TO COPY, TO IMPRESS, TO DISTRIBUTE: THE START OF EUROPEAN PRINTING

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HOW TO CITE

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_Abstract

In order to distribute our thoughts and feelings, we must make intelligible and distributable copies of them. From approximately 1375 to 1450, certain Europeans started fully mechanized replication of texts and images, based on predecessor "smaller" technologies. What they started became the most powerful means for the distribution, storage, and retrieval of knowledge in history, up until the invention of digital means. We have scant information about the initiation of print technologies in the period up to Gutenberg, and the picture of Gutenberg that we have has become a great deal more complicated than hitherto. There has not been, however, an approach to the "pre-printing" period in terms of the history of idea or intellectual history. After a brief survey of established approaches, this essay argues that distribution by impression, or print, is bound up with ancient metaphors for understanding communication by the making of multiples. I suggest that there is a rich field of study for printing history in the sophisticated concepts of reality that medieval and late Scholastic philosophy developed. These concepts helped to express and develop a desire or need for communication that led to the technology of replicating texts and images for wide and continued distribution.

1_From October 1454 to April 1455

It was in October of 1454 that a man dispatched from Mainz to Frankfurt collected several wooden barrels full of books, shipped down the Main River. He distributed his books first by showing them to buyers and then by offering them for sale at the annual manuscripts market that had flourished for at least two centuries.[1] His books were the Bible that Johannes Gutenberg (born Henk Gensfleisch) spent four or five years copying onto paper by mechanical means. So many orders for copies were taken before the fair that a witness reported in March of 1455 that most copies were sold.[2] Gutenberg's 42-line Bible announced that act of copying on which the distribution of text and images, of ideas and vision, the substance of all graphic communication, had been mechanized. He had replicated text with ink impressions made on a re-conceived winepress from metal type created by a process we do not yet fully understand. Its technology was more or less mysterious to the browsing buyers at the fair as well, although we wonder what some of them might have learned by asking the bookseller.

We cannot do this, nor did Gutenberg or his associates leave us any account. Each advance in our instruments of empirical analysis adds to our uncertainty, leaving us with a puzzling menagerie of possible early methods for making letterforms, such as cuneiform, sand-cast, two-line stereotypes, and mixes of these techniques, as well as

the casting from a brass punch-cut matrix traditionally ascribed to Gutenberg.[3] At some point, perhaps within a decade, one of his successors who was very proximate to the Mainz workshop invented the hand-mold.[4] Out of this compact and rudimentary invention poured the billions of pieces of type that filled the world with printed matter until Otto Mergenthaler's linotype machine appeared in 1884. The one characteristic all products of crafts of casting and impressing shared was that they could be re-distributed from one text for use in another text, from one job to the next. Their re-distributable character is precisely what enabled the distribution of mechanically produced text.[5]

Distribution of our expressions of facts, thoughts, and emotions necessarily requires copying. Transmissions re-copied become distribution, in the sense of the word addressed in this essay, and thus knowledge grows upon itself by copy: where copies are few, it is scarcer; more copies are required if it is to grow into abundance. Yet scarcity itself was the condition of knowledge in Western societies before printing. In April 1455 the growth of various traditional crafts of copying by incision and impression into the technology of replication by impression turned scarcity into abundance and chance into implacable development. Gutenberg and his colleagues, including the bookseller in Frankfurt, had set industrial logic to work on the problems of representation, of truth, of the relations between creator and creators and their creations, and of the force by which humankind and nature speak, write, think, and act. Printing channeled the free range of representation into more rationalized forms, as when light in the wild is captured and organized by columnar lenses. The growth of distribution networks and the growth of the manufacture of material to be distributed depend upon one another in any field of commerce or social exchange. The increase of knowledge always depends in part on augmenting the power of the means of replicating the material records of the information and wisdom that we have gained, and need to distribute to other persons, groups, and generations.

