching way

Understanding: In the understanding stage, Instapaper and Readability provide only texts and images in the content. However, Pocket enables the reader to save movie clips associated with the contents. Supporting various contents and file types helps the reader focus on reading activity, which is an important issue in digital reading ecosystem.

Kang and Eune (2013) found out that quick approaching, communication through SNS, and background knowledge are important features for immersion in reading news articles in the understanding stage. However, none of the applications provides such features to the readers. Also, none of the applications provides any expression tool that helps the reader be engaged in the contents.

In all the applications, menu interface disappears when tapping the screen and it re-appears when tapping the screen again such that people can concentrate on the contents without being distracted by the menu. While Pocket and Readability only support scrolling, Instapaper provides both scrolling and flipping. We thus conclude that Instapaper respects the traditional way of reading. In addition, it is safe to provide these two options since mental models for navigating pages may be different depending on the contents.

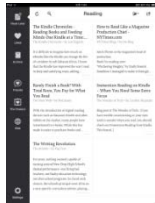




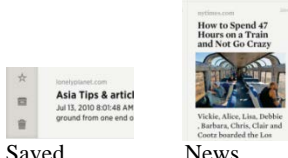
All the applications commonly provide Like, Share, Open in browser, and Move to archive functions, which is followed by evaluating. Also these apps provide legibility settings such as brightness, typefaces, background color, and type size. Among them, Instapaper provides the most delicate control of these features, which seems to care more about the reading performance. On the other hand, Pocket which handles multimedia contents as well as texts provides the simplest control of such features.





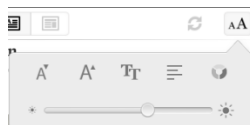
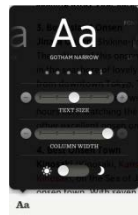


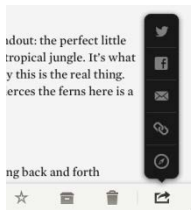
Sharing: All the apps commonly provide Email, Copy, Twitter, and Facebook. So we can assume that they are necessary services. Instapaper provides a manageable number of sharing methods. The logo icons next to the list help people quickly recognize individual services. However, Pocket provides too many sharing services to find an individual service. In addition, there is no logo icon to help recognize the service. Moreover, the list is ordered not by the popularity but alphabetically. Readability supports just the common services. All the apps provide just the

links to the sharing services and tools. Instead, if the sharing functions such as reading and writing comments, like, and tweet are at users' fingertips, it would be easy to read and interact with other people's opinions. The communication channel helps people engage in the contents.

Creating: None of the applications provides an editing tool for creating stage. Instead, all the apps provide links to an outside editing application like Evernote. However, the people who read for research may need the editing tools such as scrapping, annotation, and drawing feature during reading. This feature also help a reader internalize the contents by expressing their opinions.

Table 3. Analysis of Three Reading Applications

Apps Stages	INSTAPAPER	POCKET	READABILITY
Approaching			
	Saved(web browser plug-ins): Y	Saved(web browser plug-ins): Y	Saved(web browser plug-ins): Y
	Search(web, inside)	Search(inside)	Search(web, inside)
	Web Browser: Y	N/A	Web Brower: Y
	Shared: Y (link, liked)	N/A	N/A
	Recommendation : Y	N/A	Recommendation: Y
	View Mode: N/A	View Mode: Y	View Mode: Y
	Reload: Y (Exposed)	Reload: Y (Exposed)	Reload: Y (Hidden)
	Edit(Move to folder)	BulkEdit(Bulk edit)	Edit (Archive, Delete)
	Category: Readlater, Liked, Archive	Category: Home(all items), Favorites, Archive	Category: Reading list, Favorites, Archive
	Organizing: Folder	Organizing: Tag	N/A
Evaluating (output)			
	Output: Title Publisher Preview text Author Dots indicating progress & amount of pages	Output: Title Publisher Preview text Image	Output: Title Publisher Preview text Image Posting time
	Input: Delete, Move to folder, Copy	Input: Delete, Tag, Archive, Like, Share	Input: Delete, Like, Archive, Share

