Research Article

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Handwritten culture through digital native eyes: student participation in the digital fragmentology project *Textus invisibilis*

Abstract: The present paper addresses the issue of how interest-driven learning can enhance an attitude of student-generated inquiry in the learning process so to promote student participation in university research projects. The research question is how wonder as an epistemic emotion may sustain students' interest-generated questioning, and how the latter may influence the design of a university research project. As a case-study, the paper describes a laboratory on palaeography which took place in Spring 2019 at an Italian State Archive within a University bachelor program in the context of a digital fragmentology project. To design the laboratory and establish qualitative analysis methods for its data, an interdisciplinary educational approach was designed that combines interest-driven learning, emotion theory, value theory, hermeneutics, and User Experience, on the background of Ernst Cassirer's view of a human being as an *animal symbolicum*. In the laboratory, the students' questions and hypotheses arising from their interaction with historical scripts and Medieval handwriting culture are helping redesign some aspects of the research project *Textus invisibilis* both on the level of the research design and of the team composition, as well as pointing to a novel relevance of state archives and historical libraries in higher education.

Keywords: palaeography, digital fragmentology, epistemic emotions, student-driven inquiring, research-based higher education

1 Introduction

The present paper addresses the issue of how interest-driven learning (also known as Interest-centered- or Interest-based learning) can enhance an attitude of student-driven inquiry so to promote student participation in university research projects. Specifically, the focus is placed on the relationship and interplay between interest and epistemic emotions such as wonder in supporting student self-questioning and self-directed learning (s. Candiotto, 2019). Such a student-centered learning approach enables students to participate proactively in research projects in the humanities, since qualitative research begins with "a question, or at least an intellectual curiosity if not a passion for a particular topic." (Janesick, 2000, p. 382).

As a case-study, the paper describes a laboratory on palaeography which took place in Spring 2019 at the Urbino State Archive during a Medieval philology and literature course within a humanities bachelor program at the University of Urbino (Uniurb); the term *laboratory* / *lab* will be used here instead of *workshop* to point out the experimental nature and aims of this experience.

The lab was organized as part of the digital fragmentology project *Textus invisibilis*. This project is focused on medieval parchment manuscript fragments. It was established at Uniurb in 2011 as a partnership with the Urbino State Archive. *Textus invisibilis* originally aimed to recover and study parchment manuscript fragments by virtue of the texts they witness: it was conceived as a contribution to fragment philology. However, the students' questions and their approach to fragments during the 2019 laboratory have led me to redefine my view of fragments from mere text witnesses to multifaceted historical objects,

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and, consequently, to shift the epistemological approach of *Textus invisibilis* from fragment philology to fragmentology. The 2019 palaeography laboratory was designed to explore the following research question (RQ): *how can epistemic wonder sustain students' interest-generated questioning so that the latter may influence the design and the team composition of a university research project?* Up to the academic year 2017/2018, I had been designing my paleographical labs at the State Archive as a standard part of my Medieval philology and literature courses at Uniurb – as learning environments where students were being requested to practice and test their palaeographical notions previously acquired in the 'normal' philology class. The labs had been a place where students should fulfil some tasks previously given to them in palaeography and codicology lessons mostly held in a frontal-teaching style in class. However, since many of the students participating in the labs asked me to participate in the project *Textus invisibilis*, I decided to design my 2018/19 lab on a student-centered and interest-driven basis as a contextual part of the project. Accordingly, I created an experimental educational framework on which basis I then designed the program of the lab, to be held for philology and literature bachelor students in Spring 2019. In the newly designed palaeography lab, there was a strong focus on the importance of *student self-questioning*, as well as on the role of epistemic emotions, especially wonder, for originating questions, helping students discover their own learning interests, and boosting their learning motivation. Unlike the case of the previous labs, this time, very limited notions of palaeography and codicology were transmitted to the students in class before they came into the lab, so that they had to approach the fragments drawing on their own general cultural background and personal interests rather than being pre-conditioned through the philology and literature program. This gave the students the chance to develop an attitude of self-driven inquiry. Raising questions, especially when they arise in connection with surprise, astonishment, as well as any kind of emotional involvement, is of vital importance for one's advancement in critical thinking, knowledge creation, creativity in general, problem-solving attitudes, self-expression and self-confidence, both in utilitarian and non-utilitarian life contexts. Various fields of knowledge acknowledge this fundamental point (s. literature review in Sect. 3). Thus, this paper will be structured according to the following steps.

Section 2 will present Urbino as a 'learning landscape' linking its University with the Urbino State Archive and other institutions from the territory. The original design and aims of the project T*extus invisibilis* will be outlined here as well.

Section 3 will present the interdisciplinary framework that I developed to forster student participation in the Spring 2019 palaeography lab as well as in the project *Textus invisibilis*. The framework combines interest-driven learning, value theory, emotion theory, philological hermeneutics, design thinking, and User Experience, on the background of Ernst Cassirer's view of a human being as an *animal symbolicum*. Section 4 will briefly describe the palaeographical lab in Spring 2019. Section 5 will present the findings from the lab. Here, the data produced by the lab participants will be prepared and organized for discussion through qualitative analysis methods. Section 6 will assess the relevance of the findings for the research question of the present study: *How can epistemic wonder sustain students' interest-generated questioning so that the latter may influence the design and the team composition of a university research project?* In view of the discussion, the RQ has been split into two components: (RQ1) *How can wonder, conceived as an epistemic emotion, sustain students' interest-generated questioning?* And (RQ2) *How can students' interest-generated questioning influence the design and team composition of a university research project?* Section 7 will propose some conclusions and outlook.

2 Setting the context: Uniurb, the State Archive, and *Textus invisibilis* as three landmarks in the Urbino learning landscape

Uniurb is a mid-sized state university. It is embedded in Urbino in a way that it creates a campus town. Within this learning landscape, *Textus invisibilis* organizes student internships which connect Uniurb with the Urbino State Archive as well as several historical archives and libraries in the territory (the term *learning landscape* is used here as in Zuiker & Jordan, 2019).

2.1 The parchment fragments of *Textus invisibilis*

In winter 2010/11, I initiated *Textus invisibilis* 2010/2011 to valorize the parchment fragments from the Middle Ages and the Early Modern Era preserved at the State Archive in Urbino (on the history of the Archive, s. Scorza, 1986; Paolucci, 2009) . More than 3000 parchment units containing texts in different languages and types are preserved in the form of fragments in three fonds of the Archive. In the most cases, they are still part of the bindings of 16th- and 17th-century archival units, as a result of book-binding techniques involving parchment recycling in Early Modern Europe. The parchment fragments are used in different ways in these fonds. Three techniques are most common: first, bifolios are wrapped around the cover, kept attached through simple folding; second, folios, bifolios or strips are glued around the covers, or on parts of it (for instance, on the spine), even on multiple layers; third, bifolios or folios are folded into the form of an envelop (*busta*) to contain a small register called *vacchetta*, or a non-bound heap of documents, the latter being often loosely held together through a leather string sewn across them (in which case the heap of documents is called *filza*).   A small group of approximately 150 fragments was detached from their archival units in the last 3 decades; at present, we are trying to trace back each fragment to its original host unit.   Here are some examples of parchment fragments from the State Archive in Urbino (Fig. 1).

The state of preservation varies remarkably. At present, we have not yet classified the types of damage occurred. As results from a preliminary survey, besides the 'common' damage types affecting parchment manuscripts in general – such as bookworms, mold, etc. – other types of damage, such as dust, folds, holes, or tears, result from their century-long use as bookbinding elements, as well as from their present storage system: most of the volumes hosting the fragments stay on shelves, ready for use. To make the faded scripts readable again, we are using a spectronomy technique developed at Uniurb (s. Lanfrancotti & Carini, 2016). This technique exploits light-induced fluorescence on parchment. It is being used to improve the documents' readability on a more superficial level, so to support especially the first, large-scale censusing of all the extant fragments. We have chosen this technique because it can be easily learned and applied also by students from curricula outside informatics.

2.2 The original research design of *Textus invisibilis*

I conceived *Textus invisibilis* in 2010/11 as a project based on a textual understanding of fragment. The project should follow a philological-bibliological approach: restoring the faded scripts of the fragments so to read the texts; censusing and cataloging the fragments in the State Archive primarily on a textual basis (i.e. according to the text they contained, on principles similar to those of *Manus online* https://manus.iccu.sbn.it/, s. also Corbo, 2017) *e-codices* (https://www.e-codices.unifr.ch/it) or *Fragmentarium* (https://fragmentarium.ms/); re-combining together fragmentary texts belonging together (for example by re-joining text portions in fragments dismembered from the same codex or folio); editing the re-established texts in their reconstructed textual unit; setting up a multimedia database to make these fragments and the reconstructed texts accessible to the scholarly community through searching options which should mainly meet the needs of philologists, text scholars from different fields, and historians. The images, restored and (in the case of *membra disiecta*) juxtaposed to one another, should be made accessible as well. This textual criterion was first challenged in 2015. In that year, the Administration of the territory near Urbino (Unione Montana del Catria e Nerone) with their historical archives and libraries joined the project, and in the year 2016 the partnership with the Paris-based *Books within books* (http://www.hebrewmanuscript.com/) was established. This has posed new issues to the project. As concerns the collaboration with the historical libraries involved through the Unione Montana, the issues have to do with the nature and aims of a library: this is a holding institution with aims, rationales, and storing criteria different from those of an archive. Furthermore, libraries with so-called *fondi antichi* (historical fonds) hold different types of items such as *incunabula* or *cinquecentine* where fragments are employed with their own bookbinding techniques. In frequent cases (s. e.g. Fig. 3), the fragments, in the form of stabs, run over the spine of the bookblock under the cover, thus joining the former to the latter.

Since 2016, the collaboration with *Books within books* has raised issues around the theoretical and technical compatibility of their cataloging system with that of *Textus invisibilis*. As we will see below in Sections 5 and 6, these issues, together with the challenges that emerged from the analysis of the library fragments from the Unione Montana

Figure 1: Parchments used as book-binding and document-storing material. Published by the courtesy of the State Archive of Pesaro-Urbino.

Figure 2: A fragment photo before and after restoration, after Lanfrancotti's & Carini's 2016 technique. Details from photos by Emilio Lanfrancotti. By the courtesy of the State Archive of Pesaro-Urbino.)

del Catria e Nerone, and with the students' unexpected approach to the fragments in the lab, have led me to thoroughly re-design our project on a new understanding of our objects (the fragments) and of our aims.

3 The interdisciplinary framework at the basis of the Lab

The research presented here addresses the issue of how interest-driven learning can enhance an attitude of student-generated questioning and inquiry in the learning process so to promote student participation in university research

Figure 3: Biblioteca del Monastero di Fonte Avellana: a 1590 Venice print of Mario Antonio Berarducci's Somma corona de' confessori, details of the spine inside the cover. The stabs come from different manuscripts. They join the spine with the pastedowns. The cords do not surface with the stabs. Photos by Nicoletta Biondi. By the courtesy of the Monastero di Fonte Avellana.

projects. Within this main issue, the palaeography lab was conceived to explore the following research question (split into a main RQ1 and a subordinate RQ2):

– RQ1: how can wonder, conceived as an epistemic emotion, sustain students' interest-generated questioning?
– RQ2: how can students' interest-generated questioning influence the design and team composition of a university research project?

The challenge was therefore to build an interdisciplinary framework which should combine the fundamental tenets of philology and palaeography – i.e. the disciplinary areas of the course which hosted the lab – with the theoretical instruments needed to approach the objects of the lab so to support the students' learning process. In addition, assessment methods for the lab findings had to be worked out which should be epistemologically compatible with the interdisciplinary framework at the basis of the lab.

