COST

European Cooperation
in the field of Scientific
and Technical Research
- COST -

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COST 048/14

Brussels, 15 May 2014

MEMORANDUM OF UNDERSTANDING

Subject :	Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action IS1404: Evolution of reading in the age of digitisation (E-READ)

Delegations will find attached the Memorandum of Understanding for COST Action IS1404 as approved by the COST Committee of Senior Officials (CSO) at its 190th meeting on 14 May 2014.

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MEMORANDUM OF UNDERSTANDING
For the implementation of a European Concerted Research Action designated as

COST Action IS1404
EVOLUTION OF READING IN THE AGE OF DIGITISATION (E-READ)

The Parties to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the technical Annex to the Memorandum, have reached the following understanding:

1.   The Action will be carried out in accordance with the provisions of document COST 4114/13 "COST Action Management" and document COST 4112/13 "Rules for Participation in and Implementation of COST Activities" , or in any new document amending or replacing them, the contents of which the Parties are fully aware of.

2.   The main objective of the Action is to improve scientific understanding of the implications of digitization on reading, and help individuals, disciplines, societies and sectors across Europe to cope optimally with the effects.

3.   The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 60 million in 2014 prices.

4.   The Memorandum of Understanding will take effect on being accepted by at least five Parties.

5.   The Memorandum of Understanding will remain in force for a period of 4 years, calculated from the date of the first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of section *2. Changes to a COST Action* in the document COST 4114/13.

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A. ABSTRACT AND KEYWORDS

Developments in basic reading skills are a matter of urgent concern, and literacy is a key factor in the EU's growth strategy (Europe 2020). Research shows that the amount of time spent reading long-form texts is in decline, and due to digitization, reading is becoming more intermittent and fragmented. In international reading assessments (TIMSS/PIRLS [2006; 2011]; PISA [2009, 2012]), students from Asia, Canada and Oceania outperformed European students on several measures. In Europe, one in five lacks adequate reading skills. There is much speculation about the cognitive implications of digitization, and empirical evidence indicates that affordances of screen devices might negatively impact cognitive and emotional aspects of reading. The goal of this Action is to improve scientific understanding of the implications of digitization, hence helping individuals, disciplines, societies and sectors across Europe to cope optimally with the effects. Based on a multidimensional, integrative model of reading, and combining paradigms from experimental sciences with perspectives (e.g., diachronic) from the humanities, the Action will develop new research paradigms, and metrics for assessing the impact of digitization on reading. These metrics enable the development of evidence-based knowledge of paper and screen reading, and provide guidance for practitioners, policy makers, publishers and designers.
Keywords: Reading on paper and screen, effects of digitization, substrate affordances, ergonomics of reading, interdisciplinary empirical research

B. BACKGROUND

B.1 General background

Literacy is a major European concern and key in achieving the goals in *Europe 2020*, EU's strategic growth strategy. Roughly one in five Europeans lacks adequate reading skills. Even as literacy becomes more necessary to participate in an advanced information society, reading levels have stagnated in Europe, and there is an increasing gender gap (EU High Level Group of Experts on Literacy Final Report, 2012). Remedying this situation requires promoting adequate reading materials, whether in digital or print form. Digital texts are assumed to be particularly suited to increasing boys' reading motivation and might therefore contribute to reducing the gender gap, and e-readers (e.g., Kindle) and tablets (e.g., iPad) are increasingly introduced in schools to foster reading interest. However, there is evidence that digital texts are read differently than paper ones, and that cognitive as well as emotional outcomes may vary as a function of the technological

substrate. Whereas some recent studies report no or minimal differences in cognitive outcomes from reading short texts on paper and screen (e.g., Kretzschmar et al., 2013; Margolin et al., 2013), other studies find that reading linear texts (in particular, texts exceeding one page/screen) on screen might impede reading comprehension (e.g., Mangen et al., 2013; Wästlund et al., 2007) and that it might negatively impact readers' metacognitive awareness (Ackerman & Goldsmith, 2011). Additionally, empirical research indicates that features of tablets might negatively affect emotional aspects of literary reading, such as empathy, immersion and transportation (Mangen & Kuiken, submitted). More empirical research measuring the effect of digitization is required to determine the extent to which this is the case, as well as to provide more fine-tuned measures of a number of potentially mediating factors pertaining to, e.g.,

- text (e.g., length; complexity; genre; layout/structure);

- reader (age; gender; novice and expert; beginning and advanced level; "digital native" or "digital immigrant");

- substrate (audio-visual features; haptic/tactile feedback);

- purpose of reading (study; leisure; contemplation; light entertainment; news).

The transition of reading from paper- to screen-based devices provides an opportunity to reconceptualize reading, bottom-up, accommodating the full range of complexities of texts, substrates, technologies, and reading processes and outcomes. This spectrum in turn mandates a more radical kind of interdisciplinarity, implying in particular increased theoretical-methodological collaboration between scientists doing experiment-based research, and scholars from the arts & humanities. This Action will coordinate such concerted research efforts.

Additionally, E-READ will address the economic and technological dimensions that fuel the movement towards screen reading, i.e. the transition from analogue to digital publishing and the cultural changes intrinsic to this transition (e.g., internet bookselling, the emergence of e-books, and the considerable variation in e-market development between different countries and regions of Europe). One of the purposes of this Action is to see how market mechanisms (price competition between electronic and printed books) fuel the transition to digital textuality. Due to language and cultural differences, such research can only be done through networking of reading and publishing researchers from various COST countries.

