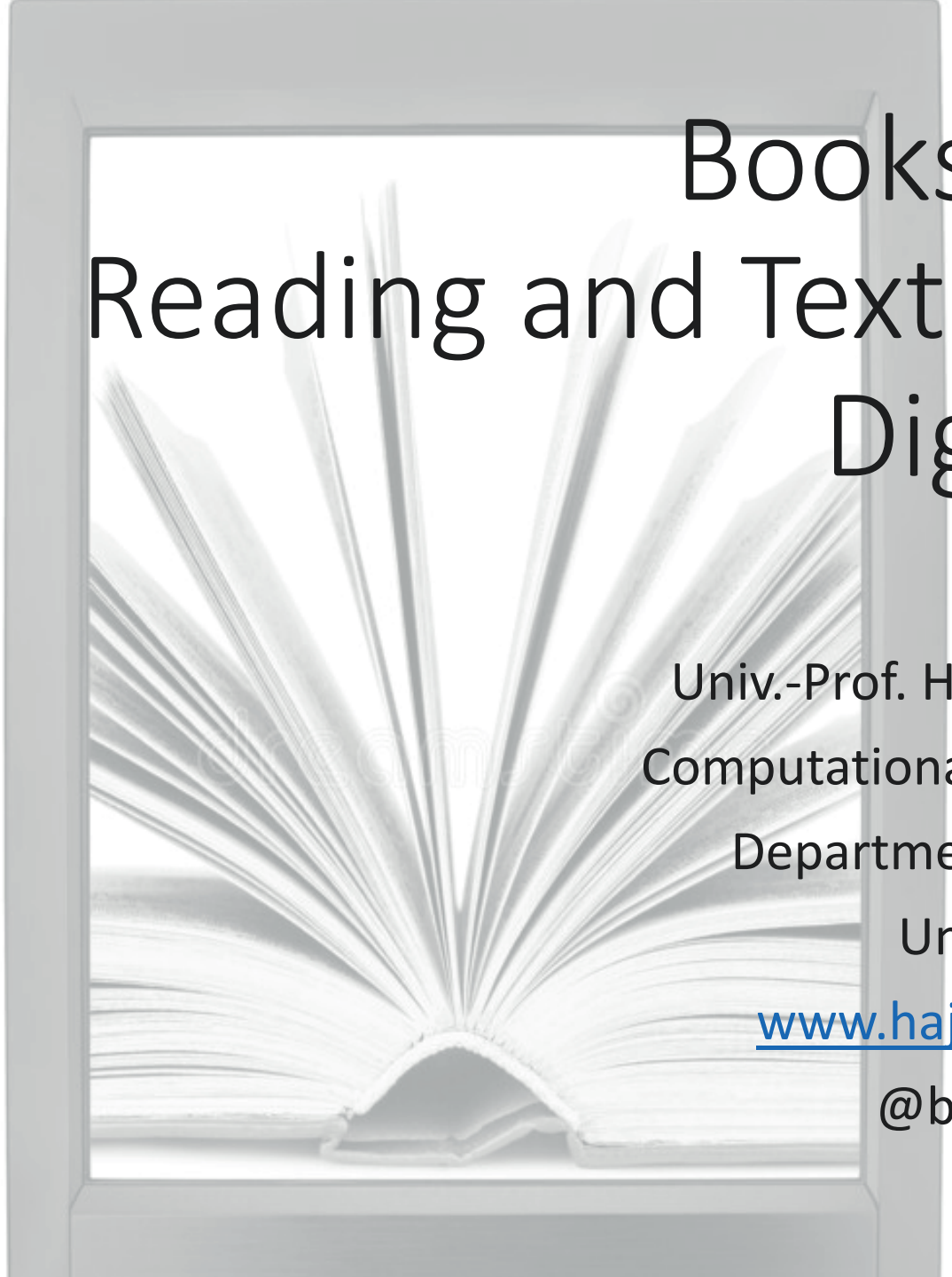


Books on Screen
Reading and Text Comprehension in the Digital Era.

Univ.-Prof. Hajo Boomgaarden, Ph.D.

Computational Social Science Lab (CCL)

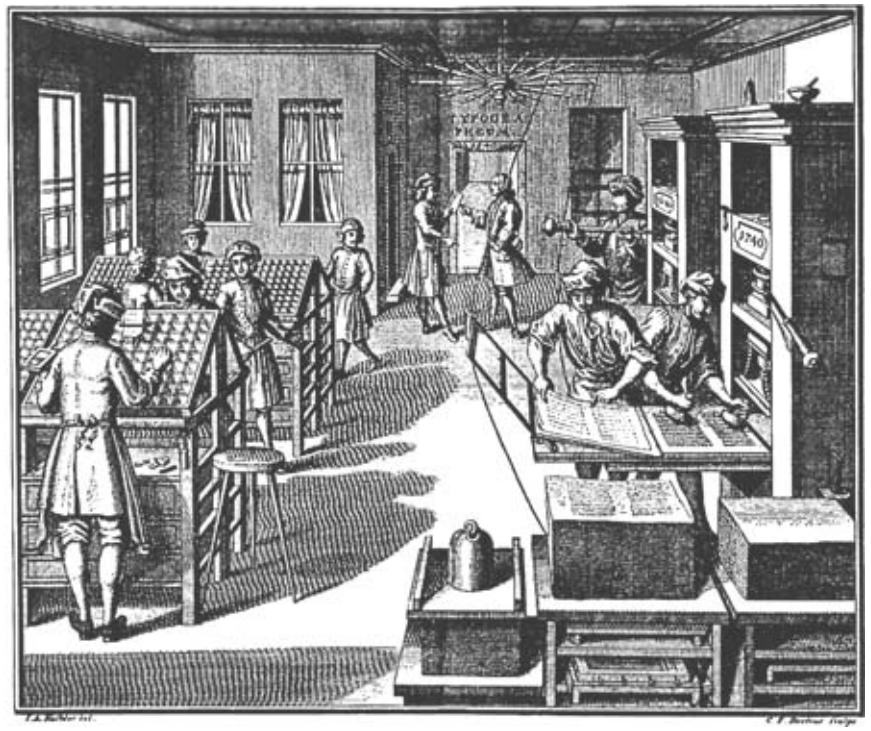
Department of Communication

Universität Wien

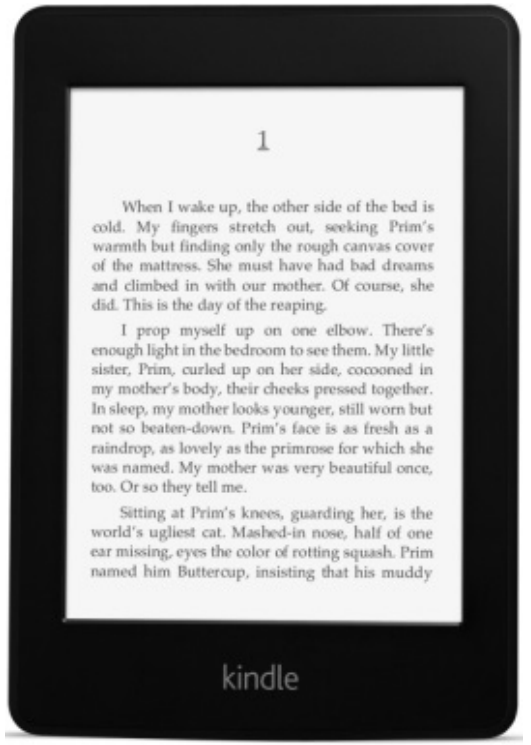
www.hajoboomgaarden.com

@boomgaardenhg

From printed books to books on screen



Kupferstich des Boetius, um 1700



E-Reader Modell Amazon kindle

From printed newspapers to multimedia only articles

Frankfurter Allgemeine

ZEITUNG FÜR DEUTSCHLAND

Das planetarische Zeitalter hat begonnen

Der sowjetische Erdsatellit sendet verschlüsselte Funkzeichen / In 96 Minuten um die Erde / Sorge in Amerika

Washington: Moskaus größter Erfolg

Politische Folgen

Wir sind dabei gewesen

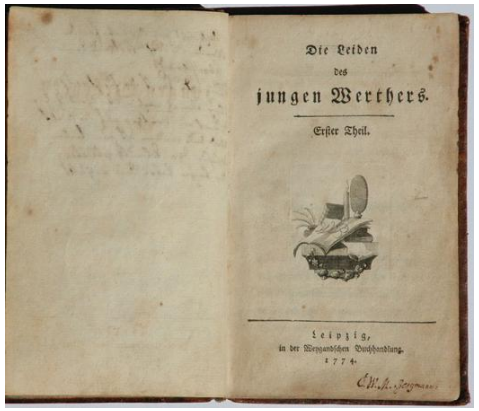
Vierstündiges Gespräch Dulles – Gromyko

Washington will die verbitterte Haltung Moskaus ergründen / Frage nach der Wiedervereinigung