Thus, we will now explore how I built the theoretical framework for the lab: how I selected those fundamentals of philology into which I then grafted some aspects of User Experience (so that I would be able to observe students interacting with parchment fragments, historical scripts, and the physical setting of the archive), value theory and motivation theory (so that I would be able to assess the value, significance, and meanings the students would ascribe to the observed phenomena as well as to their own behaviour in the lab), epistemic emotions research (so that I might be able to recognize and support the students' emotions triggering their motivation to inquiry for knowledge), and interest-driven learning combined with inquiry-based learning (so that I could structure the steps of the lab standing on an overall design thinking backbone). In Section 4, the lab itself will be described.

3.1 The place of philology within human sense-making and symbolizing activity

My courses are conceived on an understanding of philology as a historical science, in the realm of the humanities (Dilthey's *Geisteswissenschaften* 'sciences of the spirit'). As such, philology belongs epistemologically to the 'idiographic sciences'. These aim to understand human phenomenons through mainly qualitative research methods which start by perceiving and assessing single entities to achieve 'objectiveness', i.e. generally valid knowledge. (s. discussion in Schurz, 2014, esp. p. 14). Philology participates in Ernst Cassirer's (1944. p. 26) view of human being as an *animal symbolicum*. This view is broader that Aristotle's view of an *animal rationale*, because it aims to take account of a human being's existential horizon. By connecting different aspects of reality with each other and to himself or herself, a human being turns reality into a universe of meaningful data. Within this universe, human beings produce symbolic acts through which they not only make sense of those data, but also transform them, thus inscribing their own existential pathways in there.

Philology investigates how humans' existential pathways are expressed in those complex symbolic entities that we call *texts*. Written texts are philology's main research objects. Cassirer's view of the nature of human being fits into the disciplinary status of philology as a humanities science that investigates a text – and its material embedment such as a parchment fragment – as a *historical phenomenon*, i.e. as a product of a human community trying to making sense of their experience with reality. Philologists aim to understand texts through their inceptional contexts, and viceversa, thus tracing out a so-called 'hermeneutical circle'. Wilhelm Dilthey described this understanding process at the basis of philology with great precision in his essay *Die Entstehung der Hermeneutik* ('The genesis of hermeneutics', 1900). Here, he makes clear that understanding is driven in the first place through the primary force of an individual's *interest*: "Das Verstehen zeigt verschiedene Grade. Die sind zunächst durch Interesse bedingt. Ist das Interesse eingeschränkt, so ist es auch das Verständnis." (p. 319) (Understanding has different grades. These are conditioned in the first place through interest. When there's limited interest, so is understanding.'). In this understanding process, *feeling* other people's states of minds ("Nachfühlen fremder Seelenzustände") plays a primary role, especially insofar as understanding otherness generates joy (or 'happiness', "Glück", s. Dilthey 1900, p. 317).

3.2 Symbols at the crossroads between an individual's and a community's values, motivations, and inclinations

The shift from understanding to interpretation (i.e. hermeneutics) takes places when individuals' experiences are organized and expressed through intersubjective, shared structures (s. Dilthey, *ivi*), which we may call *symbols*. Symbols act both inside an individual and outside him/her, i.e., in his/her interaction with others. Symbolizing is the most human activity. By symbolizing, human beings connect different aspects of reality together: they shape reality in a way that *means something to them*, both as individuals and social beings (s. discussion in Rolf, 2006, esp. pp. 1-9). Dilthey, Langer (1948 [1942]) and Makkreel point out the knowledge-generating force of both language-based and non language-based symbols (s. discussion in Makkreel 2020). They share Cassirer's view that symbols carry and express human inclinations, interests, and, most importantly, values, according to their changing embedment contexts. Interest is strongly connected to what we *value*. The notion of 'value' has been discussed mainly in economics, philosophy, and psychology (s. discussion in Hügli, Schlotter, Schaber, Rust, & Roughley, 2004; Schroeder, 2016). Value in present-day philosophy has parted from the ontological quest of whether an entity of reality has a value independently from human consciousness. It has shifted to logical, axiological, and teleological discourses: something has a perceived value *for someone*. Value results from the human act of estimating (Lat. *aestimatio*) (Hügli, Schlotter, Schaber, Rust, & Roughley, 2004, col. 557). Valuing is a human act of acknowledging reality according to different criteria. A cross-disciplinary distinction is between *intrinsic* and *extrinsic* (or instrumental) value: I may perceive something as valuable in itself, regardless of the use and advantage I might gain from it, or as valuable for a goal, as an instrument to achieve an outcome (s. Schroeder, 2016; Zimmerman & Bradley, 2019). Human perception of intrinsic and extrinsic value correlates strongly with human intrinsic and extrinsic *motivation*. Intrinsic motivation "refers to doing something because it is inherently interesting or enjoyable", while extrinsic motivation "refers to doing something because it leads to a separable outcome." (Ryan & Deci, 2000, p. 55; s. theoretical discussion in Covington & Wiedenhaupt, 1997; Rheinberg & Vollmeyer, 2019; for altruistic motivation, as a sub-category of intrinsic one, s. discussion in Watt et al., 2012). As numerous studies from different research areas have shown, intrinsic motivation – i.e. motivation driven by one's own interest in something perceived as intrinsically valuable also regardless of practical benefits or external rewards – leads to self-determination in one's own existential pathways, and to genuine, disruptive innovation in one's own studies or at work (s. Herzberg, Mausner, & Bloch Snyderman, 2017 [1959]; Harackiewicz, Smith, & Priniski, 2016; Rheinberg & Vollmeyer, 2019, par. 6.7; Schiefe, 1991). Learning sciences have provided evidence that intrinsic motivation results in high-quality learning and creativity (Ryan & Deci, 2000); that students mostly choose their studies and future professions for intrinsic motivation factors even in times of economic recession (Hilz & Riedl, 2013; for teaching, s. Watt et al., 2012); that intrinsic motivational factors are the main driver behind success in highly qualified professions and trigger disruptive innovation (Centers & Bugental, 1966; Katz & Kahn, 1978). In all these studies, surveys and questionnaires address intrinsic motivation as an individual's 'interest' in a knowledge field, 'desire to develop one's skills', 'self-expression', 'responsibility', 'enjoyment / joy', 'etc.

3.3 Philology, intrinsic values, intrinsic motivations, interest-driven learning, and UX design

Since its very beginnings, philology as a science has taken part in the humanities' effort to acknowledge *humanitas* ('the condition of being human') as a self-founded, intrinsic value (s. Canfora, 2008; Ordine, 2013; Pollock, 2016). There is something intrinsically valuable in trying to contemplate reality (including human beings) *as it is in itself*, i.e. also regardless of the *use* we might make of it. From this 'philosophical wonder' about reality, human desire of knowledge has emerged (s. Candiotto & Politis, 2020; Haeffner, 2003; s. also Sect. 3.4 below). Philological studies support a mainly non-utilitarian view of human being, of creativity, and of knowledge. Creativity can have practical outcomes (such is the case when it helps solving a real-life problem), but it does not ultimately derive its worth or its value from these: painting, playing music, drawing on the wall as a small child, all these acts express in the first place one's own impulse, one's own enjoyment and natural self, one's plain desire *to be*, and they deepen one's own awareness of oneself and of reality. As a consequence, humanities students often choose their academic studies on the basis of their deeper interests and inclinations, even if they are aware that their chances to step quickly into a successful professional career (i.e. an external reward for their studies) will be not so high as, say, these would be after an informatics degree (s. Molinari & Gasparini, 2019). On the other side, the modernization agenda of higher education in the European Higher Education Area (EHEA), together with the stiff, grade-based evaluation system at Italian universities, conflicts with the humanities' traditional agenda of cultivating intrinsic values and self-determined rewards. Furthermore, as it seems from recent findings, humanities students do want to 'feel useful', i.e. they are often strongly committed to make sense of their inclinations by co-building an advanced, developed, and inclusive society (s. Molinari & Gasparini, 2019). This coheres with evidence put forward by recent studies that intrinsic and extrinsic motivation are distinct, but complementary to each other in shaping students' decisions (Rheinberg & Vollmeyer, 2019). Therefore, I had to develop an approach for my courses that might link non-utilitarian attitudes to the practical, problem-solving challenges of the present-day occupational market. A fitting link between the humanities and the present-day job market is design: specifically, that design-driven approach to research and innovation known as design thinking (s. Molinari & Gasparini 2019), as well as the so-called User Experience (UX) design approach to objects, services, and interpersonal communities. Design theory describes creation processes, even those of scientific creation, as a reiterative sequence of phases of divergent and convergent thinking (s. Guilford 1950; Bánáthy 1996). This sequence was recently developed by the Design Council into a so-called 'double diamond' diagram, where a creation process is described as a double sequence of divergent-convergent thinking which consists of: Discovering, Defining, Developing, and Delivering (s. resumé in Ball 2019). Within this overall approach, UX investigates how a user's experience with an object, service, social situation, personal challenge, is influenced by the user's personal tastes, inclinations, desires, and values, as well as by the meanings they attribute to their experiences (s. McNamara & Kirakovsky, 2006, p. 27). UX also investigates how these values, meanings, desires, etc., shape a user's experience with an object, service, personal challenge, interpersonal relationship, etc., in habitual or changing life contexts. For example, something perceived as valuable fosters its users' engagement in a way that it also changes their perception of the time spent with it (Culén & Gasparini, 2013, p. 15).

Since a 'student' is an entity much broader than a 'user', I have addressed for the design of the lab some recent developments within UX from a 'user/consumer'-oriented approach to a more comprehensive view of human beings, such as Wright's & McCarthy's experience-centered design (2010). They consider the notion of 'user' problematic, as it connotes "a limited role-relation between people and the technology, namely that of *tool user*" (Wright & McCarthy, 2010, p. 63). Against such a reductionist perspective, they plead for "reasserting the humanist agenda in experience-centered design" (p. 8) so to "valu[e] the whole person behind the user", i.e. people who "are active in defining the nature of the roles they construct for themselves and the relationships they enter into with other people (including researchers and designers) and with technology". (p. 63; s. also Molinari & Gasparini, 2019, pp. 31-33, 49). Such a holistic view requires that UX designers "acknowledge the tight relationship between what people do and how they feel about, give value to, and give meaning to what they do and to what happens to them" in the course of their existence (Wright & McCarthy, 2010, p. 63): this also applies to students, i.e. to their experiences in the terms of value giving, expectations, etc., in a lab. For these reasons, humanistic UX fits greatly with the tenets of *interest-driven learning*. Since John Dewey's *Interest and Effort in Education* (1913), the nature of interest, its connection with motivation, and their role for engaged and effective learning, have become a widely explored research field especially in psychology, learning science, and education philosophy. Dewey proposed that school teachers should "ensure his [the child's] *mental attendance* by a

sound appeal to his active interests" so to "make school life an interesting and absorbing experience to the child", since "education comes only through willing attention to and participation in school activities. It follows that the teacher must select these activities with reference to the child's interests, powers, and capacities." (Dewey, 1913, pp. viii-ix, cursive by him). Mental attendance implies the child's self-generated *effort*, conceived as "the power of putting forth activity independently of any external inducement." (Dewey 1913, p. 6). Such independence places Dewey's understanding of interest (and of effort) very close to the phenomena of intrinsic motivation and of value perceived as intrinsic: "The genuine principle of interest is the principle of the recognized identity of the fact to be learned or the action proposed with the growing self; that it lies in the direction of the agent's own growth, and is, therefore, imperiously demanded, if the agent is to be himself." (Dewey, 1913, p. 7. For empirical evidence confirming Dewey's theses: s. e.g. Azevedo, 2013; Renninger & Hidi, 2016). The present paper adopts a 'broad' understanding of interest as "a natural draw to certain activities" and to certain aspects of reality (Edelson & Joseph, 2004), which ultimately draws on Dewey.