The change specific to assembling more powerful processes for replication of text and image by impression altered the practices, and therefore the nature, of representation itself in the West. Although all these processes, including woodcuts and metal-engraving for impressing images — based on older techniques for such media as leather and brass — had been employed within the half-century or so prior to Gutenberg's first projects around 1439–1448, they came to be at the core of the dissemination of representations in Western culture from the time of their deployment through letterpress

printing. As the practice of these replicating techniques neared this moment in 1455, after about twenty years' efforts by Gutenberg and perhaps unknown others to set up a drive-chain of materials and forces for reproducing written words, representation became more and more centered around mechanization; and thus the concepts behind representation veered closer and closer to and overlapped with the concepts behind replication. The work of Gutenberg and his contemporaries was the point of their substantial merger after they had narrowed and deepened their convergences over the course of the preceding decades or century.[6] In this frame we can begin to look at the conceptual forces that, in alliance with technology and society, composed this gradual development. What can we learn about the desire for print, behind or alongside social and economic needs, that emerged in this period?

The deeper issue here concerns how our communicating with one another both joins and divides us from one another and from the real and ideal, physical and social worlds we must call home. Two of the easy but bad answers are techno-determinism, which elides the historical acts of persons as moral agents and therefore the need for moral responsibility, and theories of distributed agency (such as actor-network theory, object-oriented ontology, and panpsychism), which, although strongly diverging from one another, obscure the existential-historical situation behind the problems.[7] A better theoretical approach to the aporias of communication is to study what the deeper and longer history of ideas that led to the start of mechanical replication because those ideas reveal the drives behind communication by distribution.

To advance the historical problem from its traditional limits toward the many theoretical questions it can raise, we seek in particular to find concepts from late Scholastic philosophy that helped to ignite the events of the 1450s in the Rhine Valley (and elsewhere to a lesser extent) in order to see the continuity of the forces previously at work in conspectus with the long unfolding of their effects. These concepts help link the start of printing and engraving to ancient and profound notions, sometimes religious, sometimes magical, sometimes philosophical, about how we access divinity, truth, and goodness. For us now, as well, we can see in the history of ideas before print an especially bright reflection of the beginning of a new great period, with its benefits and losses, in the history of communication, such as we are now in, right in the moment of the legible start of its predecessor period, that of the mechanical multiplication and distribution of

text and images. It is here that we grasp the many threads of the past drawn up together in front of what is changing.

2_When Facts are Scarce

Yet it is just here that historical and theoretical study have both stopped their joint and separate researches. Although many approaches have circled around this issue, they have all left it as a gap. We can see this by an overview of scholarship in early printing and concerning Gutenberg; in the related fields within the histories of communication, science and technology; and in the broad area of social and economic history of the period. Within book history itself, today greater and more interesting than ever before, we find that the history of philosophical concepts that helped to shape the start of print technology in Europe has not been adequately studied. Scholars have not yet looked to the history of ideas in approaching the pre-history of print; and this has left a large untraveled territory behind what many scholars consider, due to the improbability of new discovery of early typographic fragments, to be the "closed end" of the field prior to the middle third of the fifteenth century.

Along with their many successes, the various approaches by book and communications historians to the study of early printing pass over the ways in which the history of those ideas informed the pre-printing period.[8] For the most part, these historians say very little about Gutenberg's work, moving quickly on to his successors. Work on Gutenberg is generally deeply invested in reconstructing his commercial and technological career, warning us that we have no evidence that Gutenberg was aware of early image multiplication, much less of related "ideas."[9] We now know that we must regard Gutenbergian craft in light of the prolific press production of its seventh-century predecessors in China, Japan, and Korea, but this does not address the ideas that helped to shape the inventive decades in Europe.[10] One after another, as we will see below, fine surveys of the field of book history hasten to immerse Gutenberg into what followed him. Histories of communication, in addition to being inexpert in the facts and actual texture of early printing, much less proto-typography, repeat banal and brief guesses about Gutenberg's activities in Strasbourg, Mainz, Eltville, Bamberg, and Frankfurt.[11]

Up until rather recently, the elevation of Johan Gutenberg to the level of a Genius in the products of historians, if not in their explicit terminology, was necessary to support

launching the emphasis of incunable studies on the many printers of the fifteenth century and their work. The explicitly heroic image of Gutenberg, a product of printing historiography of the eighteenth, nineteenth, and early twentieth centuries,[12] has been superseded, in part by the discovery that he did not complete the establishment of print technology by one stroke, in part by our understanding that it took a couple of centuries for the book to be transformed into the core of a print-oriented culture, in part through greater knowledge of early Asian printing, and in part through theoretical and factual re-evaluation of the cult of the Genius.[13] The large story of the history of knowledge due to the effects of the printing and publishing trades on science, politics, literature, and art, through its increasing, though by no means absolute, control of reading so much stands as the end toward which we see early modernity pointing, that the developments in the decade of the 1460s and after, for which interesting evidence is relatively abundant, almost wholly captivate the attention of those interested in the early printed book.