B.2 Current state of knowledge

Compared with the amount of empirical research on cognitive aspects of hypertext reading and multimedia, empirical research comparing the reading of verbal, linear texts on paper and screen is

still scarce. Over time a crucial part of basic reading and literacy skills has come to be so-called "deep reading", that is, reading of long and potentially complex, linear texts requiring sustained mental focus over an extended period of time (e.g., essays; novels and short stories; articles; expository texts). Due to digitization, reading is becoming more intermittent and fragmented, and long-form reading is in decline. The implications of such a trend for reading (and literacy) skills overall can only be properly understood by supplementing existing, more dominant research on nonlinear (hypertext) and multimedia/multimodal digital textualities with empirical research on linear, sequential, verbal text. Because reading is multisensory and embodied, in addition to being perceptuo-visual and psychological, reading linear text on screen and on paper can be assumed to be affected by features of the substrate that have hitherto been largely neglected in empirical reading research (e.g., tactile and haptic feedback; sensorimotor and ergonomic aspects).

Promoting reading motivation and interest requires selecting appropriate kinds of texts (print vs digital; literary vs expository); this in turn requires knowing how affordances of the interface (paper and screens) impact cognitive and emotional aspects of reading. Moreover, as national (e.g., in Norway) and international reading assessments (e.g., PISA; e-PIRLS) are digitized, the validity and reliability of such assessments rest on empirically derived knowledge of the potential effects of technical, material and audio-visual affordances of screens on low- and high-level processes of reading. Adequately assessing aspects of reading (e.g., information search and retrieval; inference-based comprehension; critical reflection) requires knowing how and to what extent affordances of screen substrates might differently affect performance, compared with paper. Until such knowledge is established, the validity and reliability of digital reading assessments on different levels remain questionable.

B.3 Reasons for the Action

Reading research is, by nature, inherently multidisciplinary. There is, however, little collaboration between experiment-based research (e.g., psychology; neuroscience) and qualitative research (e.g., media/reading history; pedagogy; literary studies; sociology). This Action will bring about bottom-up, concerted and interdisciplinary research, hence countering continued theoretical-methodological dispersal and isolation in European reading research. In addition to academic disciplines, empirical knowledge on specifically digital reading is generated in three separate domains: (i) e-booksellers and –distributors generate statistical data on onscreen reading unimaginable in the analogue era (places for reading, time spent reading, speed of reading, ratio between books bought and read, language of reading, etc.); (ii) educators generate practical experience with using digital materials in

educational settings; and (iii) educational software producers and educational publishers generate statistical data and empirical knowledge on onscreen reading in schools. There is little dialogue between academic researchers and software and publishing companies involved in the production of digital reading materials; even more, in reading research there is little exchange and collaboration across the natural sciences – arts & humanities divide. Even within experiment-based sciences and disciplines, scientists and teams often work in relative isolation from other disciplines. By networking through COST-funded meetings, and setting up lab visits and exchanges, this Action will enable interdisciplinary collaboration among reading research labs, scientists, scholars and publishing researchers that will bring about crucial synergies and innovative projects covering a broad range of reading research domains such as eye tracking; cognitive psychology; ergonomics; phenomenological-psychological approaches to literary reading experience.

The COST framework is ideal for bringing together such a large but dispersed scientific community as it allows some flexibility in the day-to-day programme management. This is particularly important insofar as this Action addresses original issues likely to require decisions that could not be fully anticipated from the outset, due to, e.g., technological innovations giving rise to a number of unforeseen reading dimensions in need of empirical scrutiny.

Collaborations with reading promoters (EU-READ) and industrial partners are established, and new collaborations will be pursued, involving non-profit stakeholders (e.g., policy makers, educational practitioners, reading assessment agencies) as well as for-profit stakeholders (e.g., [textbook] publishers, publishing associations, e-reader developers, software designers). Stakeholders are involved during the work, providing materials and resources, and as beneficiaries. Such collaborations enable the Action to provide recommendations with a firm basis in evidence-based research, and to strengthen ties between academia and stakeholders.

The Action will build a robust, active European network on reading research by facilitating regular research meetings, lab exchanges and scientific events. Its overall objective is to develop, on the basis of an integrative model of reading, an aggregate measure of reading on paper and screens and a number of metrics to assess the effect of digitization on textual reading. This is especially useful for education as there is a widespread movement towards introduction of digital learning tools regardless of the absence of evidence that digital text/material is superior to other modes of reading and other formats of learning materials (such as print). Such a network allowing wider and more interdisciplinary discussions on the transition from paper to onscreen reading is of utmost importance to publishers, educators and researchers in South and Eastern Europe where reading research is in a nascent phase and where discussions on digital textuality are still marginal.

The research and networking carried out during the Action also provide the platform on which to

develop a competitive Horizon 2020 grant application.

B.4 Complementarity with other research programmes

By bringing together expertise from the natural sciences with renowned scholars from the arts & humanities and social sciences, this Action will ensure that reading/literacy research is put high on the agenda in *Horizon 2020*, the flagship initiative aimed at securing Europe's global competitiveness. In FP7 there have been very few projects on literacy. Most of them have been in ICT, and have focused on developing new technologies for technology enhanced learning, e.g., ILEARNRW – Integrated Intelligent Learning Environment for Reading and Writing (2012-2015); LITERACY: Online portal for e-learning and supporting social inclusion of people with dyslexia (2012-2015).