3.4 Philology, epistemic emotions, and self-driven questioning, for inquiry-based higher education

For the design of the palaeography lab, one aspect of the discussion on interest deserves closer consideration: the role of so-called *epistemic emotions*. These are important, as they are *a source of salience and interest in a topic* (Candiotto, 2019; Haeffner, 2003; Morton, 2010). Candiotto distinguishes between emotions which may *accidentally occur* in epistemic contexts, and emotions which are *defined* by the epistemic function. These again may be distinguished between emotions which play epistemic functions *intrinsically* (e.g. curiosity), and those which play a decisive role in *specific* epistemic situations (e.g. shame in critical dialogue). An epistemic emotion is defined through its *causal* function in knowledge acquisition: "The epistemic function played by epistemic emotions is thus the one of motivation to knowing, and their intentionality is defined by having the truth as their formal object" (Candiotto, 2019, p. 850). Epistemic emotions motivate the epistemic practices, such as "finding the correct answer to our curiosity / interest / concern", or "developing the best argument in favour of a thesis", or "justifying our judgements about what is certain or doubtful" (Candiotto, 2019, *ibidem*). Epistemic emotions of this type are the feeling of familiarity, the feeling of knowing, and the joy of verification (*ivi*). All these emotions that are intrinsically defined by the fundamental epistemic function of motivation to know the truth are related to the final object of knowledge. However, one should also consider those specific epistemic functions such as evaluation, deliberation, and belief's revision. Candiotto (2019, p. 851) mentions fear as an epistemic emotion connected to our activity of evaluating a situation as dangerous, or happiness as the emotion behind our deliberation to give a present to our partner, or doubt as the emotion felt in a belief's revision: "In these cases, emotions which are not immediately related to knowledge achievement [...] can nevertheless be recognized as epistemic" even if it should not be taken for granted that they are directed to the truth. A more generic understanding of the epistemic emotions is proposed by Brady (2013; 2018). According to him, emotions can facilitate the epistemic functions when they help the epistemic agent to focus on a topic and strive to grasp it.

On Brady's basis, we might define as *epistemic* most of the emotions, state of minds, and feelings evidenced in the surveys and questionnaires of the empirical studies on learning based on intrinsic motivation and value referred to in the present paper, such as interest itself (meant as 'feeling interested/engaged in'), thrill, fun, or joy. However, to the aims of the present study, a more fitting approach to the epistemic functions remains Candiotto's (2019) view that we need to investigate specific emotions in well-defined epistemic practices and contexts. One of these emotions is *wonder*. Plato and Aristotle consider wonder (ϑαυμάζειν, thaumàzein) as the origin of the *desire* of knowing (i.e. *philo*-sophy). Having the experience of *seeing* (ϑέα 'act of seeing, looking at; that which is seen, sight') at its root, the Greek word for *wonder* can be understood literally as 'being captured by the sight of something' ("vom Anblick einer Sache gefangen genommen [zu sein]" Haeffner, 2003, pp. 14-15). Something 'captures you' because it makes you desire to know about it. On the textual basis of Plato's *Theatetus* (155d2-d6) and Aristotle's *Metaphysics* (A 982b11), Candiotto (2019) undertakes a data-based, hermeneutical, and phenomenological analysis of the experience of wonder. She concludes that wonder is an epistemic emotion in the strong sense of *causing* the desire to know, i.e. causing questioning and inquiring, *only* when wonder is experienced in conjunction with a problem to solve ("I wonder if": interrogating wonder) or with an *aporetic* state. The latter is "a disruptive mental state wherein one faces some contradiction that one does not know how to resolve, which then leads to an epistemic doubt." (Candiotto, 2019, p. 852). We are faced with aporia,

for example, when we conceive two or more hypotheses on a phenomenon which seem to us equally plausible. An aporetic state can be also conceived more generically, and in a sense closer to the Greek root of the word *aporeia*, (literally, 'lack of passthroughs'; 'uncertainty', 'difficulty'), as the experience of uncertainty from not knowing. In any case, wonder is an emotion where feeling *and* the cognitive process are one: "In this [...] view I am suggesting, wonder is primarily an experience in which the feeling is not only the one of amazement, but also the feeling of doubt, uneasiness, and the questioning is filled with uncertainty and curiosity." Therefore, the emotion of epistemic wonder may be conceptualized as "an affective-cum-desiderative state directed at knowing" (Candiotto, 2019, p. 854), and the inquiry itself which wonder triggers is "affective and cognitive from the beginning." (ivi, p. 855). Moved by aporia-based epistemic wonder, "the inquirer is triggered to address questions, and she is prone to undertake the laborious process of inquiry for finding some answers." (*ibidem*; on the epistemic function of wonder, s. also Napolitano Valditara, 2014). But: *why* do we desire to know? Here, Candiotto proposes an existential explanation: inquiring is not only motivated by the pleasure of knowing, but also "by the desire of overcoming the distress provoked by the unknown, and specifically to the aporetic states, by recognizing contradictions and ignoring how to escape from them" (Candiotto, 2019, p. 856). Inquiring is moved by the desire to putting an end to such a *conflict going on inside us* (s. Aristotle, *Metaphysics*), since prolonged uncertainty may generate anxiety. Wonder "brings the desire of overcoming the suffering of ignorance for the pleasure of getting answers" (Candiotto, 2019, p. 858): these are pleasant because they give us some sense of clarity and safety in our existence. For this reason, wonder stays at the beginning of the history of philosophy, at the beginning of any inquiry for knowledge, and, during a process of inquiry, at the beginning of any revision of aporiai previously considered solved: inquiry is a learning process where errors are powerful knowledge generators. On an individual level, our own internal conflicts, existential aporiai, and existential awe trigger our own interests and existential pathways, and the latter are in turn driven and sustained by the former. Therefore, in higher education, learning settings are needed which encourage students' interest and self-driven questioning. These settings are designed by inquiry-based education, along the whole educational pathway from kindergarten to university and in life-long learning (s. overview in Aditomo, Goodyear, Bliuc, & Ellis, 2011). Designing a learning approach that places questioning at its core supports the learning process of individuals and groups effectively on all levels, from primary school to adult education (s. e.g. Aditomo, Goodyear, Bliuc, & Ellis, 2011; Corley & Rauscher, 2013; Schneider & Mustafić, 2015).

Questioning is most effective when students in the course of their learning pathways are enabled and trained to *self-generate their own questions*. This is the case for several reasons. First, there is empirical evidence that student-generated questioning boosts the learning process by activating both cognitive and emotional faculties, as well as helping students focus on their deeper interests and motivations (s. Pedaste et al., 2015). Second, as qualitative research begins with "a question, or at least an intellectual curiosity if not a passion for a particular topic" (Janesick, 2000, 382; s. also Agee, 2009), training students to pose their own questions develops in them a fundamental attitude of inquisitiveness along their own curricular pathway, as well as while participating in research-based degree programs and in university governance (s. Carnell & Fung, 2017).

3.5 Philology, palaeography, and experience: the sense-making power of handwriting

Philology recognizes the knowledge-generating force of symbolizing also at the basis of handwriting and of the evolution from ancient to modern scripts. One main representative of this view was the Romance philologist Giorgio Pasquali, who, on the wave of Cassirer's and Dilthey's historicism, conceived the act of handwriting as a symbolic act through which an individual's bodily gestures participate in the symbolic universe of a given cultural era; he accordingly placed palaeography at the interdisciplinary core of philology, and contextualized the latter as the written core of the history of European culture. Accordingly, Pasquali tracked a cultural continuity between some aesthetic motifs linking together handwriting styles with visual art and architecture styles through different regions and ages in European history (s. Pasquali 1931). Pasquali shared his approach to palaeography with the French palaeographist and archivist Robert Marichal (1963; s. also Dorandi 2017), who dedicated a great part of his research to produce evidence for a relationship between a scribe's writing gestures (*ductus*) and the main intellectual and aesthetic tastes of his/her age. This focus on the symbol-driven relationship between a human body's writing gestures and the imaginative universe of a given culture has become a main point within palaeography discourses. Handwriting as a sense-making, meaningful, holistic *experience* underlies Clayton's (2013) research and it has inspired many of the contributions presented at a

2019 UC3M (Getafe, Madrid) international seminar (https://analoganddigital2019.wordpress.com/event/). It should be therefore taken into account when organizing labs dealing with parchment fragments and their texts written in ancients scripts.

3.6 The design of the 2019 lab

The interdisciplinary theoretical framework described above focuses on wonder seen as the force that ignites the students' interest and inquiring, which leads to understanding, sense-making, new knowledge, and self-orienteering in one's lifepath. On this underlying terrain, I have shaped the overall structure of the lab on the basis of the fundamentals of *Inquiry-based teaching and learning* provided by Aditomo, Goodyear, Bliuc, & Ellis (2011, pp. 3-5). I have insterted these fundamentals into the *five-phase enquiry cycle* by Pedaste et al. (2015) combined with the double-diamond process of *creative thinking*: this process describes the cooperation of divergent and convergent thinking in problem-solving, and it is therefore at the basis of any design thinking approach to human phenomena. The way I applied these principles to provide the backbone for it is displayed in the template at the end of this section (Fig. 4). Here are the fundamentals of the lab structure:

– As for the *form*, it can be classified as an example of *problem-based* teaching and learning: structurally, it "[s]tarts with a real world problem which is unstructured, open-ended, and thus needs to be refined before it can be addressed" (Aditomo, Goodyear, Bliuc, & Ellis, 2011, p. 3). From the students' side, the 'problem' in my lab consisted in their encounter with objects and a setting totally new to them and quite unknown in their academic milieu as well: parchment manuscripts in various fragmentary states, in an unexpected context of use (the bindings of book covers in archival depositories).
– As for the *nature of the inquiry task,* the following key dimensions were planned (as defined by Aditomo, Goodyear, Bliuc, & Ellis, 2011, p. 4). *Temporal scale*: the lab should stretch over 9 hours *in praesentia* and a flexible number of individual or group homework hours. The 9 hours *in praesentia* should include a one-lesson discussion on the British Library digital facsimile of a 11th century manuscript containing and Old English heroic poem (*Beowulf*), to be conducted in class, and two meetings of ca. 4 hours each at the State Archive to work in groups with the manuscript fragments. For the present paper, only the two meetings at the State Archive are relevant. *Level of structure*: in the eight lab hours in the State Archive, I planned that the inquiry task should be *open,* and that the learning goal should be that students be enabled to *create new knowledge* (*ivi*). *Link between teaching and research*: I planned that the lab should be research-based: the students should pursue their questions which would originate from their own epistemic emotions, so that they would investigate in directions *which I had possibly not yet conceived myself*. This would possibly generate new knowledge to include in a re-design of *Textus invisibils* from the students' (and future scholars') perspective.

The following template (Fig. 4) shall summarize the design and contents of the lab meetings at the State Archive.