The silence from other sides of the matter, looked at roughly and broadly, is just as great. Historians of science and technology tend not to enter territory they regard as literary, philosophical, or too broadly cultural, due to both their curiosity about technical and economic matters and also to their conservatism with regard to evidence, which naturally is less useful in their own work when the matter requires a method of metaphor and analogy. Historians of philosophy exercise a disciplinary conservatism, and they are not prone to speculation about the distribution of ideas and especially about its technology. Intellectual historians working in science and philosophy generally leave the start of printing to an amorphous effluence of tightly technological or very rangy cultural developments. Historians of art, while strongly committed to theory, do not often look at the conceptual array out of which new media for representation grew. They account well for the intellectual, social, and material factors in medieval and Renaissance art, and they are keenly aware of the complex evolution of representation across these and other epochs. Nonetheless, what we might call the inner life of printing — the history of the ideas as to what copying by impression from cast impressions is able to transmit and to distribute — has not attracted their attention.

The broader historical scholarship has turned for the most part to the aspects mentioned above — to wit, economic, social, and material history. These three areas rapidly and naturally point to one another. Looking at the transmission of technical knowledge involves studying guild and craft rules, trade networks, and the nature of craft secrecy.

Looking at the ways in which different localities treated knowledge leads to the study of the relations of engineering and commerce. Looking at the migration of artisans or groups requires understanding the social and material conditions that inclined people to pull up stakes. Territorial, institutional, and civic structures helped to determine the circulation of skills. Religious beliefs, the availability of resources, the mischances of weather, the tides of capital, and laws also created the pressures and opportunities to which those who had know-how responded. These "multiple mediations" were so many and so intricate in the late medieval Europe that it seems as necessary to localize and particularize the study of invention through social history as it is through technological history.[14] Particularizing study in any case most always meets the concerns of historians for the factuality of their evidence. One force that can link and summarize these practices as well as reveal their origins and deep impulses is intellectual history.

Within the field of the history of the book, where perhaps one most wishes to find deep theorization of print, the mainstream focus has been on social history, as I have indicated. Both rooted in and separating itself from the customs of book collecting as developed after the Revolutionary and Napoleonic upheavals, which "liberated" hundreds of thousands of old books, the field slowly emerged from several streams of historiography in the 1960s and 1970s. Leaving aside economic and political impulses, these included the traditional, copy-specific, and empiricist descriptive bibliography of W. W. Greg and Fredson Bowers; the Annaliste interest in primary sources, which framed Lucien Fevre's and Henri-Jean Martin's *L'apparition du livre*;[15] the influence of hermeneutics theory on the study of communication; the discourse analysis of Michel Foucault (and "the linguistic turn" more broadly), Roland Barthes, and Jacques Derrida; the huge growth of material culture studies across the disciplines, prompted in no small measure by John Berger's Marxissant essay on Walter Benjamin;[16] Roger Chartier's and Roger Darnton's variations of the "history of mentalities"; and the branching florabundance of such new historiographic methods as micro-history, "history from below," "the turn toward things," gender studies, and post-colonialism. Also, it is right to acknowledge the impact of the heroic work of special collections curators in the great growth period of the American institutional research library after World War II and the reformation of rare books librarianship and of the education of special collections librarians accomplished by Prof. Terry Belanger, first at Columbia and later at the University of Virginia.