Understanding (input/ output)			
	Optimized view (no AD, hiding interface)	Optimized view (no AD, hiding interface)	Optimized view (no AD, hiding interface)
	Output		
	Contents Type: Articles, Images	Contents Type: Articles, Videos, Images	Contents Type Articles, Images
	Contents Info: Title, Publisher, Posting Date, Author, Pagination Dots,	Contents Info: Title, Publisher,(Author), (Posting Date), Images	Contents Info: Title, Publisher, Posting Date,
	Input		
	Pagination: Flipping, Scrolling	Pagination: Scrolling	Pagination: Scrolling
	Action: Like, Share, Open in browser Delete, Pagination on/off, Move to folder,	Action: Like, Share, Open in browser , Read/unread, Reload,	Action: Like, Share, Open in browser , Delete , Archive,
			
	View Setting: Brightness, Typefaces(14), BG color, Type size, Line spacing, Column width	View Setting: Brightness, Typefaces(2), BG color, Type size, Justifying,	View Setting: Brightness, Typefaces(5), BG color, Type size, Column width
Sharing			
	Action: Copy link, Email link, Email full text, Copy full text Services: Twitter, Facebook Tumblr, Pinboard Apps: Read in Goodreader	Action: Copy Link, Email, Open in safari, Open in google chrome, Report Issue with this article Services: Twitter, Facebook Tumblr, Pinboard, Evernote,+9 more Apps: echofon, omnifocus + 4 more	Action: email, copy link, safari Services: Twitter, facebook,
Creating	Link to Evernote	Link to Evernote,	N/A

4. Discussion

We extracted UX elements for a digital reading ecosystem that support the flow of digital reading. Figure 5 and Table 4 show differences among the apps and suggestions for the digital reading ecosystem (DRE) based on the analysis of the case. Because the apps deal with only the web contents that include diverse content types, the

results are not dependent on the contents. We observed that Instapaper is the most suitable app for DRE in the approaching stage because the app provides diverse methods to approach the contents so that readers do not need to leave the app to find new contents. In the evaluating stage, Readability is the most appropriate one because it provides flexible templates depending on the approach methods. Lastly, Pocket and Instapaper in the understanding stage are good because Pocket supports diverse content types and Instapaper cares more about readability related functions. However, none of these applications are suitable for the sharing and creating stages.