4 The lab events

35 students enroled for the lab (19 from the first bachelor year course, 16 from the second). Since the State Archive cannot admit so many visitors at once, the students were divided into 14 smaller groups which were composed from students from both courses (they were left free to choose their favourite lab schedule). The lab took place in two meetings of ca. 4 hours each. For the first meeting, the groups could choose to come to the Archive on May 4, May 14, or May 16. For the second meeting, the groups could choose between May 18, May 24, or June 19. Thus, three first meetings (with the same structure) and three second meetings took place (also sharing the same structure) (see Fig. 4). When the students came to the first meeting, they had no idea about parchment fragments. They had never been in a State Archive. Even in our introductory lesson in class on the *Beowulf* manuscript, I had not mentioned the existence of this parchment recycling practice in book binding. This omission aimed at encouraging, if possible, the students' experience of surprise and wonder while encountering the fragments and their scripts. Total lack of information on

	ORIENTATION	CONCEPTUALIZATION (QUESTIONING AND HYPOTHESIS GENERATION)	INVESTIGATION	CONCLUSION	DISCUSSION (TAKE-AWAY AND PROPOSALS)
FIRST LAB MEETING May (4 or 14 or 16) 3, 5 hours State Archive	FIRST ENCOUNTER WITH THE FRAGMENTS: Students enter the reading room, they observe/explore ca. 50 detached and non-detached fragments on the reading room common table. (OBSERVATION, INDIV.).	OPEN ENQUIRY TASK: - Teacher to students: «Pick out of the bulk a fragment you would like to work with!» (**INDIV.**) - Teacher to students (FREE SELF-QUESTIONING): **«Observe the fragment on your own and your reactions to the fragment. Does any question arise in you while observing it? If yes, write it/them down»** (**INDIV.**) - FOCUS GROUP INTERVIEW AMONG STUDENTS (SMALL GROUPS): «Why have you chosen that fragment? Which questions arose while observing the fragment?» INQUIRY TASK SELECTION (IN SMALL GROUPS): - Students select some group questions out of the individual ones and formulate hypotheses		---	
SECOND LAB MEETING (18 May or 24 May or 19 June)			IN SMALL GROUPS: RAPID PROTOTYPING OF INQUIRY METHODS: students work rapidly out several inquiry methods to test their hypotheses IN PLENUM: VISIT OF THE DEPOSITORIES (where volumes with fragments are stored) BACK TO THE SMALL GROUPS: => testing of prototyped methods on empirical data	IN SMALL GROUPS: Each group selects at least ONE hypothesis and testing method to be discussed in plenum IN PLENUM: Students and teacher discuss and validate the selected hypothesis by connecting them to current scholarship; zoom-in on new insights from the lab	PLENUM DISCUSSION ON NEW INSIGHTS: - «What do we take away from this experience?» - «Have these insights/issues been already discussed by scholarship? «How might we involve these rew insights into scholarly discussion / into Textus invisibilis?»
DOUBLE DIAMOND	FRAGMENT OBSERVATION → SELF-OBSERVATION; QUESTION-STORMING; INTERVIEWS *Discover*	INQUIRY TASK SELECTION, HYPOTHESIS FORMULATION *Define*	PROTO-TYPING OF INQUIRY METHODS *Develop*	TEST OF INQUIRY METHODS, SCONCLUSION, DEFINITION OF NEW INSIGHTS *Deliver*	MUTUAL INTERVIEW, BRAIN-STORMING ... and again: *Discover...*

Figure 4: Template of the structure of the palaeography lab.

fragments, as well as almost total lack of previous knowledge on Medieval manuscripts for the first-year students (save the introductory lesson on the *Beowulf* manuscript with some basics on palaeography, and the optional view of some youtube videos on palaeography and manuscript construction) should also enable students to approach the fragments and scripts, formulate questions, and start their inquiries, being guided solely by their personal interests and inclinations rather than by the course program or any pressures from the teacher's expectations.

Figure 5: First meeting. Students' individual free self-questioning. Photo by Alessandra Molinari.

4.1 Events of the first lab meeting (May 4 or 14 or 16)

The lab started with the students gathering around a large work desk in the reading room. There, they were given two boxes and two folders which contained mainly detached fragments and a selected number of fragments still employed as part of the bindings of archival volumes. The lab followed these phases (which are defined following Pedaste et al. (2015). (S. Fig. 4):

4.1.1 Orientation

Upon my invitation, the students started exploring the fragments: taking them in their hands and perceiving them, each student individually. This exploration (or OBSERVATION) lasted ca. 15 minutes.

4.1.2 Conceptualization

I gave the students an *open inquiry task*. The task started with my request: "Pick up a fragment *you would like to work with* – for whatever reason." I gave them ca. 5 minutes to select 'their' fragment. Then I asked the students to focus individually on the following task (FREE SELF-QUESTIONING): "«Observe the fragment on your own and your reactions to the fragment. Does any question arise in you while observing it? If yes, write it/them down.». This observation and questioning phase lasted 20 minutes.

After this, the students had to gather into small groups of 2 to 4 persons each. In each group, a FOCUS GROUP INTERVIEW took place: each student should show 'his/her' fragment to the others, while the others should ask him/her the reasons for choosing that fragment and what observation and questions he/she had formulated about it. They also had to take notes on their interviewees' views.

The subsequent task was INQUIRY TASK SELECTION AND HYPOTHESES GENERATION: each group should select some questions out of the individual ones, and, still in group, formulate hypotheses on the selected questions.

Figure 6: Focus group interview. Photo by Alessandra Molinari.

As the question selection was over, each group should write the selected questions down, and email them to me, together with the hypotheses proposals and the photos of the fragments to which they referred.

Not all groups were done with their selection by the end of the meeting: therefore, they decided to finish the task in a group meeting at home, so to take it into the second meeting.

4.2 The second meeting

In the second meeting, I briefly gathered the hypotheses generated at home by the groups (s. taxonomy in the OR). Then the program of the second meeting started with the inquiry phase Investigation (s. Fig. 4). Besides the students, a palaeographist staff member of *Textus invisibilis* took part in the last two phases of the meeting.

4.2.1 Investigation

The students gathered into small groups. Having taken with them the questions and hypotheses they had selected at the end of the first meeting (or in its continuation at home), each group was given the task to work out several possible investigation methods for at least two of their selected questions-and-hypotheses (RAPID PROTOTYPING OF INQUIRY METHODS, 20 minutes, s. full list in the Online Repository).

After this, the students were allowed to access the archival depositories during an in-plenum visit guided by an archivist from the State Archive (VISIT OF DEPOSITIORIES WITH THE VOLUMES HOSTING THE FRAGMENTS: 30 minutes). After the visit, the students went back to their groups, where they could test their inquiry methods on the basis of the new empirical evidence provided to them by seeing the fragments *in situ*, in their factual context of use (i.e. attached to the bindings of the archival documents).

Figure 7: Students prototyping inquiry methods. Photo by Alessandra Molinari.

4.2.2 Conclusion phase

Up to this phase, each small group had designed at least two inquiry paths, each made out of: 'free questioning - selection of relevant question(s) – hypothesis formulation – inquiry method prototyping – method testing'. Now, in the Conclusion phase, each group had 10 minutes to SELECT one of their inquiry paths, to be discussed and validated in plenum. After the selection, each group in turn presented to the plenum group (students + me + palaeography colleague) their results. The other listening groups asked questions to their presenting mates, and, at the end, my colleague and I, as the 'reference scholars', helped each group to connect their findings to extant scientific knowledge. Here, we pointed at insights emerged from the students' observations and inquiry pathways which had not yet been considered by scholarship, and which surprised me as well as my colleague as unexpected (s. data, below, Sect. 5 and 6).

4.2.3 Discussion phase

In this concluding phase, we summarized what happened in the course of the lab: what this experience of creating and designing an own inquiry path had meant to them, what they would take away, and whether they would be available as test persons and/or participants and/or co-designers in a subsequent phase of the project. This phase took part as a progress: it started at the end of the lab still inside the State Archive , went on in one in-class lesson after the Lab, and was concluded during the final course examination.

5 Presentation and analysis of the data from the Lab

The present section will display and assess the data from the lab to respond to RQ1 (*how can wonder, conceived as an epistemic emotion, sustain students' interest-generated questioning?*) as well as to RQ2 (*how can students' interest-generated questioning influence the design and team composition of a university research project?*). The method to assess the data is qualitative: for each phase of the lab, we will assess *whether or not* the outputs from the students' work may be classified as 'interest-driven' or 'emotion (wonder)-generated' according to the students' or my own judgement within the framework provided by the definitions of interest, emotion, and wonder presented in the interdisciplinary Section 3 of the present paper. The subjective criterium of Judgement is a specificum of qualitative

research: it consists in recognizing a thematic, conceptual, and terminological coherence between a theoretical framework and human being's empirical behaviour. 'Empirical behaviour' refers to the actions performed and the utterances formulated by the students as experiment participants, as well as by me as the designer of the experiment and as the students' observer (on judgement as a qualitative research criterium in design, design thinking, and UX, s. Roto, Law, Vermeeren, & Hoonhout, 2011). Quantitative assessments (in the form of percent calculations) will database the students' evidence to foster transparency.

5.1 Presentation of the data

5.1.1 Data from the first meeting

For Conceptualization phase, the students were free to choose whether or not to handle over to me their notes from the individual Free-Questioning and the Focus Group interview, while I requested that they gave me access to the data from the Inquiry task selection and Hypothesis generation.

5.1.1.1 Data from the Inquiry task selection

Each of the 14 groups from the first meeting (May 4 or 14 or 16) selected and sent me a list of questions they had sorted as relevant out of the questions previously raised individually in the preceding tasks (Observation, Selection, Free Self-Questioning, Focus-Group Interview). In addition, one of these groups sent me also their hypotheses, while the other groups referred them to me orally and I took notes (the full list of questions selected by the group out of their individual questions, and the hypotheses generated, are stored in the Online Repository). The groups decided to select 194 questions out of the total sum of 227 questions they had formulated individually in the phase "Open enquiry task > FREE SELF-QUESTIONING ". In order to analyse them for RQ 1 and 2, I have databased them into two overarching categories which reflect the issues addressed by the students in their questions, and the ways they phrased them. These two overarching categories are: *general* questions and *idiographic* questions (s. Taxonomy and Group questions in the OR). Both categories are divided into subsections and their occurrence percentages displayed in the following histogram (Fig. 8).