The first of the social history theories applied to book history was a result of the ideas of Harold Innis and Marshall McLuhan mixed into these other influences, presented in Elizabeth Eisenstein's *The Printing Press as An Agent of Change*.[17] In her view, distribution by replication is due to the "fixity" that the machine assembly of printing imposes on its products. Technology thereby powers erudition into capitalism and nationalism. In the blizzard of controversy that followed this book, Michael Warner and others argued that it is necessary to prune back the techno-determinist tendency of her thesis within social history.[18] A more adequate method for social history links all the makers and users of printed matter into a "communications circuit" that drives "the social history of ideas," as Robert Darnton described it.[19] In a series of brilliant works, Donald McKenzie reformed analytic bibliography by pressing the texts it took as its objects first into the twisting and jagged work of physical manufacture by the book crafts and then framing this within the sociological study of the mediation of texts.[20] Although they also aimed to take the many channels of human meaning into account, Thomas Adams and Nicholas Barker, however, regarded the book, rather than people or printers, as agentive.[21] We follow a book to follow its social history. They recognized the *longue durée* of the prestige of written matter in the printed book. But none of these approaches to the social history of print conceptualize howthe desire for meaning allowed for the generation and reception of influence by print.

Adrian Johns, at the beginning of his *The Nature of the Book*, enjoins scholars to explain the origins of the veracity we ascribe to the book.[22] Throughout this meticulous and thoughtful book Johns describes the way in which confidence in the veracity of print developed, inch by inch, through the discussions and activities of the scientists, learned, printers, and booksellers associated with the scholarly activities in the early years of the Royal Society, founded in 1660. Much of the success of the revolutionary science of Boyle, Hooke, Newton and others in this critical period depended on the trust they developed. Although the book trade was large and complex, it was still necessary for readers and publishers to cooperate in order to make an effective book culture. Johns centers his account of these intellectual labors around "veracity"; and with this word he laid his finger on the concept central to distribution by replication that we can also trace two and more centuries before the period Johns writes about, when the Middle Ages slid into the Renaissance.

Truth and the Good it brings —the objects of inquiry and the motive for its passion — must somehow attach to what is distributed. Whatever is distributed comes with a warrant (whether honest or deceitful) for its authenticity, or truth, and for its moral worth or utility. All the schemata of the social history of print are addressed to its developing production, circulation, and reception, mostly after 1460. They all look forward in time, along a progressivist flow of economic and social production, each moment of which hides its foundation a bit in its victory march up to our day. But if we apply Johns' injunction for historians to this unstudied aspect of the history of ideas in this period, before the start of print yet at the cusp of its start, to date little studied with respect to mechanical multiplication, we will start to seek something about the transmission of truth by the distribution of copies that must have been laid into the cornerstone of print as Gutenberg and others were trying and failing to figure out how to mechanize copying.

For all the close study of the development and influence of print media that the past half-century of scholarship has accumulated, and despite its incorporation of social, political, economic, rhetorical, linguistic, technological, and even post-humanist theories, and its use of advanced imaging and quantitative science, the study of the beginnings of print has not yet penetrated the techno-socioeconomic complex launched by Gutenberg in terms of the development of philosophical concepts in Europe that led to the breakthrough he orchestrated in Mainz: European intellectual history of the century or more during and prior to the first tinkering, probably undertaken in the early fifteenth century by persons now unknown to us, and then by Gutenberg, Nicholas Jenson, and their colleagues, all in a small patch of the Earth, where the desire and the need for the distribution of text and image crested over the attritive resistance of tradition into the start of the mechanized and rationalized manufacture of multiples that helped to found modern science, art, and culture — a vertical band of lands likely footed in Italy and ranging northwards through the alpine southern German-speaking lands but intensely centered in the middle of the Rhine Valley, with possible topmost tendrils in Holland and Flanders. The changing world-view of European civilization as it passed through the early fifteenth century has been examined in detail and on the whole, but the start of the most consequential and effective actual medium of diffusing influence and circulating ideas in these parts of Europe, by transforming the agency of molding, casting, and impressing through a novel technological assemblage, remains unexplored as a

historiography that is wider than or different from what established practices of the history of early printed books studies.