Addressing the implications of digitization, E-READ is thematically related to two ongoing COST Actions:

- IS0906 Transforming Audiences, Transforming Societies (2010-2014)
- FP1104, New possibilities for print media and packaging: Combining print with digital (2012-2016)

However, IS0906 is concerned with reading at a broad, macro, social and cultural level, as merely one aspect of the concept of media audiences; it does not measure empirically the impact of digitization on a more fine-grained level, individual reading. The relevance of FP1104 pertains mainly to its WG1, "Customers and users – Effect of the changing media use habits on traditional media." By focusing on empirical research on individual reading processes in a diversity of settings, E-READ will provide a required supplement to more context-oriented perspectives represented by these Actions.

The Action will continue to work closely with EU-READ, the consortium of European reading promotion organisations.

C. OBJECTIVES AND BENEFITS
C.1 Aim

The main objective of the Action is to develop, on the basis of an integrative model of reading, an aggregate measure of reading on paper and screens. The model and measure will improve scientific understanding of the implications of digitization and help individuals, disciplines, societies and sectors across Europe to cope optimally with the effects, and consolidate E-READ as a hallmark

European research initiative across scientific, disciplinary and national boundaries.

C.2 Objectives

The overall objective translates into the following concrete secondary objectives:

- to provide evidence-based recommendations to educational practitioners and policy makers;

- to provide recommendations for optimal text/content design for educational publishing;

- to prompt systematic, empirical, interdisciplinary research transcending established boundaries between scientific disciplines involved in reading research;

- to facilitate joint scientific publications and new, radically interdisciplinary, collaborative research projects (esp. across humanities/social sciences and natural sciences);

- to establish long-term theoretically and methodologically innovative research collaboration;

- to increase collaboration between scientific research teams and relevant industrial partners, reading promotion initiatives, educational practitioners and agencies;

- to facilitate exchange of researchers, prioritizing juniors and early career researchers;

- to provide a solid platform for strong and competitive education policies and pedagogies built on empirically derived knowledge of the effects of technology on reading.

The scientific outcomes will also result in a *Horizon 2020* grant application, including a continuation of several of the research projects implemented and coordinated by the Action, and developing new interdisciplinary projects stemming from its research exchanges.

Expected deliverables:

- Collections of existing empirical data on digital text reading;

- Scientific publications resulting in visibility in scientific communities in the different fields (e.g., psychology, linguistics, pedagogy, book history, publishing studies, literature and media studies, computer science [HCI], cognitive and visual ergonomics, interface design), the publishing sector, the educational field, policy makers, as well as European citizens;

- A comprehensive, interdisciplinary, and testable model of reading;

- Interdisciplinary paradigms for measuring the impact of digitization on text reading;

- Relevant indicators of reading (different kinds of texts) on paper vs. screens;

- Recommendations for industry (developers and publishers of e-books, textbooks, and educational software);

- Recommendations for the pedagogical field;

- A shared European research/knowledge database for national education policy makers, publishing

associations, reading assessment agencies and test developers to strengthen European competitiveness;

- Online publication and networking/collaboration tools (e.g., a web site and newsletter informing the public about the progress of the Action).

Recommendations based on collaborative Action projects will be widely disseminated to end users (scientists; practitioners; policy makers; publishers; e-book content providers; software developers; hardware engineering) via the Action website and print resources.

C.3 How networking within the Action will yield the objectives?

The Action will unite research teams from different countries and disciplines, which are already funded by their own research institutions/affiliations, or by national research councils, but which have no specific funding to support the building of a European community. COST is invaluable to further and consolidate this collaboration. Achieving the objectives requires a coherent infrastructure over a sustained period of time, to provide researchers with collaborative work sessions (working meetings; STSMs); assistance in publicising their findings in terms of communication (conferences; workshops), publications and training (training school for juniors); opportunities for mobility (STSMs); regular interaction between researchers, practitioners, policy makers, and professionals (at least 10% of participants at each scientific event will be professionals and practitioners: publishers; reading and literacy promoters; software designers; hardware engineers; policy makers); and the creation and maintenance of a website presenting the network's findings and recommendations.

C.4 Potential impact of the Action

The main benefit of the Action is the advancement of scientific progress by:

- providing a bottom-up, interdisciplinary, empirically derived understanding of the effects of digitization on a range of aspects of reading;

- developing theoretically and methodologically innovative research paradigms enabling systematic empirical measurement of the impact of digitization;

- uniting currently isolated reading researchers and disjoined reading research teams;

- establishing sustainable and long-term venues for collaborative, empirical reading research;

- facilitating the emergence of new reading research teams and labs by connecting junior/early

career researchers with senior ones;

- developing a genuine European research profile in empirical research on reading.

Finally, E-READ will strengthen communication between research and educational policy making, educational practices, and the needs and interests of the book industry, reading promotion associations, and European citizens at large.

C.5 Target groups/end users

The main beneficiaries of the Action are:

A) The scientific community. Improved scientific understanding of the effects of digitization on reading is relevant to a number of scientific disciplines in the arts & humanities, social sciences, and technological and natural sciences. The reading model provides an integrative, interdisciplinary theoretical platform on which to develop empirical reading research across a range of disciplines and research objectives, and a range of text types and reading purposes.