In the general questions (42 out of 194, s. Fig. 8, col. 1.1 and 1.2,), the students address wide-scope issues on the Middle Ages, medieval textuality, and manuscript culture. These questions were divided into two subgroups: 1.1 *Manuscript construction practices* (9 questions, such as "'How was animal skin usually worked to transform it into parchment?") and 1.2 *Practices of text embodiment onto page* (33 questions, e.g. "Did punctuation exist at all?"). However, the vast majority – ca. 78 %, i.e. 152 out of 194 – are idiographic questions, i.e. questions which aim to reconstruct the individual history of each fragment as a meeting point for generations of human beings interacting with it, and with each other through it: from the inception of a parchment as a self-contained manuscript, to its fragmentation, to its arrival at the State Archive, until its use nowadays. Each aspect of the material and visual outlook of the parchments, including the scripts used in their texts as well as their text contents, is investigated in these questions in so far as it allows to reconstruct such events and the motivations and actions of the persons involved in them. I have divided the 152 idiographic questions into 5 subgroups: 2.1 *Material and visual outlook of the manuscripts* (23 questions, such as: "Why has the linen thread been stitched along the top and the bottom [of the leaf] instead of along the left margin? Was this not a book?"); 2.2 *Use, functions, and perceived value of the manuscripts* (56 questions, e.g. "'Were the manuscripts [we had in our hands] used for some period as the spines of the [archival] books? We have noticed folds, and [signature] notes which remind those of archive storing.", or "'How can we infer whether one manuscript was held to ben more important than others / should be recognized as more important than others?"); 2.3 *Users' traces on the writing surface* (37 questions, e.g. "What do the notes on the margin [of this fragment] stand for? Do they date back to the time when the document was written, or were they added later?"); 2.4 *Handwriting as a skill and experience* (14 questions, e.g. "How could they write such tiny characters [as we see in these two fragments] by hand?"); 2.5 *Text contents* (22 questions, e.g. "What text is this? Is it a song? If it is, can we identify the object/topic of the song?"). The division into General and Idiographic questions was based on the inquiries as they were formulated in the Italian language by the students (in the present discussion, they are rendered in English). Some of the questions are
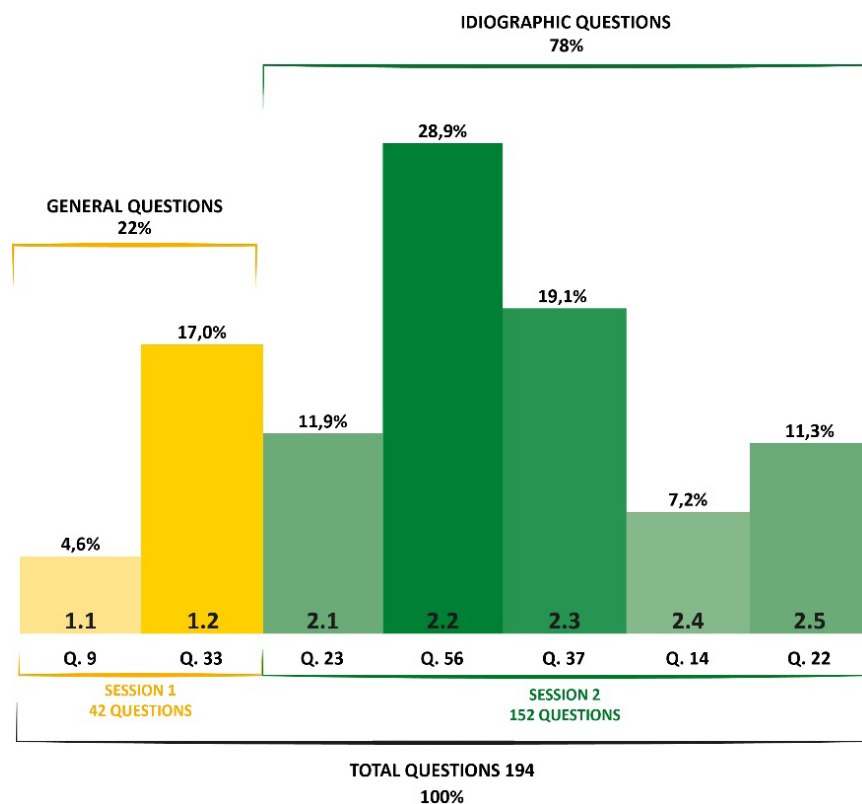
Figure 8: General and Idiographic questions. The percentages are rounded ≥ 0,5. The complete list of questions for each section 1.1, 1.2, 2.1 etc., is contained in the Taxonomy, Online Repository.

multiple-phrased: the students formulate their inquiry by rephrasing their issue so to better focus. For example, in Sect. 2.3, entry no. 25 of the Taxonomy ("'Why are there some letters (A AS P A A I) which are written randomly on the left margin on the first page [i.e. fragment]? What do they mean?", s. list in Online Repository) is listed in the Taxonomy as *one* question, i.e. it is left in the form that it was emailed to me by the students, even though formally it consists of two. The students viewed it clearly as *one* self-contained enquiry and their perspective had to be respected. However, in order to assess RQ1 and 2 it was necessary to split the 194 entries from the Group question taxonomy (Fig. 8) into basic, single-phrased questions (for example, entry 25 quoted above consists actually of two questions). A total sum of 219 single-phrased questions resulted out of the 194 entries from the Taxonomy in the Online Repository. These 219 simple questions were then analysed in view of their assessment for RQ1 and 2. This analyis procedure was based on two basic principles of text linguistics (s. e.g. de Beaugrande & Dressler, 1981): *cohesion* and *coherence*. Cohesion pertains to the analysis of a text on the sentence surface level; coherence to the analysis of the deeper, syntactical and logical-semantic relations underlying a one-sentenced or multiple-sentenced text. From the cohesion perspective, I split the single-phrased questions into the categories of WHAT-, WHO-, HOW-, WHY-, WHERE-, WHEN-, HOW OLD/LONG/MANY-, and IF-/WHETHER-questions (Fig. 9).

I then zoomed into *coherence*. This analysis was carried out on the levels of *text* (i.e the single-phrased question), *linguistic co-text* (i.e. the single-phrased question as embedded within the students' inquiry utterance), and *situational context* (i.e. the students' behaviour while formulating the inquiry, according to my perceptions in my role as observer and designer). The procedure is exemplified for one inquiry in Fig. 10.

The coherence-cohesion analysis has produced evidence for 10 coherence categories underneath the phrasing surface: *Mode*, *Cause*, *Aim*, *Meaning*, *Content*, *Agent*, *Origin*, *Time*, *Space*, and *Quantity*. The percentage rates for each categories are presented in the following histogram (Fig. 11).

As results from the examples in Fig. 10 and Fig. 12, multiple coherence categories may underlie a single cohesion category, depending on the reference to the extra-linguistic object (i.e., the parchment fragment etc.) observed.
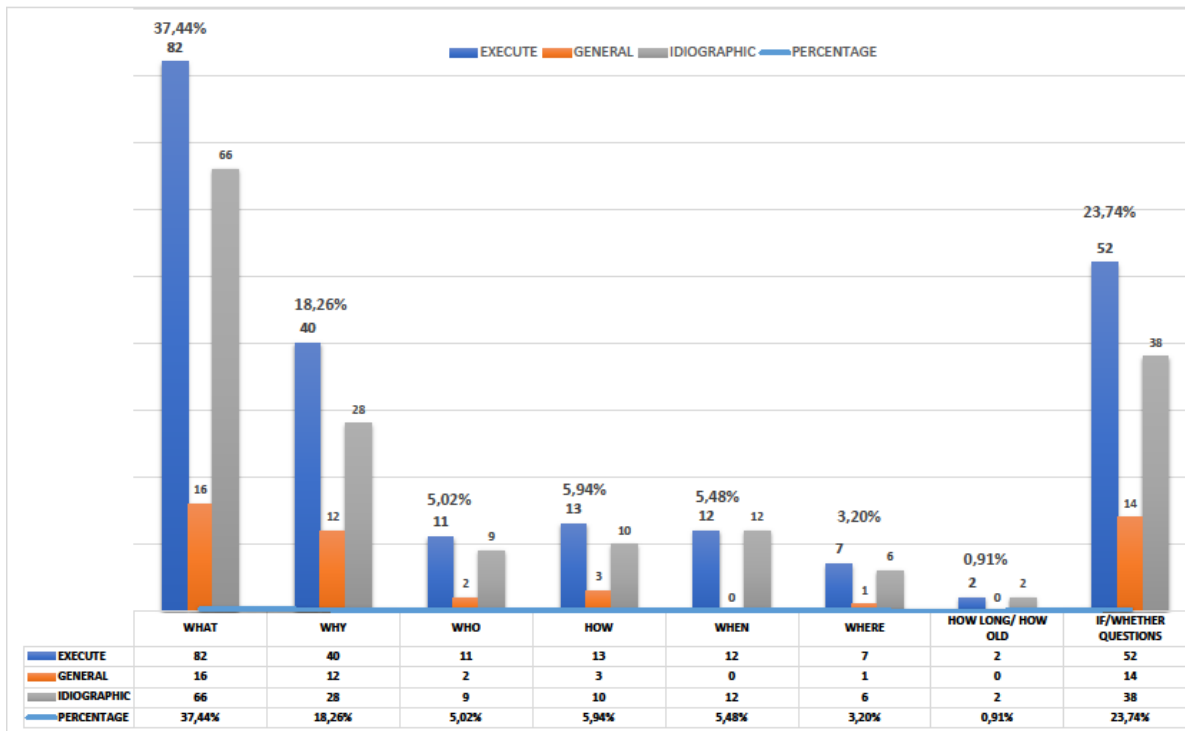
	WHAT	WHY	WHO	HOW	WHEN	WHERE	HOW LONG/ HOW OLD	IF/WHETHER QUESTIONS
EXECUTE	82	40	11	13	12	7	2	52
GENERAL	16	12	2	3	0	1	0	14
IDIOGRAPHIC	66	28	9	10	12	6	2	38
PERCENTAGE	37,44%	18,26%	5,02%	5,94%	5,48%	3,20%	0,91%	23,74%

Figure 9: Wh-, How- and If/whether- single-phrased questions. In percentages.

Students' inquiry utterance	(31 G.) *Dove inizia e dove finisce il paragrafo? Da cosa si può intuire?* 'Where does a paragraph begin and end? What can one infer this from?'	
Single phrase questions	***Dove** inizia e **dove** finisce il paragrafo?* '**Where** does a paragraph [usually] begin and **where** does it end?'	*Da **cosa** si può intuire?* '**What** can one detect this from?'
Cohesion analysis of the text	Two WHERE-questions	One WHAT-question
Coherence analiyis of text and co-text	Coherence category: • Space	Coherence category: • Mode • Meaning • Cause • Space (linking the WHERE-questions and the WHAT-questions together)
Relationship to situational context	The students raised this issue already in the Orientation phase. While taking the folios in their hands, they had exclamations such as «OmG, how could they READ this?!? I see neither beginning nor end!» «Text layout looks totally different from ours!» «I see no full stop, no commas. No new line. No spacing.» «I'm feeling quite stupid right now.»	

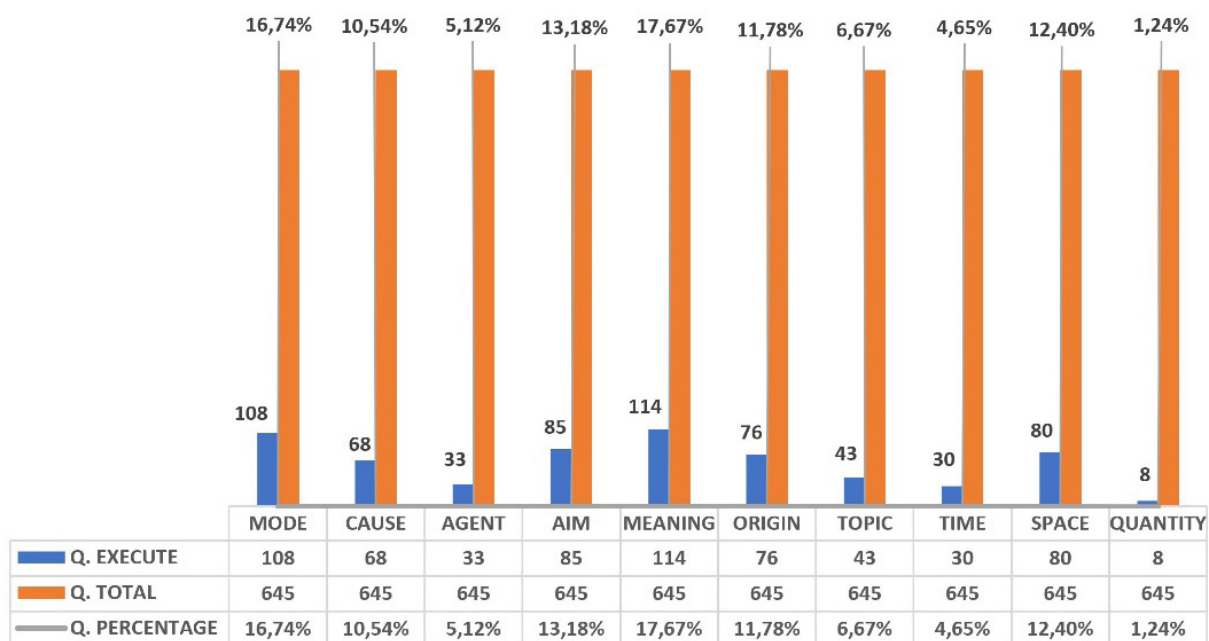**Figure 10:** Cohesion and coherence analysis of General question no.31 from the Taxonomy.

Figure 11: Coherence categories underlying the single-phrased questions.