With this we come to a hole in the middle of the study of the history of print. The notion of the copy, the power of mimesis, the whole range of relations of original to copy, of truth to what we know, and of the good to what we do, of the divine to who we are — all these run through the changes in distribution into what representation was in the development of knowledge in the West. In particular, it is copying by incision that propelled casting and thence printing; Greek *charein* (to carve), Latin *scribēre* (to write), German *drucken* (to print), and English "to write" all grow from the root concept of incision. There has so far been no exploration of how the long train of philosophical conceptualization prior to the start of printing helped to start replication by printing. The possibility and the need for print was shaped by the meaning with which that tradition endowed it, enabling the massive distribution of text and images flooding the noonday of the fifteenth century during the passage from the Middle Ages to the Renaissance.[23]

One basic reason that scholarship has not explored the intellectual pre-history of print is also the compelling reason to turn in the direction of the history of ideas: as is evident by now, the facts about pre-typography and the earliest engraving are scarce. As to Gutenberg's activities, only a few documents are extant; and of his letterpress prior to the 42-line Bible, mere scraps — remember that only about two to four percent of the tens of millions of post-Gutenberg incunabula survive. Precisely one piece of new external testimony as to Gutenberg's activities has been discovered in the last century, whereas some was lost to bomb damage in World War II.[24] We have no solid evidence at all of experiments by others before or contemporary with Gutenberg. It stands to reason that others were trying, but echoes of rumors do not take us far. Of the 6,000 or so extant early single-sheet woodcuts, only a few are duplicate copies of the same image, whereas about 100 copies were likely to have been made of many of these images. If we then imagine the possible number of woodcuts of which no impression survives, we must reckon that we can look at less than one per cent of the production. Several score woodcuts of the period prior to about 1455 survive — perhaps 100 of these. The lack of evidence makes for what the historians of early prints Peter Parshall and Rainer Schoch call "the closed end" of early woodcuts research.[25] Perhaps bits of type will be dug up, or proto-typographic binder's waste will be noticed, or prints

pasted in an old coffer or on an old wall will be discovered.[26] But all in all, study of the invention of mechanical replication as based on technological and (to a lesser extent) social history faces a closed end of the portion of its inquiry that relies on artifacts, whereas the relative abundance of information about incunable and later printing has greater possibilities to attract scholars. I turn now to the way to open this closed end into a very large field for fresh research in pre-modernity and early modernity, the intellectual and scientific history of Western and global civilization, the history of communication, and cultural theory.

3_Looking Backwards

Historians like to think that facts shape their narratives. They do not as much as many historians think, but one way in which they surely do is the limits of what historians designate as facts limits the scope of the accounts they give. Although the body of empirically verifiable information available for a topic of research is an actuality that influences discourse, the higher-order epistemological, ontological, and moral commitments that the historian brings to research control her decisions in constituting the body of facts. These commitments can cause her to notice new information in a salutary way just as much as they serve to narrow the result of inquiry, though in the story of human knowledge the latter result is more common than the former. This makes the challenges by which knowledge grows, which intellectual history frequently can advance. It is often rejected or reduced, as well, because the kinds of influence that can be credited to ideas themselves are far more difficult to prove than to assert and bring up troublesome theoretical issues. In some measure the present essay is an argument for intellectual history.

The evidence we do have of what people in Europe in the pre-printing period thought about the world in general is abundant in one direction: the systems of conceptual thought developed by philosophers, theologians, and natural philosophers. Whereas physical evidence of experiments in replicating techniques is scant and its supply is likely closed, we do have vast evidence for the work with concepts of the late Scholastic and early Renaissance periods. Most of the chief and lesser philosophical texts that consumed debate in the schools and among the clergy survive, extremely well-attested

and secure. Although for medieval philosophy from its revival at the time of Charle-magne through the Victorine period in the early twelfth century the situation is murkier, we nonetheless know the important points and can speculate in interesting ways on the lines of conceptual development and influence.

It is true that this evidence tells us only that which a small percentage of the members of the world we are interested in studied and thought. It is also true that we do not have and likely shall never have evidence of direct contact leading to personal intellectual influence between philosophers and tinkerers. But if it can be fruitful, there is no choice for moving forward other than the methods and materials of intellectual history. This requires that we accept correspondence rather than direct causality into our understand-ing and that we accede to some notion of the conceptual environment out of which changes in praxis emerged. We must accept this not as final explanation of anything but rather as a part of the picture in which all elements "helped" whatever changes were afoot, as mixed together as human motives, interests, and purposes always are.