Faz.net

Shutterstock

The mediality of reading

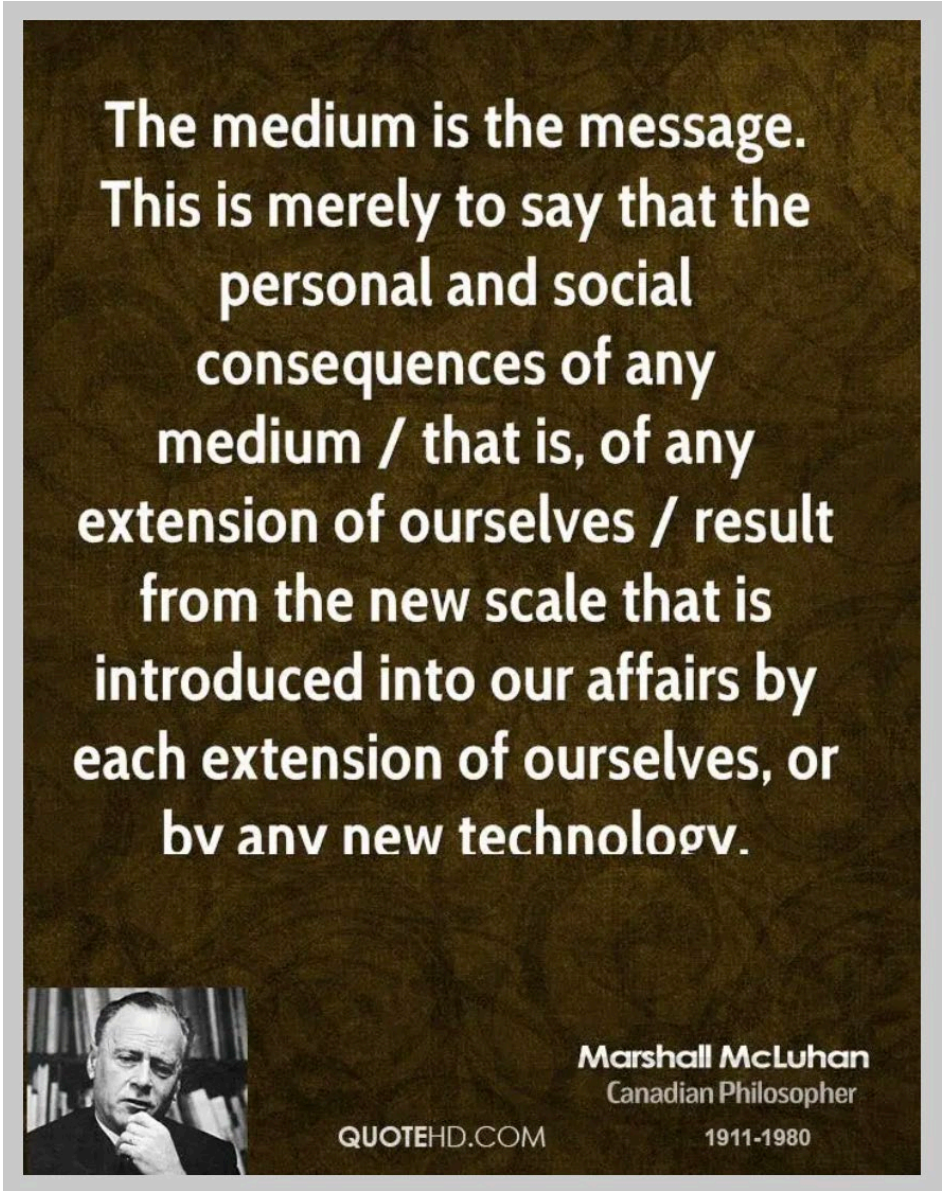


Roger Chartier (1992):

„ Readers in fact never confront abstract, idealized texts detached from any materiality. They hold in their hands or perceive objects and forms whose structures and modalities govern their reading or hearing and consequently the possible comprehension of the text read or heard. (…) it is necessary to maintain that forms produce meaning and that even a fixed text is invested with new meaning and being when the physical form through which it is presented for interpretation changes.“

The medium is the message

“the form of a medium embeds itself in the message, creating a symbiotic relationship by which the medium influences how the message is perceived”



New media, old threats?

“For this invention will produce forgetfulness in the minds of those who learn to use it, because they will not practice their memory. Their trust in writing, produced by external characters which are no part of themselves, will discourage the use of their own memory within them.” (*Sokrates, in: Plato. Phaedrus.*)

*“*As for the radio's object, I don't think it can consist merely in prettifying public life. Not is radio in my view an adequate means of bringing back coziness to the home and making family life bearable again. But quite apart from the dubiousness of its functions, radio is one-sided when it should be two. It is purely an apparatus for distribution, for mere sharing out.*”* (*Berthold Brecht, Der Rundfunk als Kommunikationsapparat, 1932, p. 553*)

Digital reading

Thinking and understanding take place in an active exchange between the body and its environment (Calvo & Gomila, 2008).

When reading, the process of understanding a text does not take place in an isolated awareness, sensory and motorical processes are active at the same time (Brosch, 2018).

The haptic dimension of the printed book, its specific spatiality, the landscape layout, etc. influence the reading process as much as the practice of turning over the page or other related gestures (Brandl et al, 2020).

Digital reading

Reading is increasingly goal-oriented and not experience-oriented (Baron, 2015; Kovač and Van der Weel, 2018; Kuhn and Hagenhoff, 2015; Mangen and Van der Weel, 2016; Mangen, 2020)

- Text are becoming increasingly short
- Information is taken up in smaller bits
- Reading becomes less continious

The context of digital texts leads to distraction from the text (Copeland, et al., 2016).

- Superficial reading, the skimming or scanning of texts, may increasingly dominate the reading of digital books and thereby replace the deep reading of printed books (Baron, 2015; Wolf, 2018).

Central questions

Who reads which types of books on screen, and in which situations?

Who profits most from digital (academic) reading?

Does reading on screen make for a different reading experience compared to reading a printed book?

Can interactive visualizations in digital formats contribute to better text comprehension?

Two projects – five studies

- **Books on Screen.** FWF funded. Together with Günther Stocker, Annika Schwabe, Lukas Brandl
- **Visualizations in the news.** UNIVIE funded. Together with Esther Greussing.

- Schwabe, A., Brandl, L., Boomgaarden, H. G., & Stocker, G. (forthcoming). *Readers in the digital age: Reading practices and media technologies*. Mobile Media & Communication.
- Kuhn, A., Schwabe, A., Boomgaarden, H. G., Brandl, L., Brendel-Kepser, I., Krause-Wolters, M., Lauer, G., & Stocker, G. (2022). *Who gets lost? How digital academic reading impacts equal opportunity in higher education*. New Media & Society.
- Schwabe, A., Brandl, L., & Boomgaarden, H. G. (2022). *No negative effects of screen reading media on comprehension of narrative texts compared to print: A meta-analysis*. Media Psychology.
- Schwabe, A., Brandl, L., Stocker, G., & Boomgaarden, H. G. (2021). *Experiencing literature on the e-reader: The effects of reading narrative texts on screen*. Journal of Research in Reading.
- Greussing, E., Kessler, S. H., & Boomgaarden, H. G. (2020). *Learning from science news via interactive and animated data visualizations: An investigation combining eye tracking, online survey, and cued retrospective reporting*. Science Communication.

Who reads which types of books on screen, and in which situations?

Schwabe, A., Brandl, L., Boomgaarden, H. G., & Stocker, G. (forthcoming). Readers in the digital age: Reading practices and media technologies. Mobile Media & Communication.