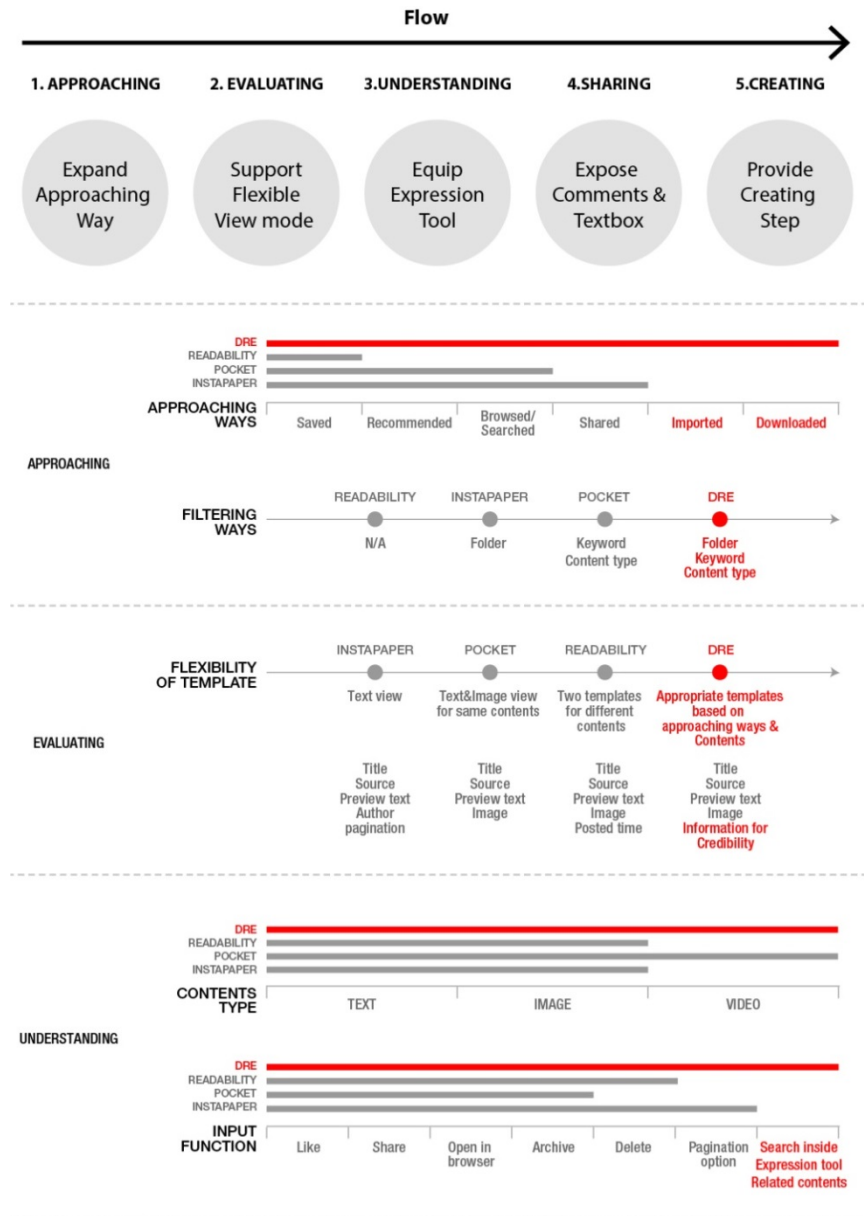


Figure 5. Suggestions for DRE(digital reading ecosystem)

In the approaching stage, even though Instapaper provides more methods (save, share, search, browse, and recommend) than others provide, it only focuses on web-contents. Thus, if the app includes the features of opening files from storages and downloaded e-books, it would be helpful for readers not to be distracted by using several reading apps. Also, it would motivate readers if the reading lists of celebrity are shared and are accessible by other readers just as twitter does.

In the evaluating stage, Instapaper pursues cognitive immersion with texts whereas Pocket pursues affective immersion with images. Readability is a compromised version because it shows only texts for the saved content list, whereas it mainly shows images for new contents. Thus, we conclude that when people read the saved contents, text oriented preview helps them calm down and warm up before starting intensive reading. In terms of reading new contents, affective immersion is important so that images and visual languages help draw readers' attention and interest. Because people have different mental models by the contents type and approaching methods, flexible templates that change depending on the contents would be desirable. In addition, if there is reliable information that help user grasp the value of the contents such as number of view, share and like, it would convince users to read the contents. Automatic extraction of keywords when content is saved would also help users filter out their saved contents easily. Such convenient function lets users have good attitude of reading.

In the understanding stage, there are common features such as "like", "share", "open in browser", and "move to archive", which normally is followed by evaluation. However all applications lack participatory immersion so that it is recommended to add expression tools such that the readers write their own thoughts or underline the texts in the content page in order to help the readers engaged. Another suggestion is accessibility functions such as search or bookmark so that users can save time to find a specific content. In addition, when nonprofessional people read technical contents, if the related information is provided, it would be very helpful for them to understand the contents without frustration so that the reader may have increased cognitive immersion.

In the sharing stage, all applications provide just links to other sharing services. Since communication with other people is more important for news contents than other contents, we propose that the application for news contents should provide the features such as reading and writing comments and interacting with others by expressing "like" or redirecting (or retweet in twitter) the contents to others. These features would lead to the affective immersion of the reader.