It is rather a common matter to correlate technology and science generally with phi-losophy and conceptual thought, both synchronically and diachronically, without as-suming hylomorphism. There must be many forms of their co-operating and mutual causality. The nature of their interaction in historical processes is not easily explained, and this is not the occasion to attempt it; but that they constellate in the development of human knowledge is undoubted. The history of ideas can reveal one kind of necessity that correlates an abstract problem with a desire that becomes a hungry drive across a society to express new meanings in new ways. We can address the question of how older media of expression and transmission started to become a trade, them an industry, and then an entire world civilization of distribution at the start of printing by connecting the start of the making of multiples to the history of ideas in the preceding period.

As a start to learning what motivated distribution by copying and impressing, we can observe the wider range of crafts of making multiples by molding and casting, stretching out from before the Gutenberg workshop back to the Bronze Age. The two pre-typographic methods of making impressions of letterforms in Europe were casting and incision, often combined, as for example in gold- and silver-chasing and in leather-work.[27] Artisans who decorated gold and silver objects engraved letterforms and other patterns in them with tool made by hand, perhaps forged, or cast.[28] They also made and used molds for intricate elements of both large and small pierces.[29] Their work is deeply

connected with early printing both for its financing and for the secrets of the crafts. But the domain of creativity we associate with the start of printing is suggested as much by depictions of the workshop of St. Eloy, patron saint of goldsmiths, as it is by the milieu of manuscript production.[30]

A similar possible association of casting and incision is found in other crafts. Working leather involved the production of letterforms. Initials and even whole words are sometimes found on belts and purses and bells; they had been cast on coins since antiquity. Cast brass letters were attached to leather and other articles of clothing as well. These were made in multiples by molds that might themselves have been replicated by punches. Letterforms are also found in large sculptures produced by casting. Numbers and letters in gothic forms are found in molds for all kinds of metal-work. Sometimes woodblocks were used to print designs on textiles, in one case in a grand manner.[31] The so-called "paste-prints" were probably made with tin stereotyped forms.[32] It is hard to believe that in a culture so highly and publicly visual as that of the high and later Middle Ages no one used direct transfer methods to replicate imagery for centuries on end, when pouncing and other indirect means of copying were well known to artisans. Part of the problem is indeed very much this sticking point, that the idea of impression is so obvious and so common as to make us balk at the very idea of invention, much less the tardy pace of refinement.

The signal example of this is the pilgrim-badge. Among the several thousand of these that survive, quite a few include words or initials with the image that comprises the badge's iconography, and a few badges are even letters alone.[33] Some badges were cast, but some were made by a small press that cut intricate designs from sheets of tin or brass; some are silver.[34] The most significant fact we know about Johann Gutenberg's activity before he undertook printing is that he worked with a partner, and possibly others, to cast tin frames for hand-held periscopes in which two small mirror relayed to the viewer the magical rays distributed by the miraculous relics displayed at Aachen to the eyes of pilgrims too deep in the vast crowd to catch direct and clear sight of the ostension blocked by the heads of the thousands standing closer to the platform.[35]

What receiving some rays of light meant to the pilgrims and even to Gutenberg in addition to his hopes for profit complicates, rather than clarifies, the problem we face in accounting for the start of European printing. The same holds for understanding what compelled the union of the skills of incision and casting. The connections of reflection

to source puts the relation of copy to original into a network of meanings far wider than even the social historians of early printing have yet examined, much less the historians of technology. Study of the documents that tell us about the transactions in this matter, although they tell us quite a bit, does not take us into its complex intellectual and psychic environment. In a way, this is a scale model example of the limits of social and technological historiography in addressing deep questions that the history of communications gives rise to. The pilgrim periscope venture, involving both replication of forms by casting and replication of light by reflection, is the most important intersection of a proto-typographer with non-printing techniques that we know of as a concretely documented fact. Research into the crafts and techniques that seem now to have assisted in or in some way led to the possibilities of replicating texts and images by a powerful and readily dispersed technological and industrial complex, as launched by Gutenberg, does in some ways add to our body of evidence; but it also enlarges the question we call upon the evidence to answer.