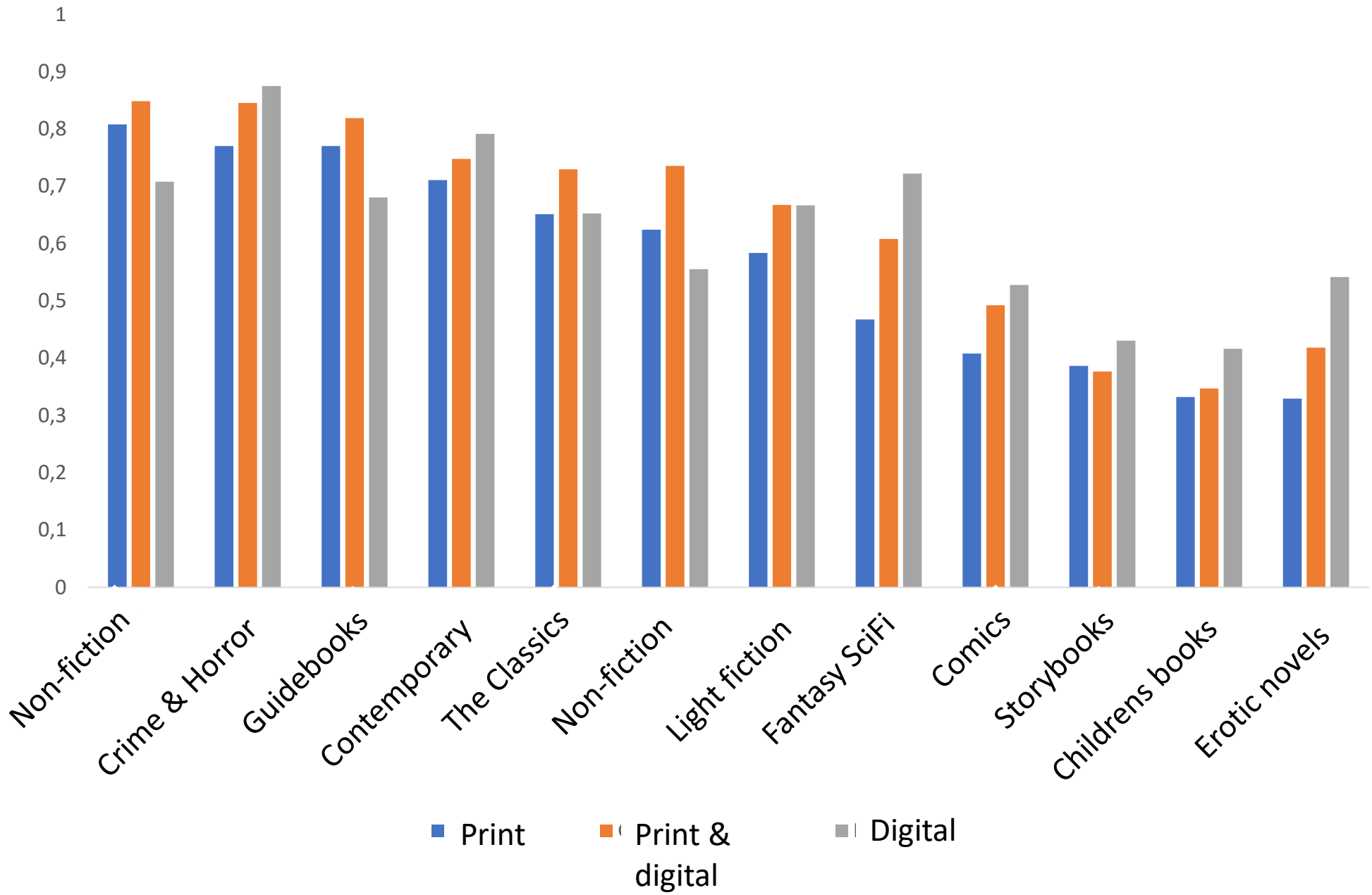
A survey about reading habits in AT

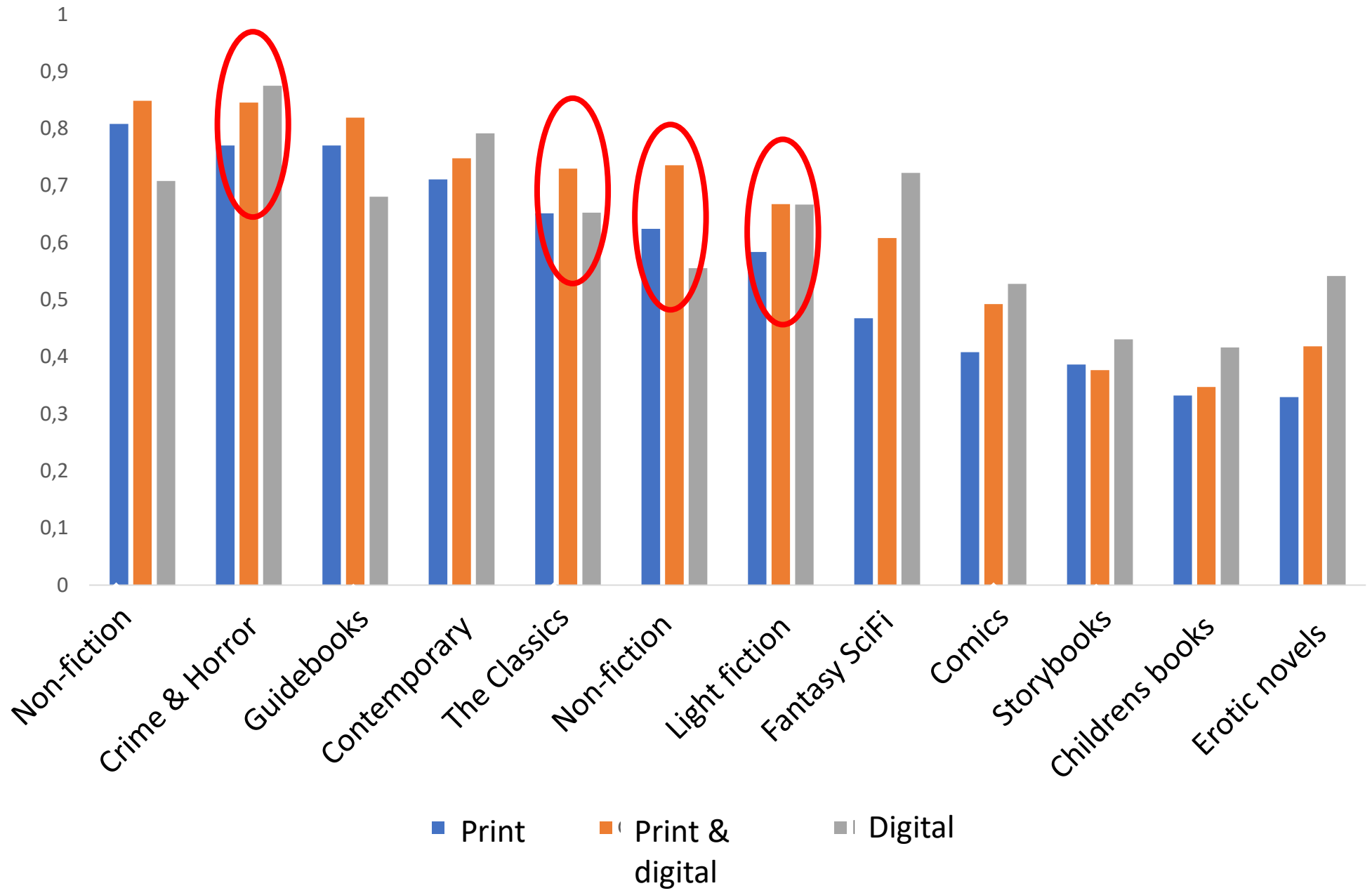
-> Quota based sample of 1012 people, of which 772 readers

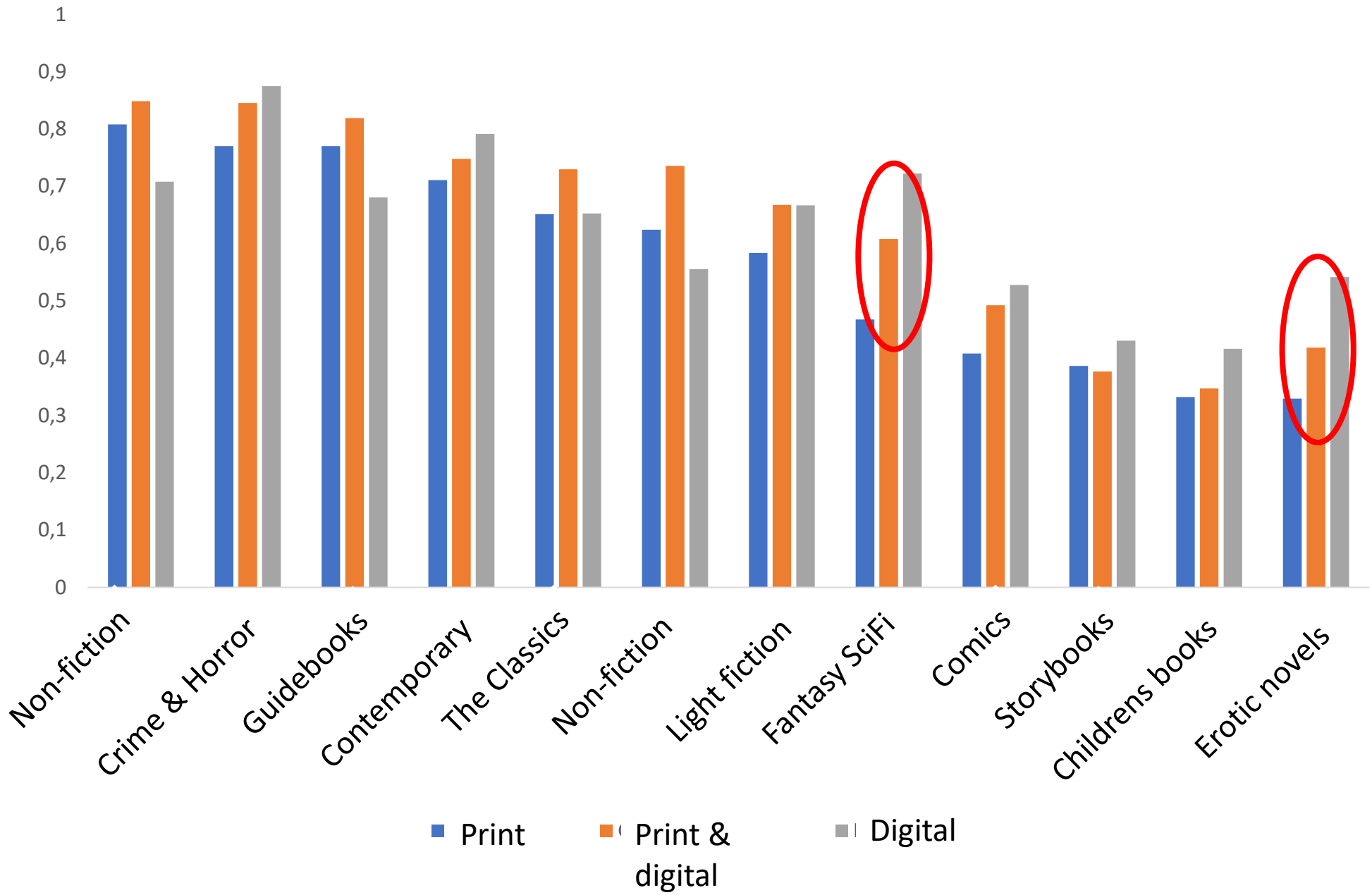
47.5% only printed books
43.3% printed and digital books
9.2% only digital books