	MODE	CAUSE	AGENT	AIM	MEANING	ORIGIN	TOPIC	TIME	SPACE	QUANTITY
Q. EXECUTE	108	68	33	85	114	76	43	30	80	8
Q. TOTAL	645	645	645	645	645	645	645	645	645	645
Q. PERCENTAGE	16,74%	10,54%	5,12%	13,18%	17,67%	11,78%	6,67%	4,65%	12,40%	1,24%

5.1.1.2 Data from the Hypotheses generation and Inquiry task selection

The task "Generate hypotheses for at least two of your group questions" produced a total of 84 outcomes, i.e. an average of 6 hypotheses by each of the 14 lab groups (i.e. well over the task to produce at least two per group). The percentages of the questions developed into hypotheses as well as two example entries are in Fig. 13.

5.1.2 Data from the second meeting

5.1.2.1 Data from the Investigation phase

The second meeting (18 May, 24 May, or 19 June) began with the task of RAPID PROTOTYPING OF INQUIRY METHODS for the students' hypotheses. The groups were left free to choose how many hypotheses they wanted to select for this task. They were also free to decide how to deliver their data (through a written, oral, or audio/video medium). Each group prototyped methods for one of their hypotheses. Only one group delivered their prototype data in a written form. The others described them orally (and I took notes) and shew some self-producted video (and I took notes). The full prototype list is stored in the Online Repository. In Fig. 14 is one random example.

As results from the prototype list (s. Online Repository), the most frequent inquiry method prototyped by the students is inductive analogy: "Compare this script with that of the other fragments observed"; "Compare this fold with the folds we saw on the other fragments"; "Compare these initials with any we might find on the internet"; etc.

A plenum VISIT OF THE DEPOSITORIES followed. In those rooms, the students could see the parchment fragment in situ: their re-use as book binding and storing envelopes on the archive depository shelves. The students could become aware of the different bookbinding modes, and the various places the fragments were employed within the bookbinding structures. They could freely ask questions to the Archive personnel. Besides fragment-related issues, the students gradually focussed more and more on the archival books themselves: on their contents, on the institutions which produced them, on the relationship between the bookbinding techniques and those institutions (for example, whether the bookbinders for the volumes of the archival guild would prefer some bookbinding techniques to others), on the sense and tasks of the State Archive, and, consequently, on the history of Urbino and its inhabitants. They asked to see all depository sections – not only those with the books and registers with the fragments in their bindings. Since

EXAMPLES (questions no. 26 Sect. 1.2, no. 1 Sect. 2.2, and no. 1 Sect. 2.4, Taxonomy, OR)

'Why are some initials bigger than others?' (WHY)

- **Cause** (What determined the scribe's decision to write the initials in different sizes?)
- **Aim** (What aimed the scribe at by using different sizes? [if it wasn't random?])
- **Meaning** (What do the different sizes stand for/denote/signify/mean/imply/express?)
- **Mode** (initials were normally written in a different script type and size [= mode] than the main text script)
- **Space** («bigger» is a space datum)

'Were these manuscripts used for some period as the spines of the archive books [or not]? We have noticed folds, and [signature] notes which remind those of archive storing.' (IF/WHETHER)

- **Agent** (did someone recycle these manuscripts?)
- **Aim** (were they re-functionalized for bookbinding?)
- **Mode** (were they employed in some bookbinding procedure?)
- **Time** (did the practice last «for some period» or did it take place only once/sporadically?)

'How could they write such tiny characters [as we see in these two fragments] by hand?' (HOW)

- **Agent** (the inquiry focuses on the agent's [scribe's] writing skills)
- **Space** (the size of the scripts and the agent's exployment of the writing space on the page are addressed)
- **Mode** (which instruments, gestures, procedures, and skills were employed to carry out such tiny script?)

Figure 12: Three examples of cohesion-coherence analysis.

1. General questions (tot. 42)	Tot. 9 Hypotheses (= 21,4% of the General questions)
1.1 (tot. 9 questions)	Tot. 2 hypotheses (= 22,2% of the 9 questions)
1.2 (tot. 33 questions)	Tot. 7 hypotheses (= 21,2% of the 33 questions)
One example (entry 1, sect. 1.1. of the Taxonomy, with indication of cohesion and coherence)	*Qual è il significato delle diverse grandezze delle pergamene?* 'What do the differing sizes of the parchment [sheets / leaves] mean?' (Cohesion: WHAT / Coherence: Cause – Meaning – Aim – Space) *Forse dipende dalla grandezza dell'animale usato, ma anche dal tipo di documento che si voleva produrre (un libretto portatile o un atto ufficiale hanno diverse grandezze).* 'Maybe it depends on the size of the animal used, or on the type of document they wanted to make (a portable booklet and an official deed have different sizes).'
2. Idiographic questions (tot. 152)	Tot. 75 Hypotheses (= 49,3% of the Idiographic questions)
2.1 (tot. 23 questions)	Tot. 8 hypotheses (= 34,8% of the 23 questions)
2.2 (tot. 56 questions)	Tot. 28 hypotheses (= 50% of the 56 questions)
2.3 (tot. 37 questions)	Tot. 20 hypotheses (= 54,1% of the 27 questions)
2.4 (tot. 14 questions)	Tot. 8 hypotheses (= 57,1% of the 14 questions)
2.5 (tot. 22 questions)	Tot. 11 hypotheses (= 50% of the 22 questions)
One example (entry 4, sect. 2.2 of the Taxonomy, with indication of cohesion and coherence	*Perché diversi manoscritti sono stati incollati su di un cartoncino?* 'Why have numerous manuscripts been glued to a cardboard surface?' (cohesion: WHY / coherence: Cause – Function – Mode – Meaning – Place) *I ragazzi di un altro gruppo ci dicono che da loro alcuni frammenti hanno delle piegature che seguono esattamente la forma di un'intera copertina di un libro, per cui forse anche i nostri frammenti, quelli incollati al cartone, avranno avuto quell'impiego, in qualche momento del passato.* 'The guys from another group are telling us that some of 'their' fragments are folded to look exactly like a book cover. Thus, maybe also our fragments, those with the cardboard glued on one side, were indeed used as covers, at some time in the past.'
Tot. questions: 42 + 152 = 194	Tot. Hypotheses = 84 (= 43,3% of the tot. 194 questions)

Figure 13: Percentages of hypotheses generated from the General and the Idiographic questions. For the full list of the hypotheses, s. Online Repository Taxonomy.

Group question 3, Sect. 2.5 (idiographic): **E' scritto in latino?** **'Is this [manuscript/text] written in Latin?'** Cohesion category: IF/WHETHER-question Coherence categories: Content – Meaning – Code	

Group hypothesis:
Si, sembrerebbe latino (scrittura Carolina)
'Yes, it looks like Latin (Carolingian script)'

Investigation methods prototyped by the group:
- Studying palaeography (from teacher, reference works, university courses, ppt, video tutorials on youtube...), and then compare the script in our fragment with the ones described in the palaeography reference works etc.
- Ask an expert (the teacher or other specialists)
- google search for photos of scripts similar to this, and search for explanations for the script in the photos found in the internet (on their website)
- Try to read: transcribe and detect the text in our fragment. Two of us in our group can good Latin. If they recognize most words as Latin, then language of the text itself is Latin
- Google search for the transcribed texts (digit some extracts from our fragment text and search for information on them in the internet

Figure 14: Investigation method prototype for group question 3, Sect. 2.5.

the visit took this unexpected turn and I wanted to fully perceive the discovery process going on, I did not take any quantifiable notes.

Back in the reading room, the groups gathered to TEST their method prototypes and REDEFINE their inquiries on the basis of the insights from the visit and further group discussion. The full list of the test outcomes is in the Online Repository. Fig. 15 contains two examples.

5.1.2.2 Data from the Conclusion and Discussion phases

The Conclusion phase began by transferring the testing activities from the groups into plenum. A palaeographist member of Textus invisibilis joined us. The aim of this plenum discussion was to validate their insights (= theses and new emerging questions) by connecting them to current scholarship. For time reasons, the students selected with us 3 out of the 14 group inquiry issue they were testing. One was picked up from the many questions on parchment recycling (*What is the function of these leather strings [i.e. these strings which are bound to these fragments]?* Q 8 idiographic, Sect. 2.2., see Online Repository, "Recap"). Another one is the one presented in Fig. 14 (*Is this [manuscript/text] written in Latin?*). During the plenum validation of their thesis (*The script is Carolingian and we could read some Latin words, therefore it is Latin*), the students became aware that they tend to confuse, even in the normal in-class lessons, between the notion of 'language' and that of 'script'. As they discovered during an internet image search in the TEST phase, a so-called *Latin script* such as the Carolingian might be also used to write non-Latin texts such as Old High German etc. (therefore, the script in itself is no substantial argument for the thesis that the text is in Latin). They asked us for validation for this internet information. My palaeographer colleague and I confirmed this and gave them concrete examples of Medieval vernacular texts copied down with a (late) Carolingian script. Contextually, I pointed to all the moments where students, during the course, had been confusing their visual with their aural perception of language, and proposed them to think about the possible reasons for this after the lab. The third case was discussed in plenum upon my own proposal. It is idiographic Q 2, Sect. 2.4 of the Taxonomy in the Online Repository (s. Fig. 15): *How could they write such tiny characters by hand and so squeezed against one another, in the fragments making up the manuscript in folder no. 44?* I told them that I was surprised that so few students – one group – had chosen to investigate this,

Group question 2, Sect. 1.1 (general) **_Quale parte specifica dell'animale veniva utilizzata per creare le pergamene?_ 'Which specific part of the animal body was used to make the parchment [sheets]?'** (cohesion: WHAT Coherence: mode –origin – space)
Group hypothesis: **_Forse il torace o la pancia. Abbiamo visto dei bifogli molto grandi._ 'Possibly the chest or the belly. We have seen some very large bifolios [among those preserved at the State Archive].**
Investigation methods prototyped by the group: - Compare with other fragments at the State Archive: are there many large ones? If yes, take measures. - Internet search: which animals were used? Check measures for animals used for parchment. - How large could be an intact book folio? Take measures at the State Archive and search for measures for other manuscripts described on the internet. - Read in a reference book for manuscript studies - Descriptions in medieval treatises or In medieval poetry?
Group prototype test after the depository visit: - On the shelves or the notary fonds, we could find some whole parchment bifolios which were wrapped around volumes from the early 17th century. Those folios were rather large. Too large, we think, to derive from a goat. Their size suggests they might come from a calf or a cow. We searched for some information in the internet: the part used came from across the spine and chest area. None of us has never observed a goat long enough to be sure. We should measure a living exemplar and then try to figure out which animal was best suited (e.g whether a goat was big enough). However, were there some sorts of "fashion trends" or at least "regional habits" guiding the choice of the animal? And did all animal skins have the same features, or were some sorts 'better' than others? We should need more time to check this.
Group question 2, Sect. 2.4 (idiographic) **_Nel manoscritto n' 44 come hanno fatto a scrivere così piccolo e così appiccicato?_ 'How could they write such tiny characters by hand and so squeezed against one another, in the fragments making up the manuscript in folder no. 44?'** HOW – instrument, mode, manner – agent – place, space, shape)
Confrontandoli con le nostre scritture attuali, così diverse l'una dall'altra e così irregolari, non riusciamo a capire come. Noi probabilmente non ci riusciremmo. Devono avere avuto una tecnica speciale. 'If we compare these scripts with our present-day handwriting, we notice that ours are very irregular and very different in each individual. So we can't understand how the scribe in this manuscript could write like that. Probably we wouldn't manage to carry out such a script. Those scribes must have been trained in a special technique.'
Investigation methods prototyped by the group: - Search for original descriptions of the scribe's profession in medieval texts - Read scholarly literature about this - Look for miniatures in medieval manuscripts or wall paintings depicting scribes in the act of writing - Compare with our writing gestures and instruments
Group prototype test after the depository visit: - We could see that also more recent scripts (those in the archive registers from the 16° to 19° centuries) were much more accurate than ours. Even the smaller ones looked in any case clearer and neater than ours. So we started thinking that the problem lies in our present-day handwriting techniques. We asked the teacher. The teacher suggested that if we observe each other while writing and compare each other, maybe we get some helpful insight on how to carry on our inquiry.