None of the applications actually has any tools for the creating stage since they mainly deal with web contents. However, for researchers, reading is to create new concept so that the features like excerpting and writing their thoughts are important during reading. Also even for the people in general, creating stage helps not only internalize the concept of contents, but also invite others to be more actively involved in creating new contents. In addition, when researchers excerpt some sentences from an article, if there is a function like auto arrangement of references, it will reduce their work so that they can focus on reading.

Table 4. UX elements for DRE

Stages	Extracted Specific Elements	Suggestions
Approaching	Ways: 1)saved from websites, 2)searched 3)browsed by typing URL 4)shared by friends 5)recommended Functions: reload, edit, folder, keyword Content type: text, image, video Organizing: folder, keyword, content type Show the page where the user left.	<ul style="list-style-type: none"> • To add a function to open the files from other storage • To make reading list sharable to see the book list of the people that you are interested in.
Evaluating	Output: Title, Publisher, Preview text, Image, Progress dots, Posting date Input:	<ul style="list-style-type: none"> • Flexible view and functions depending on the approaching way and contents • Reliable information to evaluate value such as number of view, share and like

	Move to folder, delete, copy, tag, archive, like, share	<ul style="list-style-type: none"> • Automatic extraction of keywords when content is saved
Understanding	Output: Text, Image, Video Input: Pagination(scrolling & flipping) Archive(read/unread), Like, Share, Open in browser, View Setting	<ul style="list-style-type: none"> • Accessibility Function • Related knowledge • Expression tool(note, highlight, handwriting, scrap)
Sharing	Common features: Email, Copy, Twitter, Facebook	<ul style="list-style-type: none"> • To expose other people's comments and list who hit like such as Flipboard • To allow users to comment or tap like(stars)
Creating	Link to evernote	<ul style="list-style-type: none"> • Edit functions such as writing and scrap • Auto arrangement of references when a reader excerpts

5. Conclusions

In digital environment, a reader tends to use various applications depending on the purpose of reading and the type of the contents. Such reading experience distracts readers from immersion. Thus, this paper is extended from the previous research that proposed DRE(digital reading ecosystem), which brings seamless reading for flow. The goal of DRE is to support a contents' production to consumption through one application. In order to achieve this, this paper extracted the UX elements that help the immersion of each stage through a case study.

From the literature review, we learned that the digital reading has both features of analogue reading and multimodality. In particular, flow in DRE can be achieved by affective, cognitive, and participatory immersions. These three immersions can be satisfied by the benefits of multimodal input and output such as attraction, accessibility, recognition, and expression in each reading stage. In the previous research (Kang and Eune 2013), we found out that digital reading stage consists of approaching, evaluating, understanding, sharing, and creating.

To know about the UX elements of each reading stages, we analyzed three similar reading applications, Instapaper, Pocket, and Readability, which cover most of digital reading stages. From the analysis, we found out the pros and cons of these applications, the features of multimodal input and output, and the lack in each stage.

Based on the results, we set up the goal of each stage. Diverse approaching ways are important in order to let users stay in the same app. Thus, we recommend adding the features of importing files and downloading e-books in what the Instapaper provides. In the evaluating stage, a flexible view mode depending on the content type and approaching method is important. In the understanding stage, an expression tool should be added to help readers engage in the contents. In the sharing stage, exposing the function to read and write comments would be helpful for the affective immersion instead of just link to SNS since reading other people's reaction motivates the reader to keep reading and share what he/she thinks. Lastly, although all the apps do not include the creating stage, we propose adding it to a reading app since first, researchers need to write and excerpt during the reading to create new concept and second, people can internalize the contents by writing their thoughts.

As a future research topic, it would be interesting to design a reading application to help the flow of reading for tablet PC, which provides suitable modules for different reading stages depending on the type of contents. Then, one may find out whether the DRE helps the flow of reading via user testing.

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