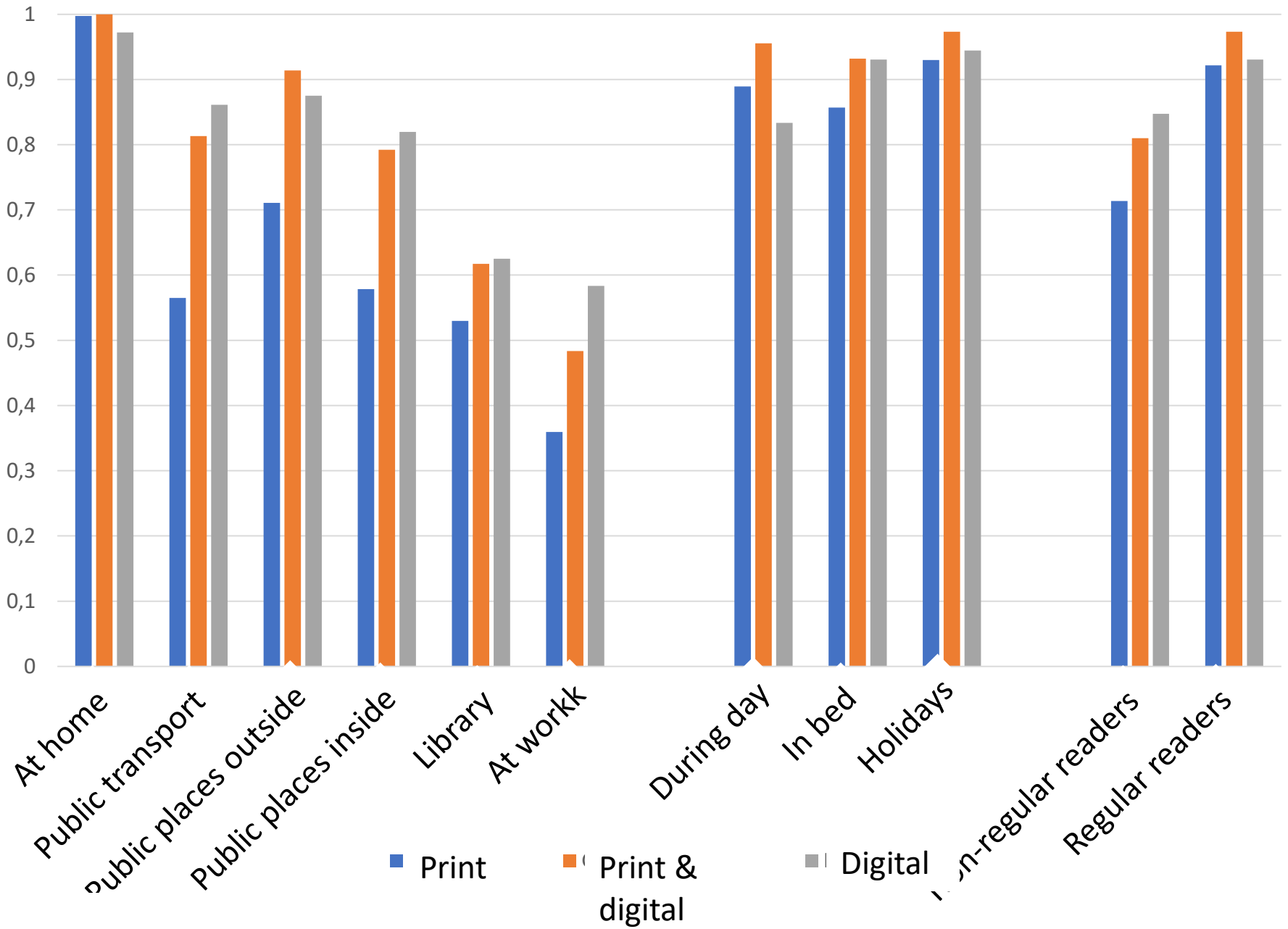
Table 1

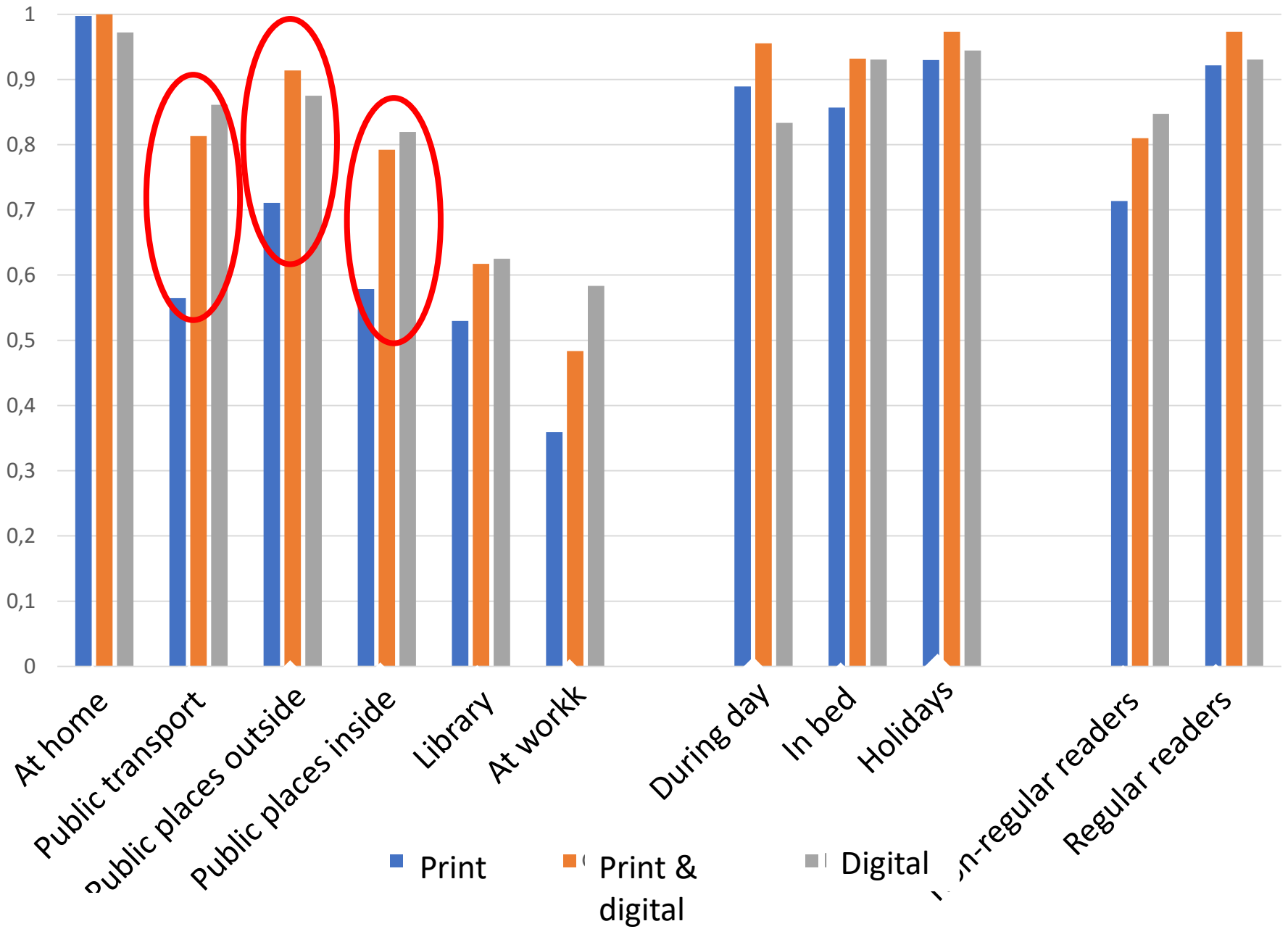
Reading Mode	Age (mean/ SD)	Gender (%)	Education
print readers	50.06 (15.38)	women: 60.0 men: 40.0	secondary: 73.0 tertiary: 27.0
multi-format users (print & e-books)	48.34 (14.86)	women: 49.9 men: 50.1	secondary: 70.9 tertiary: 29.1
digital only readers	43.31 (14.95)	women: 38.9 men: 61.1	secondary: 80.6 tertiary: 19.4