B) The educational community. E-READ will provide educators and practitioners evidence-based knowledge of the effects of digitization on reading various text types for various purposes.

C) Policy makers. The Action will provide evidence-based recommendations on optimal and appropriate use of print and digital texts for different purposes of reading.

D) Publishers; the book industry. The Action will provide industries and professionals with up-to-date knowledge of differences between digital and print reading and would make much easier the decisions which medium to use for a given purpose.

E) Reading/literacy promoters (e.g., EU-Read). The Action will provide evidence-based knowledge on the effects of digitization on various kinds of reading materials.

F) EU citizens. The Action will improve citizens' understanding of the effects of digitization.

D. SCIENTIFIC PROGRAMME
D.1 Scientific focus

E-READ will assess the implications of digitization for reading, using an empirical, interdisciplinary approach. For this purpose, we are developing a comprehensive, integrative model to capture the multidimensionality of reading, at the same time allowing focused, in-depth exploration. In this model, reading is defined along the following four dimensions:

- Ergonomic (physical, multisensory engagement with a device);
- Attentional/perceptual (allocation of attentional resources; perceptual processing);

- Cognitive (cognitive, linguistic processing);

- Phenomenological (as a personally meaningful activity).

Two theoretical assumptions underlie the model: (1) reading is human-technology interaction; and (2) reading is embodied and multisensory. The model provides a conceptual framework for the research to be implemented and coordinated by the Action, resulting concretely in a number of metrics to assess reading objectively. These metrics are tailored to four main topics, each of which is monitored and coordinated by a Working Group. This way, E-READ will develop a framework for testing hypotheses about the effects of digitization on reading across multiple dimensions. For instance, for studying literary reading on e-readers and tablets, the model enables a combination of qualitative measures of subjective, first-person experiences with objective, quantitative measures from a third-person perspective. The model thus facilitates combining paradigms from, e.g., neurophysiology and -psychology with historically and culturally oriented approaches more typical of the arts and humanities, enabling a comprehensive study of how reading, for emotional engagement as well as for information and learning, is transformed by digitization. Aspects to be measured include:

- ergonomics; haptic/tactile affordances (Osgood and haptic/sensory dissonance scales);

- visibility (visual detection tasks);

- legibility (colour, typography, paralinguistic cues);

- attention (dual task technique);

- comprehension (levels of depth: surface, semantic, inferential);

- memory (R/K paradigm);

- metacognition (multiple judgment measures);

- phenomenological/experiential (narrative engagement scales);

- emotion/immersion (pupil diameter; skin conductance response; heart rate).

Metrics will be aggregated into indicators of "readability" of reading devices, and of reading, allowing evaluation of individual readers according to, e.g., PISA criteria, and generating knowledge about implications on individual as well as social levels across a range of genres and purposes of reading. The interdisciplinary paradigms provide the backdrop of the research prompted by the network, and new partners are invited to complement them. Hence, evidence-based research findings will feed back into the model, helping to refine and elaborate it. Crucially, this in turn allows the model to serve as a standard by which to evaluate digitized reading materials, educational software and hardware, effects of digitization on different text types, and provides a means to assess the results of existing research projects.

Four WGs will be in charge of planning, monitoring and coordinating research activities in line

with the scientific programme of the Action:

WG1: Continuing/skilled (PISA-age) reading

International assessments (e.g., PISA 2009, 2012; PIRLS 2011) have underlined that the increasing literacy demands of everyday life demand improvement of the reading skills of all students, not just those in difficulty. Individuals of all ages are increasingly exposed to information in a wide range of digital forms and sizes (smartphones, computers, tablets, e-readers, interactive whiteboards) that needs to be visualized, read and understood in order to be used. Some devices are specifically dedicated to reading activities, such as e-readers; for others (e.g., smartphones) reading seems to be a secondary function. The features of these devices must be studied specifically during reading activities.

The research projects planned and coordinated in this WG2 will focus on measuring the effect of digital interface features on reading and comprehending performance for young and older adults. Experiments will test the impact of different features and variables of electronic reading:

- reading devices: e-readers, tablets, paper and computer displays;
- display characteristics: display size, color and luminance;
- tasks: reading vs information seeking;
- type of texts: expository, narrative, procedural; simple, complex; short, long;
- attention: simple vs double tasks.

Both qualitative and quantitative analysis will be carried out. Integrating all these measures later by means of classifying techniques will also enable isolating reader profiles.

- Qualitative metrics: questionnaires (comprehension), R/K procedure (memory)

- Quantitative metrics: eye movements (vision), pupil dilation (stress), blink rate (fatigue), beep task (attention).

WG2: Developmental aspects of reading

Today's children are steeped in digitally dominated media; this digital exposure is likely to affect deep reading. Deep reading is a complex process that builds on the efficiency of lower level linguistic skills, such as orthographic, phonological, semantic, morphological and syntactic knowledge, to decode and comprehend text (Wolf, 2007; Wolf et al, 2009), as well as on higher level skills such as inference and analysis, allowing readers to fuse their own knowledge with the text to think thoughts that go beyond the author's words. Thus, deep reading requires motivation, cognitive effort, and time. The absence of a genetic blueprint for reading, however, means that there is no guarantee that these deep reading skills will develop. The plasticity of the brain's reading

circuit means that it will adapt itself to what is being asked—by the characteristics of the writing system (e.g. English alphabet vs. Chinese logosyllabary) (Tan, et al, 2005); by the formation process (how much, how well the child is taught) (Sandak, et. al, 2004); and by the medium (print; digital).