Figure 15: Two example for testing of investigation method prototypes.

while most of them, during the EXPLORE-OBSERVE phase at the lab beginning, had reacted so emotionally to those tiny scripts ("Oh my God, how cute!" "Look at this! Here! Was it written by ants?!?" "Can we measure it? I guess the 'a' is around 1,5 millimeter!"). Some of them answered that they feared that issue was not "serious enough" or "scientific enough", or just technically impossible to be carried out, and that they thought their wonder might ultimately draw on their own critique against their own handwriting style (which one of them defined as _uno schifo_: a mixture of 'miserable', 'awkward', 'awful', 'helpless', etc). The group who brought the issue through the hypothesis generation, prototype and test phase told us that they had compared their own writing gestures with each other, they had noticed how differently they grasped the pen, hold their backs, position their arms on the desk, etc. I asked then: "Do you think this difference affects the 'beauty' and 'correctness' of the writing style?" They answered that this might be the case, and that the medieval scribes might have had a regular, codified way to hold and move the pen and the body while writing. Thus, they asked my colleague and me how they could validate this new hypothesis. We replied: "Think about it after the lab, and we will validate your new hypotheses in the course". The lab finished at this point with the perspective to carry on this question and further open questions in the in-class course.

A feedback dialogue took place for each student after their examination (s. Recap in the Online Repository). Data from the feedback will be integrated in the Discussion section.

6 Discussion

The role of evidence produced in the lab for RQ1 and RQ2 will be discussed as it pertains both to the students' wonder and to *my own* wonder. Assessing the latter was not part of the original lab design. However, since my wonder has resulted from the students' behaviour, it has become an unexpectedly substantial part of our shared experience.

6.1 Assessing RQ1: how can wonder, conceived as an epistemic emotion, sustain students' interest-generated questioning?

Let us assess evidence for students' wonder from the single-phrased questions (what, how, etc.) i.e., from the *cohesion* analysis. On a formal level, virtually all their questions express wonder: they are formulated in an [*I wonder*] *what/why/how/ if-* etc. mode, which corresponds to the indication given by our reference literature (in Sect 3.4 above) to detect linguistic hints for the epistemic emotion of wonder on the sentence surface. Of the categories of the single-phrased questions given above (Fig. 9), *What-* questions are most frequent. This is not informative, as *Cosa...?* ('What...?') with its correlates *Per cosa? Con cosa? Su cosa?* etc. ('For/through what?' 'With/through what?' 'On/about what?' etc.) is the most flexible interrogative pronoun in Italian; the informativeness of that category will have to be assessed on the underlying level of coherence, where the semantic-logical information expressed through *Cosa...?* will provide us some useful insights for RQ1. On the cohesion level, the category most diagnostic of epistemic wonder is that of the *If/Whether-*questions. It is most diagnostic because a question that is formulated as *[I wonder] If/whether...* is in itself already a hypothesis: it reveals that the speaker has perceived a phenomenon which has ignited their wonder, he/she has already started speculating in different directions, and he/she has come to a possible explanation, which they formulate as: "I wonder if...". A question is formulated as *If/whether-* when wonder has triggered an inquiry which is already well in process. For example, the idiographic question no. 1, Sect. 2.3 (Taxonomy, Online Repository): *Might the writings on the side [of the main text] be some kind of notes?* implies that the following knowledge searching steps have already occurred in the speaker's mind:

– *We have seen some writings here on the fragment margin.* => *What are they?* => (Hypotheses generation:) *Maybe they are random scribbles, or pen trials, or notes* => (Hypothesis selection:) *Which hypothesis is more plausible?* => (Presentation of the selection outcome for validation:) *Might the writings on the side of the main text be some kind of notes?*

As we see, an *If/Whether-*question always implies at least *one* preceding unexpressed question. The knowledge triggering function of wonder proposed by Candiotto 2019 is here fully at work, which validates the role of *If/Whether-* questions for RQ1. Remarkably, the *If/whether-*category alone makes up a good 23,74% of the simple-phrased questions (s. Fig. 9). This means that leaving the students free to choose their objects of interest awoke their wonder so strongly that they were well engaged in their investigation already in the first phases of the lab. This is also confirmed by the average number of hypotheses generated by each group at the end of the Inquiry task selection: 6 pro group, well over the 2 requested by the task. Let us now assess the nexus between interest and wonder on the level of *coherence*, as well as the nature of the issues investigated by the students. As a premise, we should keep in mind that most of our students enroll in our degree course in order to become language and literature teachers in middle and high schools. Given this premise, it is remarkable that almost none of them explored the manuscripts in search for 'canonical works' from European cultures, i.e. those very works they are supposed to love and promote among 'their' students in their future profession. In *no* phase did one ever ask: "Are there any works by famous authors here among our fragments?" If they had, they would have found many, since the State Archive fragments witness, among others, Dante Alighieri, Thomas Aquinas, Augustine, the chivalry work *Mort Artu*... This coheres with the low percentage rate of the Agent-category among the students' inquiries (Fig. 11) only 5,12 % of all coherence entries address this category, and among these 33 Agent

entries, only 4 entries (= 0,62% of all coherence entries) ask about the texts' authors. And only 6,67% of the entries address questions related to specific topics (such as 'theology', 'poetry', etc.) (S. Fig. 11 and "Coherence list", Online Repository) or specific historical dates (only a part of the Time entries, which themselves make up a meager 4,65%). On the coherence level, substantial evidence for the students' wonder is precisely the fact that they asked very few questions to validate what they already knew from previous courses, or to consolidate the standard contents of their degree curriculum, such as language, text contents, historical events, by making connections between their insights in the lab and the knowledge acquired, say, in their Medieval history courses. Original medieval and early modern manuscripts – such as those the lab students had in their hands - are primary sources for the issues faced in our degree courses: since the students were left free to investigate in the directions they wanted, they would have asked those sorts of questions, if they had wanted. To the contrary, almost all of their inquiries address *the unknown*: phenomena new to them. This fully confirms the philosophical and psychological findings from Section 3. Triggered by wonder, we are 'magically' drawn to the new, to the unknown, precisely because the unknown phenomena around us – which our senses cannot ignore – generate a curious mixture of admiration, excitement, and unease inside us. And we want to put an end to that unease so to feel confident again that our world is safe. The affective-subconscious side of this epistemic emotion draws us to a new phenomenon with the precise function of generating in us that cognitive learning process which will produce the tangible knowledge data we need to calm down and feel safe and satisfied. This is why the beginning phase of wonder has something *both* irritating *and* exciting in itself: because we evoke and pre-taste the result of our enterprise already from the start. Thus, our mind organizes a strategy to win the learning challenge step by step. In the case of the lab students, this is how they proceeded. As the contents of their questions show (s. Taxonomy, Online Repository), the students' approach to their inquiries was inductive and idiographic: they started by perceiving the fragments with their physical senses, and formulated questions which aimed to comprehend the world of each single fragment 'from within'. The highest coherence rates pertain to the categories of Cause (10,54%), Origin (11,78%), Space (12,40%), Aim (13,17%), Mode (16,74%), and, above all, Meaning (17,67%) (s. Fig. 11). For any of their inquiry objects – say, the notes on the margin of a text; the tear in the middle of a fragment; the interplay of red and blue initials on a page; the position of a fragment glued onto a book cover – the students try to figure out the standpoints, intentions, motivations, and concrete behaviours of those who were interacting with those manuscripts across centuries. Significantly enough, the highest rate concerns Meaning. This category underlies formulations such as *What does... mean? Was this not a ...? Is there some code to decipher this...? What can we infer this... from? How can we explain this....? Why was there this... here? What does this... stand for? Can we gain any insight on... by observing...? How can we infer/ understand whether ... was ...? What do these... represent?* All these and other formulation modes, as referred to material and textual phenomena (s. Taxonomy, Online Repository), point at the students' effort to *make sense* of what they see by 'stepping into the shoes' of all those who were interacting with fragments along their history: from their inceptions as intact manuscripts, to their recycling, until their landing into the students' hands. In one word, the students tried to understand the phenomenon 'fragment' by *empathizing* with their users.

Employing empathy to overcome the unease and distress implied by wonder, is a powerful cognitive strategy. Throughout the history of philology, empathy (codified as *Einfühlung* withing the hermeneutical soul of this discipline) has always been employed as a high, if not as the highest possible, form of knowledge. Since empathy is based on the recognition of *otherness*, its activation prevents an interpreter from the dangers of over-interpretation, that is, of projecting one's own expectations and assumptions onto reality. This quest for truthfulness at the basis of empathy provides the wonder-driven inquirer with an effective instrument for landing to conclusions which are safe or at least perceived as such. For the tasks of the second meeting (Rapid prototyping of inquiry method, Testing of inquiry methods, Plenum validation), the students basically employed the same inductive-empathic approach: comparing objects perceived as similar to each other to gain inferences which they might generalize. The visit to the parchments *in situ* allowed the students to fill the knowledge gaps, redefine their issues, and raise new questions. As the texts of the prototypes show (s. Recap, Online Repository), already the prototyping phase had been generating new questions. This happened again when connecting their findings to current scholarship (during the plenum discussion). Wonder combined with empathy is an *ongoing* knowledge trigger: it directs the inquirer's interest to new territories, not for the sake of utility – as would have been the case if they had taken the chance of the lab to consolidate their familiar fields – but for the sake of discovery. Wonder supports intrinsic motivation.

6.2 Assessing RQ2: how can students' interest-generated questioning influence the design and team composition of a university research project?

Two factors left me deeply wondering: the students' empathic approach to fragments and their 'unempathic' approach to their own handwriting. The first factor has led me to redefine the research design of *Textus invisiblisis* on a new definition of 'fragment'. The second factor has let me reconsider the role of palaeography and handwriting in present-day higher education. Both factors have made a strong case for a major involvement of students in the very design of our project.

6.2.1 A new design for *Textus invisibilis*

Originally, the guiding principle for our cataloguing work as well as for the fragment database was a view of a fragment as a 'fragmentary text'. As a result of the students' responses to the 2019 lab, an overarching perspective has been adopted in our project. Starting from fragments as *physical* objects, we have developed an integrated approach to fragments as historical objects embedded in their context of use (s. theoretical details in Molinari, Biondi, & Abate, 2019; s. also Duba & Flüeler, 2018, p. 3. S. also the approach to fragments underlying the Bergen-based initiative *Virtual manuscripts* https://fragment.uib.no/). In *Textus invisibilis*, fragmentology is conceived as 'the study of fragments', i.e. as a historical study where fragments are many-faceted phenomena, like knots tied and untied within a complex network of mutual human relationships and interactions across centuries, cultural communities, and technological revolutions. In our new approach, 'fragment philology' is just a subsection of the integrated and interdiscplinary domain of 'fragmentology'. The new guiding principle is now the 'fragment object' and the very phenomenon of fragmentation, rather than the 'text'. The students' questions have led us to undertake a thorough fragment scholarship review (s. Molinari, Biondi, & Abate, 2019). This review as well as our findings from the lab and from our fragment case-studies have produced the insight that manuscripts, *even physically and textually intact ones*, may be perceived as fragmentary by their users as a consequence of intentional or unintentional factors and events which lead to such a perception shift (s. Fig. 16 and Fig. 17; s. discussion in Molinari, Biondi, & Abate, 2019). Therefore, fragments are investigated in our project, and consequently databased, to allow the users of our database a multiple-angled investigation of each of them. On these premises, a new cataloguing template has been worked out which integrates the earlier philological criteria with new ones focussing on the fragmentation procedures, recycling modes, and the historical relationships between each fragment and its host volume (both 'old' and 'new' catalog templates for our database are stored in the Online Repository).