1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
Non-fiction
Crime & Horror
Guidebooks
Contemporary
The Classics
Non-fiction
Light fiction
Fantasy SciFi
Comics
Storybooks
Childrens books
Erotic novels
Print
Print & digital
Digital


1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
Non-fiction
Crime & Horror
Guidebooks
Contemporary
The Classics
Non-fiction
Light fiction
Fantasy SciFi
Comics
Storybooks
Childrens books
Erotic novels
Print
Print & digital
Digital


1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
Non-fiction
Crime & Horror
Guidebooks
Contemporary
The Classics
Non-fiction
Light fiction
Fantasy SciFi
Comics
Storybooks
Childrens books
Erotic novels
Print
Print & digital
Digital


1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
At home
Public transport
Public places outside
Public places inside
Library
At workk
During day
In bed
Holidays
Regular readers
Print
Print & digital
Digital


1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
At home
Public transport
Public places outside
Public places inside
Library
At workk
During day
In bed
Holidays
Regular readers
Print
Print & digital
Digital

Summing up

- Almost half of the readers read print only.
- More than half of the readers uses at last also digital reading divices (multi-users und digital only).
- Reading only digitally is more pronounced among younger, well educated men
- Multi-users read more and more diverse, more different genres.
- Digital reading is for reading not at home.

Who profits most from digital reading?

Kuhn, A., Schwabe, A., Boomgaarden, H. G., Brandl, L., Brendel-Kepser, I., Krause-Wolters, M., Lauer, G., & Stocker, G. (2022). *Who gets lost? How digital academic reading impacts equal opportunity in higher education*. New Media & Society.

A closer look at university students…

- Digital texts are rather then norm in academic contexts (Mariën and Prodnik, 2014) and reading comprehension and reading behaviour have a strong impact on study success (Frauen et al., 2007)

- It is suggested that digital reading contributes to new social inequalities (Hill and Lawton, 2019; Robinson et al., 2015).

- Digital Divide -> Differences in access to and knowledge of information and communication technologies

Table 1: Relations of digital academic reading divides. Thick arrows indicate relations analyzed in this study.

First-level divide	Second-level divide	Third-level divide
		Learning success

Inspired by Dijk, 2000

Survey among university students in AT, D (and CH)

Gender	Female	Male	Non-binary	
	2577/72.4%	946/26.6%	37/1.0%	
Country	Germany	Austria	Switzerland	
	3265/91.7%	266/7.5%	26/0.7%	
Academic Institution	University	University of Applied Sciences		
	2758/77.5%	802/22.5%		
Planned degree	Bachelor	Master	Ph.D.	Other
	2196/61.7%	823/23.1%	35/1.0%	506/14.2%
Academic progress	beginner (1–2 lecture periods)	advanced (3–7 lecture periods)	postgraduate (8–12 lecture periods)	long term (>12 lecture periods)
	670/18.8%	1486/41.7%	1084/30.4%	320/9.0%

- **Elite Digital Readers**
  - Geneally positive attitudes towards digital technologies, very good digital skills, using digital tools proactively, enhancing their possibilities by using digital texts,
- **Advanced digital readers**
  - Positive attitudes towards digital technologies when appearing useful, good digital skills, but not regarding reading in particular, appear to benefit from using digital texts
- **Pragmatic digital readers (largest group)**
  - Don’t see usefulness of digital texts, but follow the trend, no intrinsic motivation to read digitally, have partially other digital skill, could benefit from instructions
- **Digitally excluded readers**
  - Negative attitudes towards digital reading media, only little digital skills, read on print whenever possible, would need a lot of support to benefit from digital reading.

Summing up

- „Digital natives“ are by no means also „digital reading natives“.
- Mixed analoge as well as digitale offers remain important
- Special support structures needed to not further enhance digital inequalities

Does reading on screen make for a different reading experience compared to reading a printed book?

Schwabe, A., Brandl, L., & Boomgaarden, H. G. (2022). *No negative effects of screen reading media on comprehension of narrative texts compared to print: A meta-analysis*. Media Psychology.

Schwabe, A., Brandl, L., Stocker, G., & Boomgaarden, H. G. (2021). *Experiencing literature on the e-reader: The effects of reading narrative texts on screen*. Journal of Research in Reading.

- “Is the immersive experience of reading Dan Brown’s page-turner *Inferno* (2013) ‘the same’, regardless of whether you read it on an iPad, a Kindle or in a print pocket book? (…) What happens to the literary reading experience as it goes digital?” (Mangen, 2016, 243–244)

- Meta-analyses regarding differences between reading print or digitally conclude that the digital reading medium has a negative impact on text comprehension, but it remains unclear whether that also goes for narrative texts (Clinton, 2019; Delgado et al., 2018; Imel, 2018; Kong et al., 2018).

Study 1 – Meta-analyses

- Academic publications between 1982 and 2020

- Focus on narrative texts

    - With or without interactive enhancements
    - Publication year
    - Different types of screens

Results

Across all studies:

- No significant differences between print and digital reading concerning text comprehension
- No differences in the relationship across time
- But, digital narrative texts that are enhanced with interactive features yield higher text comprehension

    -> These findings foster the hypothesis that positive emotions evoked by multimedia features and interactive information processing support comprehension (Plass et al., 2014; Xu & Sundar, 2016).

But...

- Often assess the reading of very simple narrative texts
- Looks at very short reading periods
- Printed texts are usually not in original formats
- Reading situations are highly artifical

Study 2 – Experiment

- What is the difference in reading experience when reading digitally or in print?