We know that the printed book is an excellent medium for the development of deep reading skill. Increasingly, today's youths are reading in digital media. Our knowledge of the process of print reading may be of limited use in understanding the skills and mindsets that develop in digital media. Some theorists have raised the concern that reading primarily on screens will "short-circuit" the development of deep reading processes (Wolf, 2007). They argue that young readers may be overwhelmed by the quantity of digital information, and so distracted by animations, links, pop-ups and the brain's attraction to novelty as to make reading a process of skimming, rather than of reflection and contemplation.

This WG will focus on general questions about the influence of digital media on the attitudes of children of all reading ages towards reading and literacy, as well as on the impact of specific features of digitally presented texts on children's reading development and comprehension. Experiments will analyse the influence of different reading devices and their features (e.g., text-to-speech) on children's development of decoding, semantic, syntactic, and comprehension skills. Study designs will be both cross-sectional and longitudinal.

Experiments will make use of standardized assessments of reading, comprehension, and linguistic skill, as well as of questionnaires on engagement and motivation to probe developing attitudes towards reading, reading skill and comprehension. Measures of brain activity during reading (e.g. EEG) will provide a means of comparing the neurological correlates of various forms of digital and print reading among developing readers. Keystrokes, swipes, dictionary use and other data that can be recorded from the devices will be used, in combination with behavioural and neurological measures, to better understand how device use influences children's development of deep reading skills.

WG3: Experiential and emotional aspects of reading

Empirical research shows that *literary* deep reading, by virtue of its appeal to first-person experience, yields potentially unique cognitive and emotional benefits (enhancing the capacity for empathy, social inference, emotional self-regulation, verbal abilities and intelligence). The increasing use of e-readers and tablets for literary reading warrants closer scrutiny of the effects of such interfaces on affective and emotional processes and outcomes. Literary reading in print has been found to be positively correlated with cognitive skills such as vocabulary and reading

comprehension (Mol & Bus, 2011). A growing body of research indicates that literary reading plays a role in the development and support of social and emotional skills, such as empathy and sympathy (Kidd & Castano, 2013; Mar & Oatley, 2008; Mason & Just, 2009; Oatley, 2011). If literary reading contributes to mental and social well-being we need to know how affordances of, in particular, handheld digital reading devices affect these outcomes.

The research projects planned and coordinated by this WG will focus on measuring the effect of digital interface features on emotional and experiential aspects of literary reading. Interdisciplinary paradigms enabling collaborative experiments will be developed, and small-scale experiments will be carried out in participating labs. Experiments will be designed to enable adequate measures of the impact of such different features and variables as:

(1) Reading devices, e.g., print (different binding and paper; pocket; cloth); e-readers (e.g., Kindle; Sony Reader; Kobo); tablets (e.g., iPad; Samsung Galaxy); smart phones (e.g., iPhone; BlackBerry; Android). Devices may vary along a number of technological dimensions, each of which may affect aspects of reading as outlined in the model, e.g., weight; screen/display size; backlighting vs ambient light (LCD vs electronic ink); ergonomics (haptic/tactile feedback; flexible/bendable electronic paper display; networking/online access; remote/gesture (touch-free) navigation; one- or two-page layout).

(2) Texts (e.g., genre; complexity; length; layout/structure; stylistic features; literariness)

(3) Emotional aspect (e.g., immersion/transportation; empathy & sympathy; ToM; sensual pleasure [e.g., haptic dissonance])

(4) Reader-related (age; gender; experts vs novices; avid vs reluctant literary readers)

(5) Situation- and task-related (e.g., manipulating purpose of reading, e.g., the striking and evocative passages paradigm [Miall & Kuiken, 1998, 1999])

In order to capture subtleties of personal emotional engagement during reading, experiments will make use of combinations of third-person psychophysiological measures (e.g., heart rate, pupil dilation, skin conductance response) and first-person phenomenological approaches (e.g., numerically aided phenomenology [Kuiken & Miall, 2001]).

WG4 (transversal): the ergonomics of reading (physiology; haptic & tactile feedback)
Reading has usually been considered as a purely cognitive process, only based on visual perception, and not really involving body actions except eye movements and, to a lesser extent, head movements. Yet, reading is a multimodal activity involving other body parts, particularly the hands, and hence depending also on haptic (kinesthetic and tactile) information. Although manipulating is an intrinsic part of the reading process, this dimension has not been much explored in empirical

reading research, regardless of discipline.

One of the most obvious differences between reading from paper and from screens is that print books lend an obvious physicality to individual texts, while e-books are not tangible volumes and are differently touched, held, carried and navigated. Paper is manipulated by manual dexterity, using fingers to turn pages, keeping one finger in a section as a location aid, or flicking through dozens of pages while browsing the contents of a document. Interactions with the physical support of the computer screen or the e-book during reading are very different than with a paper book. Many studies in experimental psychology and neuroscience show that manipulation provides spatial information which is crucial for building coherent mental representations of the manipulated object. In a book, spatial information ("where in the book") can be directly related to time ("when in the story"). Sequence information often contributes to the meaning of a text, such as in cause-effect relations. Sequence memory should, therefore, be related to comprehension. Aspects to be considered are:

- Reading devices (e-readers, tablets, computer screens, smart phones);

- Interface characteristics (one or two-page display, page turning, thickness, weight, bendable/flexible screens);

- Text length;

- Type of text and reading context: narrative, expository, leisure vs. educational;

- Levels of comprehension: from surface (word, sentence) to deep inferential comprehension;

- Time of recall: short- vs. long-term memory;

- Readers: children, students, adults, socio-cultural background, gender.