The new approach to fragments requires that they are made readable without being detached from their host volumes, so to avoid destroying the habitat they have been appointed when fragmented and preserve these testimonies of the practice of parchment recycling. However, fragments are often glued in multiple layers over or inside the cover and greatly differ from each other as concerns typology and conservation state. Therefore, after assessing similarities and differences, we will have to develop specific acquisition methods for each category, as the choice of imaging techniques that may reach deeper beneath the object surface. In fact, different spectral range of acquisitions affects the reading of the fragments and the processes of virtual analysis: each range allows to derive hidden information data that diverge from each other in quantity and quality (s. Salerno, Tonazzini, & Bedini, 2007). This will also enable us to acquire those fragments and scripts that are physically difficult to access (i.e. parchment fragments glued in between others in multilayered parchment binding sections; scripts facing the glued inside of covers; etc.). Digital acquisitions represent the fundamental starting point for any subsequent virtual processing. Therefore, in the first place, digital reproductions will have to fulfill the following requirements: coherence with the original dimensions of the fragment, high spacial resolution, readability in all parts of the fragment, accurate color reproduction, absence of light reflexes, perfect image overapping and alignment. In the second place, after having carefully acquired the fragments through the multispectral images, we will intervene with their analysis by applying specific image analysis algorithms (s. Tonazzini & al., 2019), so to separate overlapping texts, or to extract various types of hidden information (s. Tonazzini, Salerno, Mochi, & Bedini, 2004; Tonazzini, Bedini, & Salerno, 2004). All these data will allow us a holistic approach to fragments. All the technical features of the acquisition tools, software and algorithms used will be documented to make all operations replicable. For each fragment a graphic
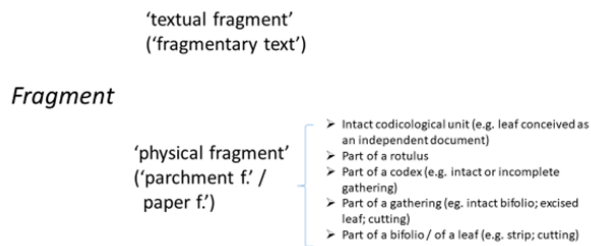
Use of the word *fragment* in *Textus invisibilis*

'textual fragment'
('fragmentary text')

Fragment

'physical fragment'
('parchment f.' /
paper f.')

➢ Intact codicological unit (e.g. leaf conceived as an independent document)
➢ Part of a rotulus
➢ Part of a codex (e.g. intact or incomplete gathering)
➢ Part of a gathering (eg. intact bifolio; excised leaf; cutting)
➢ Part of a bifolio / of a leaf (e.g. strip; cutting)

Figure 16: The understanding of 'fragment' in our research project.

Factors/Events triggering perception shift
from 'intact manuscript' to 'fragment'

Intentional factors/events

❖ **Technological revolutions:** from handwriting to print to digital
❖ **Cultural attitudes and practices:** new liturgical rites; censure; antiquarian practice; etc.

Non-intentional factors/events

❖ **Natural catastrophes:** fire; flood; etc.)
❖ **Accidental damages:** ink plotting; copying mistakes; material damage
❖ **Linguistic change:** => text no longer understandable

➡ **Perception shift mostly leads to change of use** (e.g. to parchment recycling for manufacturing activities, to black antiquarian market for social status aims), **however, not in all cases.**

Figure 17: Perception shift as the foundational element of fragmentariness.

elaboration will also be created that will serve as the main instrument of communication and synthesis of the data obtained as well as of the interventions carried out (s. Amura & Baratin, 2019; Amura, Tonazzini, Salerno, Pagnotta, & Palleschi, 2019). Thirdly, we will carry out interventions of reintegration, restoration and virtual reconstruction which aim to flatten down creases on the parchment surfaces,   merge together margins of cognate fragments (*membra disiecta*) in codex reconstructing procedures, or fill material gaps through inpainting (s. Amura, Landi, Pisani, Soro, Pagnotta, Zantedeschi, 2020, in press; Tonazzini, Savino, Salerno, Hanif, & Debole, 2019), for instance in cases of holes caused by animal parasites or through book-binding interventions. The listed interventions are the fundamental premise for content analysis, i.e. automatic analysis of the writings (s. Tonazzini, Savino, Salerno, Hanif, & Debole, 2019), as they make the fragment clearly readable to the machine. In fact, in the last phase, artificial intelligence techniques of deep-learning for Optical Charachter Recognition, Intelligent Character Recognition, text mining and textual statistics will be used. These techniques will contribute to re-join together scattered cognate fragments by recognizing their textual affinity, and to reconstruct lost textual *lacunae* in the case of material holes for which no corresponding 'filler' is extant, neither in the form of a smaller physical fragment corresponding to that hole, nor in the form of corresponding passages in the textual tradition of that work as witnessed in other manuscript copies to compare with. These issues are all affecting *Textus invisibilis* long-term. Here, we intend to involve students from informatics and the humanities working jointly in these areas.

6.2.2 New tasks for palaeography in the native digitals' era

As mentioned in Sect. 5.1.2.2, in the first lab meeting the students were handing around the plenum two cognate fragments (*membra disiecta*) containing a very tiny, regular, and neat Gothic minuscule of ca. 1,5-2 mm, while expressing great surprise and admirarion with gestures, gazes, and verbal exclamations. They were amazed by the beauty and regularity

of the script, and by the scribe's ability ("How could they write THAT neatly?!?"). So, I expected that nearly all the groups would chose these two fragments and this inquiry to generate their hypotheses and their method prototypes and test them. To my greatest surprise, only one group did (s. Fig. 15). Thus, in the second meeting I allowed myself to intervene into the last phase the process by my asking the students about their feedback on their perceptions of those fragments. The students' behaviour and feedback provide evidence that, first, they are interested in ancient scripts as concerns the functional strategies undertaken by the scribes to write a text effectively and 'beautifully' rather than for the conventional role of palaeography in philology (such as dating a document through the age of its script; placing the witness within a stemma; etc.). They want to know what a scribe aims to achieve when he/she alternates script shapes or sizes in the same text; or why it was so topical to handwrite so neatly in the Middle Ages (a question they asked me after the lab). Second, their behaviour and questioning provide evidence that our present-day students have no idea about the functions of handwriting nowadays. They simply have never wondered about this. And most of them disdain their own handwriting style. They left their amazement for that tiny script's beauty unanswered also because, as they told me, comparison with their own handwriting was too desolating. These digital natives have almost completely given up handwriting. The finding here is that when unease is too great, inquiring is avoided to prevent one from discouragement. However, since emotional involvement, whatsoever the sort – be it wonder or disgust – is *always* a hint for interest (otherwise the object would leave us untouched), the students' behaviour towards those two fragments suggested to me that they do want to learn something about handwriting, about the specific advantages of this skill over keyboard writing, and about the connections between modern and ancient scripts. The educator's task is to trace out together with the learner a step-by-step path to disclose knowledge from a feared object. Thus, this experience with the two fragments has led to a new, transformative design lab within *Textus invisibilis* (designed for my students by a University of Oslo researcher in the current academic term) where the participants are reflecting on the specific roles of handwriting in their lives and how they may transform palaeography skills and handwriting practice into a resource for their personal development. Two participants of this new lab are being contextually employed in compiling the palaeographic areas in the catalog cards of two fragments for the *Textus invisibilis* database.

7 Conclusions

The present study was built on the tenet that understanding, learning, and creating knowledge are processes that can be designed. When the investigated objects are complex, as in the case of human phenomena, a framework is needed that may enable an interdisciplinary approach to them. In this paper, design thinking as a research design approach capable of building bridges between disciplinary siloes has provided the backbone for building a theoretical framework within which insights from palaeography, philological hermeneutics, value theory, philosophy, psychology, UX, and learning sciences, were combined in a way that has granted a contextual-idiographic application of the framework to the investigation of concrete phenomena (the medieval parchment fragments) by young inquirers in their real life environment. In this case-study, seeing our research objects (i.e. the parchment fragments) with the students' eyes has provided me with unexpected insights. I had expected that these future literature teachers and literature translators and editors (i.e. the intended professional outcomes of our degree programs) would approach the fragments as textual witnesses to their beloved literature and philosophy works. Which, to my greatest wonder, they did not. This has led me to thoroughly revisit two fundamentals of our fragmentology project. First, in the students' eyes, the fragments, far from being mere witnesses of fragmentary texts, are acknowledged as multifaceted historical objects which have gone through changes in value, meaning, and aim, according to their users' multifaceted perceptions. As a consequence, we have worked out a holistic definition of fragment, and we will apply diagnostics and restoration methods to recover the texts on the fragments without detaching them from their present sites. Second, digital natives' lacking confidence with their own handwriting points to a new educational task for palaeography: that of helping our students detect that 'golden thread' (Clayton, 2013) linking the ancient scripts with the students' handwriting, so to make the younger generation aware in tangible ways (e.g through handwriting labs) of the specific cognitive and emotional skills they develop when their bodies learn how to trace those millenary signs on a blank sheet. The results of this case-study also shed new light on the nature of knowledge creation. The tenet that the process of creating knowledge can be designed implies a view of design as a process that cannot be totally controlled,

as it involves emotions with their non-conscious component. The present study provides a case of how surprise, astonishment, i.e., wonder plays a pivotal role in creation, innovation, and substantial problem-solving, for the precise reason that an emotion is unpredictable, and is therefore innovative and transformative *per definitionem*. In this case-study, a concrete way is proposed for how to integrate this precious unpredictability component into apparently structured and 'rational' enterprises, such as a research project or a higher educational program. On these premises, the role of students in creating new knowledge is investigated: how they can create new knowledge to their own benefit and to the benefit of research. Students are best supported in their own knowledge advancement when educational settings are created that valorize students' intrinsic value-giving criteria and interests. Accordingly, on the basis of the interdisciplinary framework, the palaeography lab was conceived so to let the students free to design their own experience with medieval and early modern manuscript fragments according to their own interests and motivations. As the research question was focused on the epistemic emotion of wonder, I did not know myself which direction the learning process would take in the lab and what kind of inquiry pathways would emerge among the participants. The results confirm the thesis at the basis of this paper that the learning process is most effective when it is driven by intrinsic interest, value, and motivation. It also confirms the thesis that students should be actively involved in scholarly research – in case, palaeography and manuscript studies – *precisely because they are not scholars*: their perception of a research object (in this case, fragments) is not yet pre-conditioned and pre-formed by the assumptions and pre-judices which often dominate scholarly discourse, thus impairing knowledge (s. discussion of fragment scholarship in Molinari, Biondi, & Abate, 2019). Two limitations emerge from this study. First, the laboratory was too short, so the phases in the second meeting could not display their full potential. To compensate for this, further labs are taking place in the current term to pick up the thread again. Half of the students from last lerm re-enroled so to participate. The second limitation pertains to the structure of the Italian higher education system. Its curricula are mostly organized in a way that supports vertical, monologue teaching and scoring. It is difficult to integrate such a lab into the course structure requested in most cases within the Italian higher education system.

Such an issue invites reflection on the role of educators. An educator is *not*, despite what recent EHEA policies seem to claim, a 'service provider'. *Neither* is he/she a guru whose 'Word' may never be questioned by students, as can still be sadly detected, though sporadically, in some Italian learning environments. An educator is someone who *educates*, i.e. someone who undertakes with us a journey out of our comfort zone into the feared, the unknown, the new: into life.

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