Five dimensions of literary experience

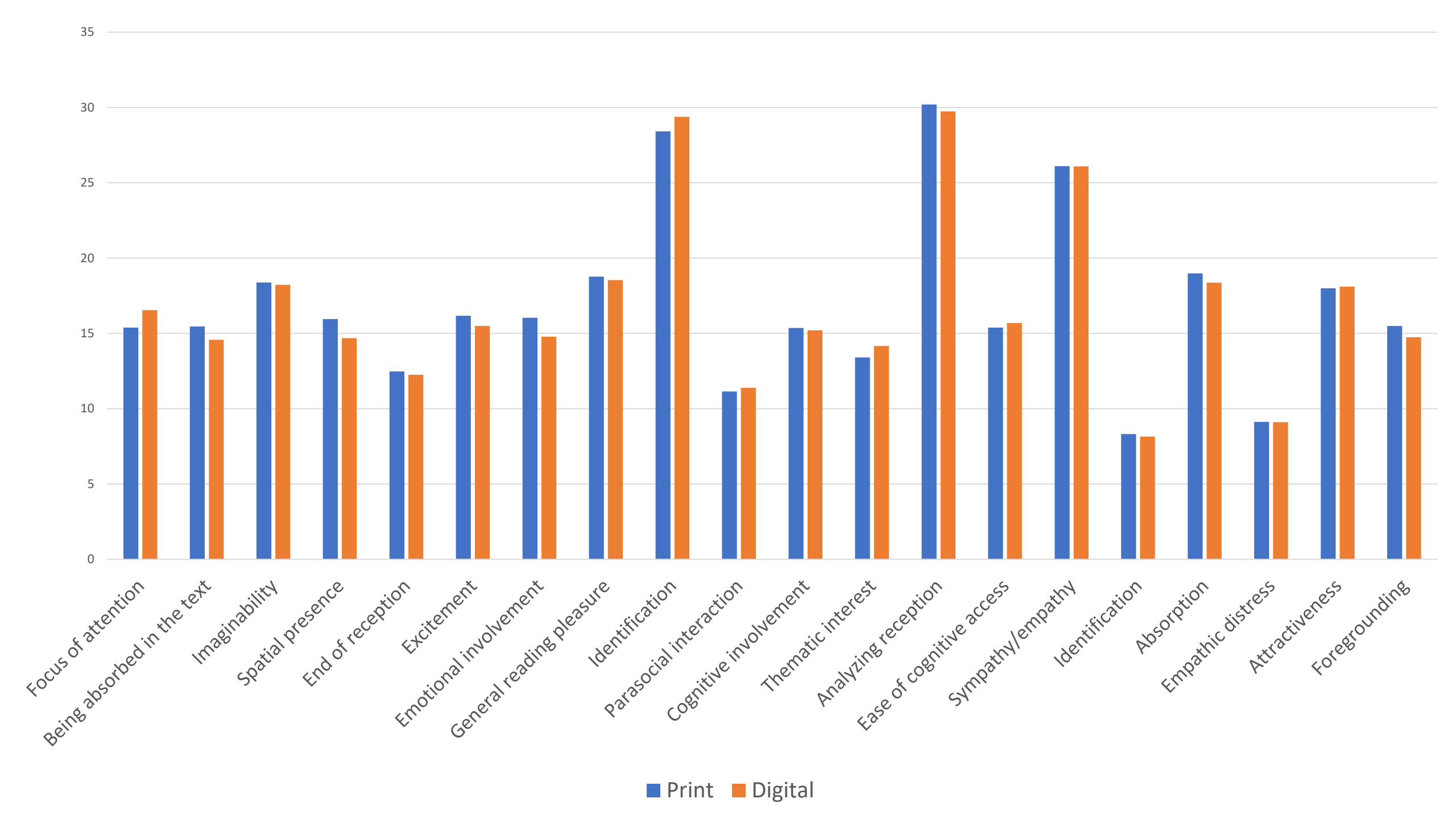
Ernst Barlach: Der Buchleser

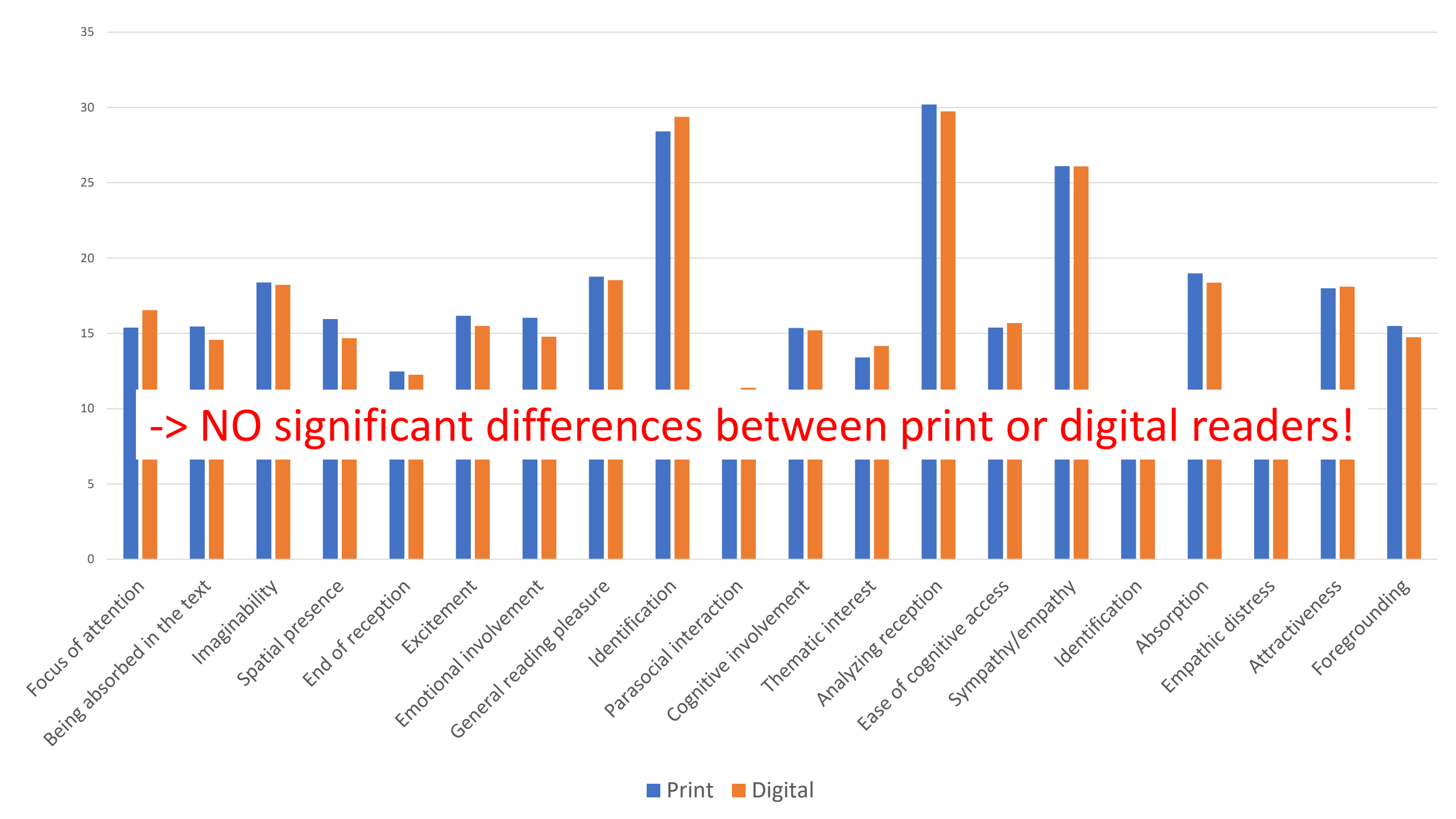
„Someone else can read a text efferently for us, and acceptably paraphrase it. No one else can read aesthetically, that is, experience the evocation of, a literary work of art for us.” (Louse M. Rosenblatt 1988)

1. Narrative coherence/ narrative understanding
2. Imagination
3. Immersion
4. Empathy
5. Analytical reading

Experimental setting

- Relatively natural reading situation (armchair, light, quite environment)
- Randomly assigned participants read on screen or in print (total 207)
- 1. Chapter, original book vs. Amazon Kindle
- Questionnaire measuring reading experience


35
30
25
20
15
10
5
0
Focus of attention
Being absorbed in the text
Imaginability
Spatial presence
End of reception
Excitement
Emotional involvement
General reading pleasure
Identification
Parasocial interaction
Cognitive involvement
Thematic interest
Analyzing reception
Ease of cognitive access
Sympathy/empathy
Identification
Absorption
Empathic distress
Attractiveness
Foregrounding
Print
Digital


35
30
25
20
15
10
5
0
-> NO significant differences between print or digital readers!
Focus of attention
Being absorbed in the text
Imaginability
Spatial presence
End of reception
Excitement
Emotional involvement
General reading pleasure
Identification
Parasocial interaction
Cognitive involvement
Thematic interest
Analyzing reception
Ease of cognitive access
Sympathy/empathy
Identification
Absorption
Empathic distress
Attractiveness
Foregrounding
Print
Digital

Summing up

- No differences between digital and print reading for narrative texts, apparent advantage of print reading more generally

- Impact of the reading situation (focussed reading)?
- Impact of the reading medium (Kindle close to book)?

- If reading narrative texts digitally, then chose a proper digital reading medium?

Can interactive visualizations in digital formats contribute to better text comprehension?

Greussing, E., Kessler, S. H., & Boomgaarden, H. G. (2020). *Learning from science news via interactive and animated data visualizations: An investigation combining eye tracking, online survey, and cued retrospective reporting*. Science Communication.

- Visualization helps to comprehend complex issues, in particular when it comes to educational/ academic reading

- In digital texts such visualizations can contain interactive elements and they can be animated, which could foster learning (Sterman, 2011; Ward et al., 2015). Such interactive graphics offer a more personalized experience of the information (Bolsen et al., 2019; Nocke et al., 2008; Schroth et al., 2014)

- Yet, do interactive and animated Infographics also positively affect the comprehension of the text surrounding them?