The main questions addressed in the research coordinated in WG4 are: Do the permanence and physicality of the print book facilitate readers' awareness of where they are within the book and, by extension, within the text? Does this impact more general reading comprehension? What may be the neurophysiological and -psychological correlates of an often reported sense of "haptic dissonance" (Gerlach & Buxmann 2011), i.e., that reading a novel on an e-reader doesn't *feel* like what it *should* feel like to read a novel?

The research will focus on measuring the effect of ergonomic affordances on perceptuo-visual, cognitive and emotional aspects, particularly focusing on haptic and tactile aspects. A main goal is to develop common experimental procedures appropriate for an experimental study of reading comprehension and reading experience. WG4 is therefore transversal, working closely with all other WGs and providing the ergonomic "backbone" to the research to be coordinated by the other WGs.

D.2 Scientific work plan methods and means

Four Working Groups (WGs) will carry out the day-to-day scientific work of the Action, focusing on the research questions as outlined, pertaining to the impact of digitization on cognitive as well as emotional facets of literary and non-literary reading. This involves systematically and empirically investigating the role of affordances of different kinds of print and digital reading devices. The research programme will be completed within the 4 years of the Action. The missions of each WG will include:

- leading the programmes and projects so that concrete outcomes can be discussed each year at the WG's meeting and formally presented during the Workshops: data, analyses, preliminary findings, findings, recommendations;

- maintaining a close liaison with non-scientific target groups such as policy makers, reading promoters, and publishers, soliciting input about their needs and demands, and access to data, facts and figures, making sure that in return results are disseminated to these target groups;

- sharing all the data that is collected in a database, and presenting all useful documents (references, bibliographies, manuals, etc.) on the website.

The research agenda will need to be regularly updated since it is supposed to help participants in identifying common research topics for which collaboration can be instigated over the duration of the Action.

E. ORGANISATION

E.1 Coordination and organisation

This Action builds on an existing interdisciplinary network of researchers with a solid scientific reputation nationally and internationally whose disciplines largely cover the dimensions outlined in the reading model. The research is funded by researchers' institutions, with COST providing support for building a larger European research community and enabling continued interdisciplinary collaboration.

The Action will be coordinated by a Management Committee (MC), with Working Groups (WGs) overseeing activities in the four areas set out in the scientific programme.
Led by the MC Chair, a Steering Group will optimize coordination and management.

The MC is responsible for the long-term planning and overall coordination of the Action. It will meet twice a year to make strategic decisions relating to the scientific programme and to monitor dissemination and progress of WG activities. In close collaboration with the MC, an international Scientific Advisory Board (SAB) will monitor the scientific progress of the Action and advise on

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further development where appropriate. SAB members will provide recommendations and advise mainly via virtual platforms (video conferencing; Skype) during COST events; pending funding from their respective affiliations, physical attendance to COST events for international experts may be possible.

The Steering Group (SG) will comprise the MC Chair and Vice Chair, WG leaders, WG coordinator (facilitating continuous communication and collaboration between WGs), STSM Manager, Website and Dissemination Manager, and Scientific Secretary. The SG's tasks include drafting the agenda of MC meetings; implementing MC's policy decisions; organising and coordinating Action events; disseminating research findings and managing the Website.

The SG's managers and Scientific Secretary liaise with the MC and the WG leaders. Members of the SG will maintain regular contact in between physical meetings, via the virtual workspace in a restricted area of the Action website, and by email. To ensure close and continuous communication with stakeholders, the Action will nominate Stakeholder Liaison Officers (SLO; two for each stakeholder category, cf. C.5). Together with the WG coordinator, SLOs are in charge of coordinating the communication and dissemination to stakeholders regarding the WG outcomes. A Dissemination Group will be established, led by the Website & Dissemination Manager, and comprising the WG coordinator, SLO, and an Editorial Manager (responsible for a book presenting current Action research). The Dissemination Group, assisted by the Scientific Secretary, will take charge of the website.

Research projects will be coordinated during the COST events. Experiments will be planned, results discussed and recommendations drafted during the Action's meetings, notably those of the WGs. The WGs will allow researchers from different countries to derive practical benefits from sharing experimental results and data, such as the creation of new research topics and inter-country partnerships. The work produced by the WGs will be used in the Workshops, to be communicated to the international scientific community and to stakeholders outside academia. WG researchers will also support the Training Schools, passing on specialist knowledge to juniors. STSMs will enable researchers to undertake advanced training and strengthen partnerships.

The final conference provides an opportunity to communicate all the findings of research conducted within the COST Action framework, not only to the scientific community but also to professionals and reviewers. Event locations will be selected in order to strengthen the construction of the cross-European network.

Milestone events will include:
- Founding MC meeting (start of Year 1);
- Biannual MC, SG and WG meetings (to oversee Action progress, plan experiments and analyse

results)

- European training school providing theoretical and methodological training (Years 2-4);

- Workshops for presenting and discussing results (end of Years 1-3);

- STSM meetings (Years 2-4);

- Final conference (start of Year 5).