Figure 1. Pre-defined Areas of Interest (AOI)

AOI: Text 1

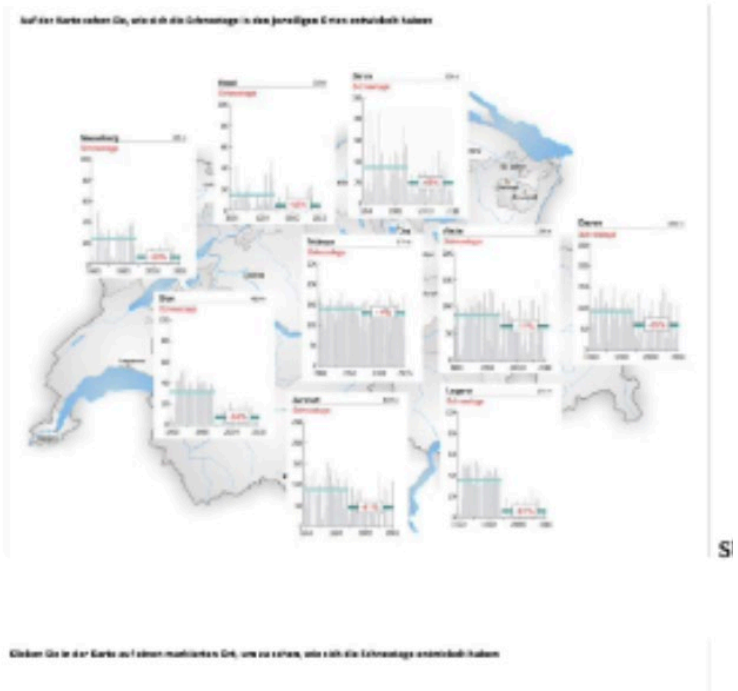
AOI: Visualization

Experimental set up

AOI: Text 2

Table 1. Description of the Three Experimental Groups.

Text-based news article with . . .	Description of the visualization
a static visualization ($N = 15$)	No possibility to manipulate the form or content of the map-based visualization. All diagrams of the average snow days are immediately visible.
an interactive visualization ($N = 15$)	Possibility to click on specific Swiss locations on the map to display a static diagram showing the average snow days of the respective location.
an interactive-animated visualization ($N = 15$)	Possibility to click on specific Swiss locations on the map to display an animated diagram showing the average snow days of the respective location. *Animation*: The change in snow days is dynamically displayed over time.



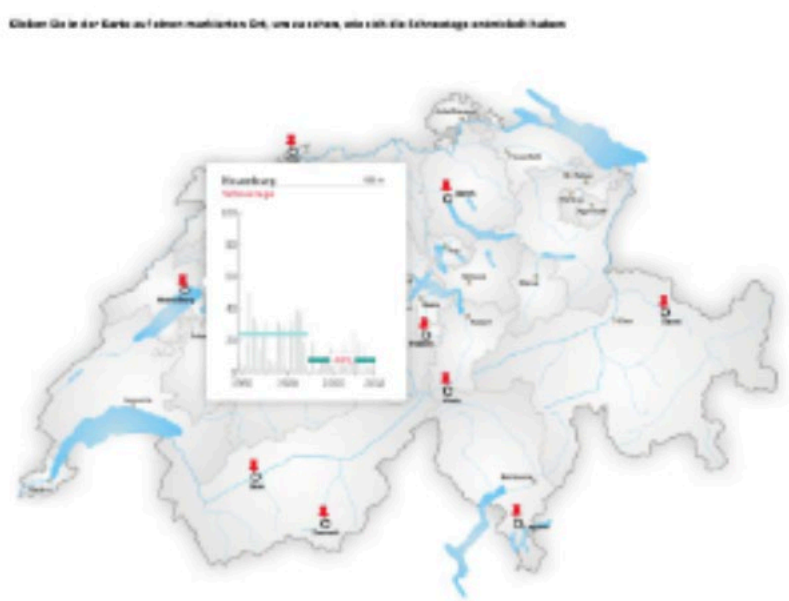
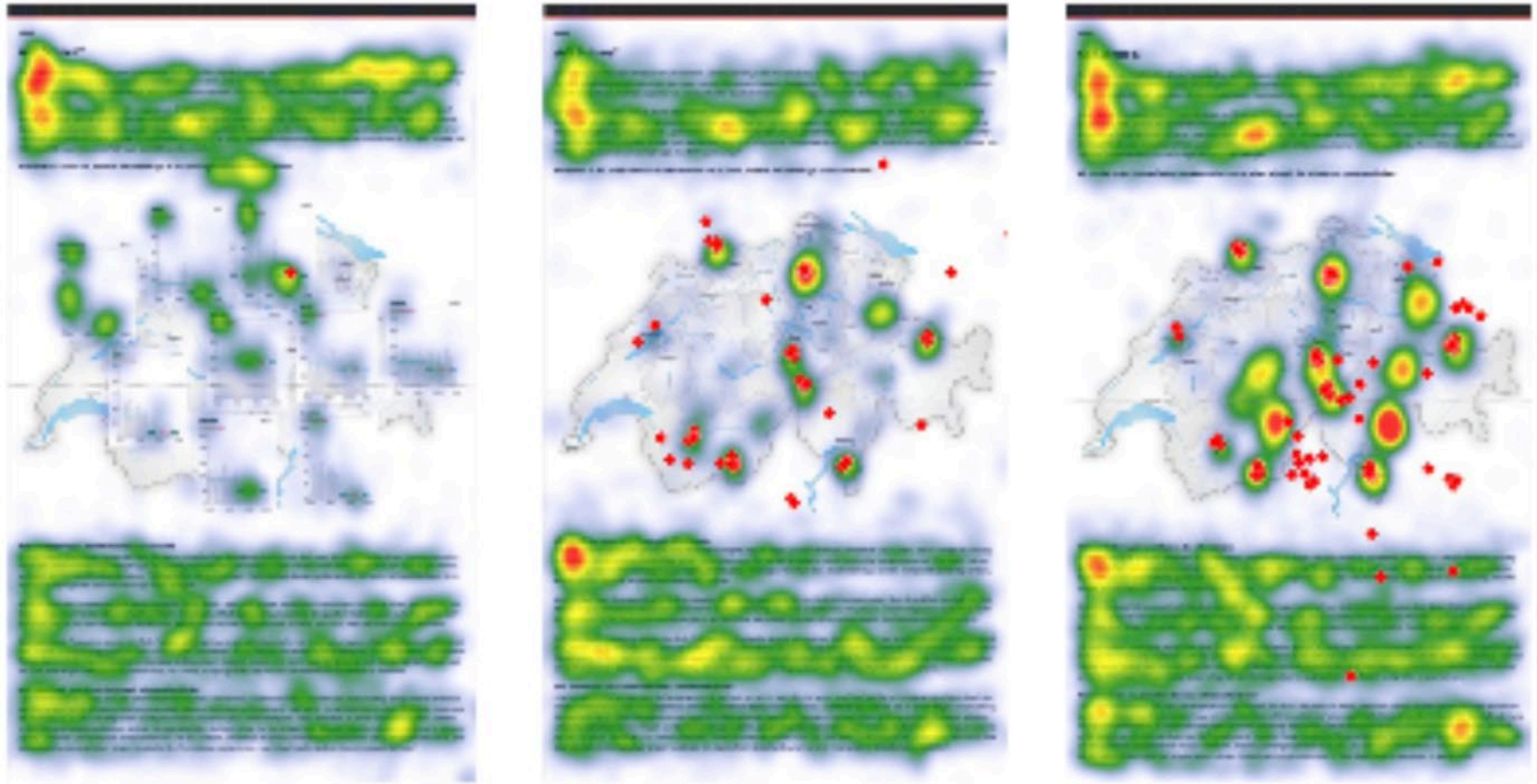


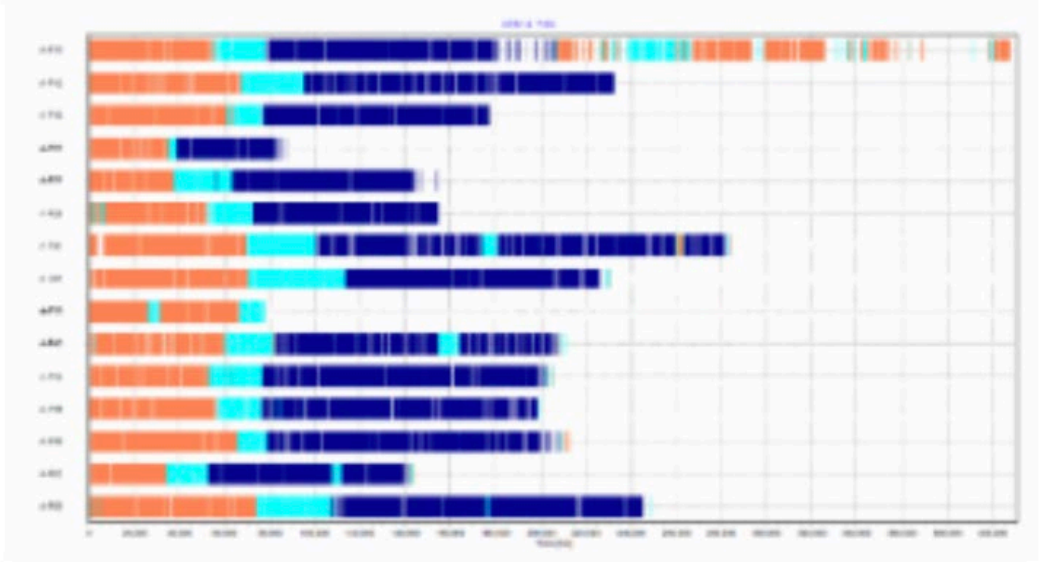
Figure 3a – 3c. Heatmaps of the visual perception of the stimulus article