The network will publish findings, recommendations and other deliverables on the Website with an open and a restricted area. The latter will allow Action members and partners to share confidential data; access to more general information will be unrestricted. The public section of the Website will feature regular updates (e.g., of newsletters), documents and deliverables in a variety of media, plus links to other relevant networks, sites and programmes and a mailing list of participants. The newsletter will – from the start of the Action – feature information on past and current events, and key achievements (e.g., publications). The restricted area of the Website will facilitate communication among network members, allowing collaborative activities between meetings such as the creation of an online database for researchers across Europe, sharing and discussion of ideas, research questions, data, etc.

E.2 Working Groups

The Action is coordinated by a MC, with 4 WGs:
(1) Continuing/skilled (PISA-age) reading;
(2) Developmental aspects of reading;
(3) Experiential and emotional aspects of reading;
(4) The ergonomics of reading (physiology; haptic & tactile feedback) (transversal WG)
The WGs implement the scientific programme of the Action. Both WG leaders are MC and SG members. In addition, a WG coordinator ensures continuous dialogue between WGs and communication of findings and recommendations to the Dissemination Group and to the SLO.

The WGs will pave the way for the Workshops and their scientific advances will be utilised by the Summer Schools and by researchers undertaking STSMs (in labs and at WG meetings). The WG meetings will be an opportunity to present research findings and plan for the future. After each meeting, the Website's public section will be updated with the WGs scientific findings and practical recommendations.

E.3 Liaison and interaction with other research programmes

Several participants in this Action are involved in other European research programmes, and they will constitute key interlocutors for initiating links with the most relevant of these. Related COST Actions and other European research programmes will be kept informed about the developments of the Action through the Website and through joint seminars or workshops, and contributions to conferences organised by other research networks.

E.4 Gender balance and involvement of early-stage researchers

This COST Action will respect an appropriate gender balance in all its activities and the Management Committee will place this as a standard item on all its MC agendas.
The Action will also be committed to considerably involve early-stage researchers. This item will also be placed as a standard item on all MC agendas. The objective is to have full gender balance (as well as an appropriate proportion of seniority and juniority; arts & humanities and science; diverse nationalities) in the MC, in the leadership of WGs, and in the SG. This objective has already been achieved for the Scientific Advisory Board. Gender balance and seniority-juniority will also be taken into consideration in the selection of Chair and Vice-Chair, and in deciding STSM grantees. Junior/early stage researchers will be actively recruited continuously, and will be prioritised for participation in STSMs and Training Schools. Researchers actively involved in the preparation of the Action include both female and male members, as well as early stage- and experienced/senior researchers.
Incidentally, in this Action, the gender aspect is integrated in the scientific programme itself, in that it attempts to address the urgent issue of the gender gap in reading skills

F. TIMETABLE

The Action will take place over four years. The calendar of events and meetings will be as follows:

Years	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4
Months	1-3	3-6	6-9	9-12	1-3	3-6	6-9	9-12	1-3	3-6	6-9	9-12	1-3	3-6	6-9	9-12
MC Meeting	X			X		X		X		X		X		X		X
SG Meeting	X			X		X		X		X		X		X		X
WG Meeting	X			X		X		X		X		X		X		X
Workshop				X						X						
STSMs		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

STSM Meeting	X			X		X		X		X		X		X		X
Training school					X								X			
Report			X			X			X			X				X
Assessment			X			X			X			X				X
Dissemination	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Website		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Closing conference																X

The Action will run for four years, calculated from the date of the first MC meeting. For logistical reasons, events attended mainly by the same researchers will be located geographically and chronologically close (MC, SG and WG meetings). MC meetings, SG meetings and WG meetings will be held twice a year.

Year 1:

The first MC meeting represents the launch of the Action. The MC will refine the scientific programme, the planning of events, the organisational framework and the dissemination plan of the Action. The Dissemination Group will begin building the Action website, and this will be active from the start of the second quarter of Year 1. A general objective of the first MC meeting is to build a common vision of the Action. Between the first and second MC, SG and WG meetings, the Action will plan the first workshop, taking place at the end of Year 1. The objective of this workshop is to consolidate the common research framework, ensure connections between WGs, present and review extant projects and initiatives, and to foster collaborative projects and exchanges and expand the Action's network. Parts of this workshop will be open to the public (pending venue facilities), and end users who are not already involved in the Action (e.g., local publishing businesses, practitioners and policy makers), will receive special invitations. STSMs will be granted on a rolling basis, starting in the third quarter of Year 1.

Year 2: two MC + SG + WG meetings (all WGs) to plan collaborative research projects, and to analyse results of ongoing research. In addition, there will be a Training School providing theoretical and practical training, in which juniors/early career researchers are prioritised.

Year 3: two MC + SG + WG meetings (all WGs) to plan collaborative research projects, and to analyse results of ongoing research. A main objective of the second Workshop is to integrate main research findings across WGs, and to start drafting an application for Horizon 2020 and other EU research funding schemes.

Year 4: two MC + SG + WG meetings (all WGs) to plan collaborative research projects, and to analyse results of ongoing research. The second Training School will focus in particular on active recruitment of juniors in newly established labs, in order to prompt empirical reading research on

the effects of digitization and to foster the development of new research teams.