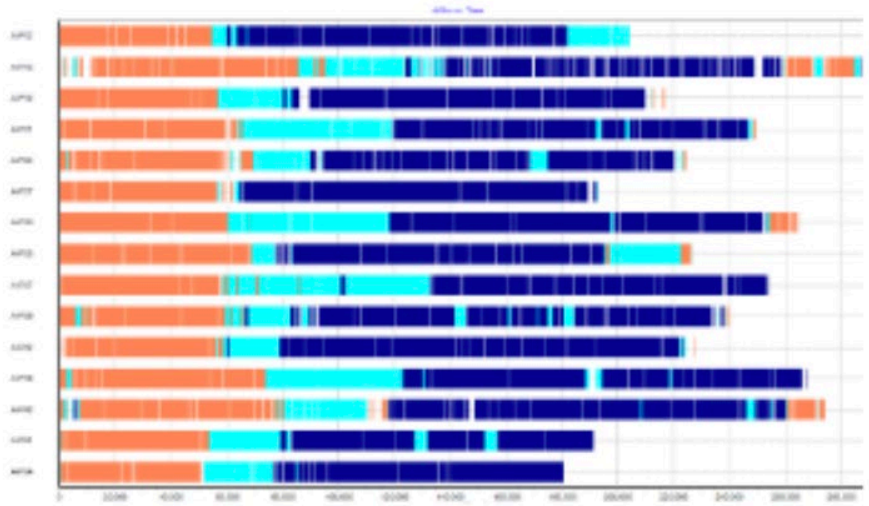
3a. Static (*N*=15) 3b. Interactive (*N*=15) 3c. Interactive-animated (*N*=15)

Notes: Red diamonds represent participants' mouse clicks. Colors represent average fixation time (in ms). Legend:

2a. Reception process of the stimulus article with static data visualization



2c. Reception process of the stimulus article with interactive-animated data visualization



2b. Reception process of the stimulus article with interactive data visualizat

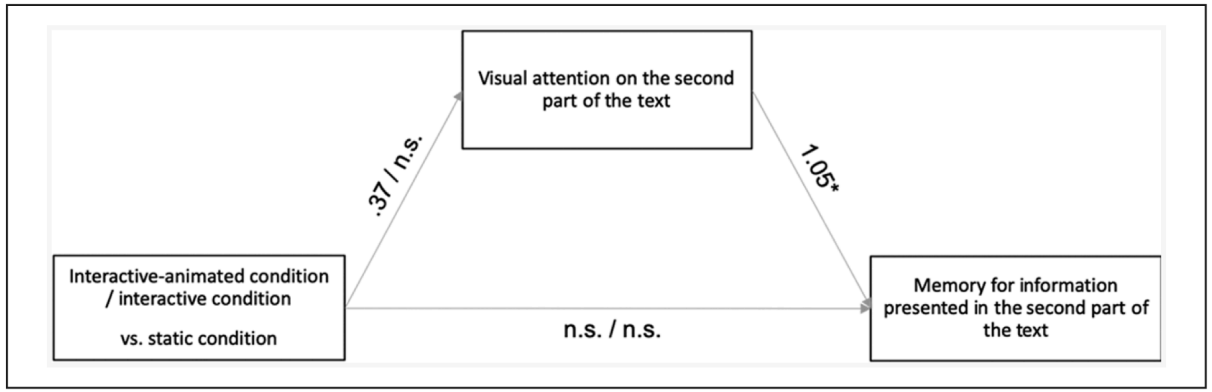


Figure 4. Path diagram of the serial mediation.
Note. Values are unstandardized regression coefficients ($N = 45$). Issue involvement is included as control variable.
$^{**}p < .001$. $^{*}p < .01$. n.s., nonsignificant.

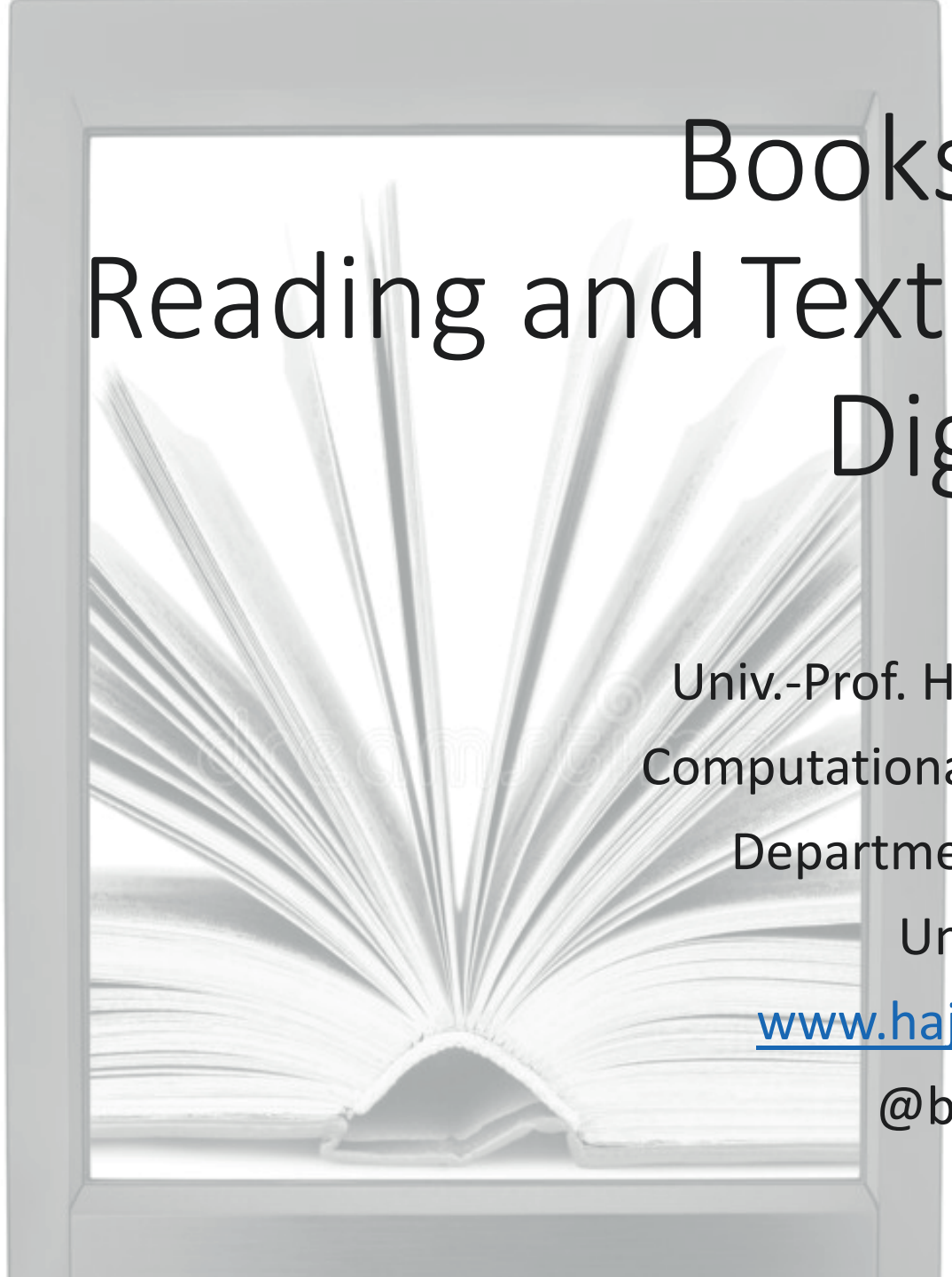
Summing up

- Interactive and animated infographics led readers to spend more time with the following text, which in turn cause better recall of information in that text.

- The positioning of infographics thus plays a role for text comprehension
- Interactive and animated infographics should be user-friendly, otherwise they are distracting from the text

- Whether using digital reading media is „good“ depends on
  - The type of medium
  - The purpose of usage
  - The type of readers
  - The type and format in which contents are presented

- Digitalization appears to demand stronger reading- and language competency as well as digital skills.



Books on Screen
Reading and Text Comprehension in the Digital Era.

Univ.-Prof. Hajo Boomgaarden, Ph.D.

Computational Social Science Lab (CCL)

Department of Communication

Universität Wien

www.hajoboomgaarden.com

@boomgaardenhg