The drafting of reports and assessments is scheduled to coincide with the Workshops where appropriate, in order to take full advantage of the appraisals performed in the wake of these two events. These reports and assessments will cover the operation of the WG and the Workshop or Training School held that year, as well as the STSMs. The results of the research undertaken by the network will be disseminated on a continuous basis, overseen by the Dissemination & Website Manager. The Website will come online at the very start of the Action and will be regularly updated throughout the Action's duration.

G. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: AT, CY, CZ, DE, DK, ES, FI, FR, HR, IL, NL, NO, SE, SI, UK. On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated at 60 Million €for the total duration of the Action. This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

H. DISSEMINATION PLAN
H.1 Who?

Six main target audiences will be kept informed of the Action's progress:
A) The scientific community: Researchers studying reading in particular, and education, psychology, linguistics, sociology and literature in general, will regularly be kept informed of the Action's findings, as will their respective scientific associations, including EARLI: European Association for Learning and Instruction (www.earli.org), ESCOP: European Society for Cognitive Psychology, (www.escop.org), IMBES: International Mind, Brain and Education Society (www.imbes.org), IRA: International Reading Association (www.reading.org), FELA: Federation of European Literacy Associations (www.felaliteracy.org), SSSR: Society for the Scientific Study of Reading (www.triplesr.org), IGEL: International Society for the Empirical Study of Literature (www.psych.ualberta.ca/IGEL)
B) The educational community: E-READ will provide educators and practitioners (from elementary to advanced level) up to date, empirically derived, evidence-based knowledge of the effects of

digitization on various aspects of reading different kinds of texts, for different purposes. Recommendations will be communicated through, e.g., regional and national school boards; teachers' associations (e.g., The International Development in Europe Committee (IDEC), www.literacyeurope.org/idec-the-committee); European Association for the Education of Adults (www.eaea.org).

C) Policy makers: The Action will provide recommendations on optimal and appropriate use of print and digital texts for different purposes of reading (e.g.; improved comprehension; testing and assessments; motivation).

D) Publishers and the book industry: The Action will provide industries and professionals with up-to-date knowledge on which to develop hardware, software and content which take into consideration the effect of digitization on reading diverse materials on a variety of platforms.

E) Reading/literacy promoters: Recommendations will be communicated through associations for the promotion of reading, e.g., EU-READ (consortium of European reading promotion organisations, www.euread.com)

F) EU citizens: the Action will improve citizens' understanding of the effects of digitization of reading by sending information through lists of school platforms, to parents' groups, or through libraries.

Stakeholder Liaison Officers (2 per stakeholder category) will work closely with the WG coordinator, facilitating smooth and ongoing transfer of knowledge and dissemination of findings and recommendations to beneficiaries.

H.2 What?

The dissemination of information, findings and recommendations produced by the Action will be tailored to each of these six audience categories. General information will be posted on the Website, while more specific information will be targeted at individual groups.

A) For scientific communities:

- articles in peer-reviewed scientific and technical journals;

- mailing list (summaries of the Action's main findings, scientific events), i.e. via laboratories and/or respective associations;

- subscriptions to a newsletter via the Website (detailed presentations of findings, scientific events);

- password-protected section of the Website (state-of-the-arts reports, interim reports, case studies, proceedings, final reports) and access to the European shared database;

- scientific events: workshops, seminars and conferences organized by the MC, and participation in

other national and international conferences and symposia;

- publication of scientific works summarizing the Action's findings in each of the four areas (in the form of an edited book);

- posting of the final assessment reports.

For B) educational communities, C) policy makers, and D) publishers and the book industry, and E) reading and literacy promoting initiatives:

- flyers and brochures explaining the Action and its potential applications;

- distribution of free DVDs featuring documents and other resources emanating from each of the four research areas (videos, texts, demo versions of measures and instruments);

- invitations via mailing lists and e-mail networks to training schools, workshops and conferences;

- access on the Website to non-technical publications and recommendations;

- posting of the final assessment reports.

E) For European citizens:

- Television, radio and newspaper interviews

- posters in public places (e.g. town halls, post offices and hospitals) highlighting the importance of reading in today's society and how it might be affected by digitization,

- press releases and news items posted on popular Websites,

- publications in the European research magazine RTD Info (Years 3 and 4 of the Action) and a range of other media, such as CORDIS Wire

- discussion forums and FAQs in the public-access section of the COST Action's Website

- social media (Facebook, blogs, twitter)

H.3 How?

A Dissemination Group will be established at the first MC meeting. The group will create a dissemination plan which will be evaluated by the MC on a yearly basis and revised at the end of the penultimate year of operations. The MC will also take into account any novel sufficient means of dissemination that may occur during the course of the Action.

Information relating to the Action will be continuously disseminated throughout the 4-year duration. The nature of this information will change as research projects evolve and will keep step with the calendar of events. The reports on all the Action's different activities will be systematically posted on the COST network, thereby ensuring a high level of visibility. The advances reported at the scientific meetings, workshops, and training schools will give rise to proceedings-style joint publications. The results of the workshops will primarily give rise to articles in peer-reviewed

journals. The volume of findings and recommendations will increase as the COST Action's work advances, while information will be regularly provided to the general public, thereby helping to raise awareness of the importance of reading effectively and the amount of research that is currently being undertaken in this field in Europe. The dissemination plan will be updated after each evaluation and in line with the MC's recommendations, especially at the end of Year 3, in order to optimise the dissemination of information. All publications and documents will be archived in an appropriate e-print repository of the COST office.