When we think of replication of objects in this way, we touch the desire or need to express ideas and to serve cultural and social needs with the kind of power that uniform, or nearly uniform, multiples can provide. Multiplication distributes the thought that inspired the production; distributing these many products influences feeling and action as well as thought and brings into alignment in a readable way the activities of individuals and group in building, eating, worshiping, and communicating: the physical shaping by a mold propels interpersonal influence and the history of collectives; the technique also symbolizes the social practice. The intelligibility of the symbol then lies in understanding the concepts inhering in its link to that which it presents. This effect of impressing one shape into another is so common and fundamental to human existence that we often hardly notice how wholly remarkable the phenomenon of it is. One takes up a three-dimensional physical object; and, by sharpening its shape in certain specific ways and into certain specific materials, one can press or punch or incise or even burn it into other softer materials, or fill it with liquid materials that will harden. The result is copies: other instances of the same, similarity in form with differences in time and spaces, many tokens of a type, or even, upon deep appreciation of this miracle, regeneration with variation as the very process itself of time and change.

Artisans worked this magic through many substances upon the infinite variations of pattern of which human minds are capable. Figures in relief carved out of durable alloys

served to drive the shape hard into the desired substrate. The hand gently coaxed colored chalk out from the loose mesh of a pouncing back through holes driven through paper or parchment in order to leave a design on another fabric placed to receive the master design.[36] Working a sharp point, as knife edge or burin tip, into wood or a relatively soft metal brought an image out of a uniform surface into the light that could, upon skilled operation, extend its light through the strong reflection of black or other colored but shiny ink bonded to cotton rag paper. Our fingers are blunter, but along with faces chiseled from rock or metal, with the minerals pure or blended, our muscular effort from the brain and eye down through the arm and wrist could create an opening in the substrate, withdrawing it to leave a ghost that shockingly becomes a real presence when liquified blends of thick, oily ores are poured in. We can also "chase" a design, as if drawing it, finding it, as it were, by hunting the surface of gold or silver or bone with exactly calibrated movements of the many muscles and small sinews in the prehensile hand.

Precision in these operations produces tools and toys; statues and doors; vessels for emptying or filling; consuming and saving; the boxes and bowls that store, preserve, and provide. Keeping what we have, what we find, and what we know grows by the devices that the metaphorical imagination evolves by copying and altering these little replicating machines. They answer our basic needs as well: by similar rightly registered action, even bread is decorated. Pressing, stamping, driving through, forcing out and into, even burning into — these actions occur at the impetus of the brain impelled at matter and of the soul forced into the world, our conceiving powers our producing and producing powers conceiving. The illusion becomes truth, and the invisible progresses into the more surely real. The soul, Pascal said, loves the hand.[37]

Such magic was coaxed into profound and rigorous conceptual forms. It was in fact just precisely the development of printing that from a very early point in its career preserved this late medieval intellectual world. In a certain sense, the first half-century of printing is a reflection of the history of ideas of the preceding half-century or century, as well as of the news lines of thought then under development; the printing of biblical, patristic, and Greco-Latin texts are part of this just as much as was the printing of the books of the Scholastics. The historian of photography Geoffrey Batchen found a hungry desire for images in the 19 pre-photographic experiments during the century before the dramatic revelation of the successful invention by François Arago in 1839.[38] We

can extend the study of pre-printing by following a similar track to seek a hunger or desire for replication in the conceptual necessities tracked by philosophy and theology of the late Middle Ages. A movement of thought was afoot that included, or perhaps was based upon, a necessity for seeing the creation of text and images in material forms that could be multiplied and distributed like the rays of light relayed by the little mirrors in Gutenberg's mass-produced pilgrim's periscopes from the venerated relic to the pilgrims who desired to receive their benefit. In all that intricate thinking of late Scholastics we find the agony of logic set to work on the problems of representation, of truth, of the relations among creator and creators and their creations, and the force by which humankind and nature are impelled to speak, write, think, and act.

These considerations suggest a long-term program of investigation into the start of mechanical multiplication in Europe in which a large array of issues in the history of knowledge and culture can be freshly studied. I conclude with three of the main directions such research can take.

First, in the Scholasticism of the late Middle Ages, just prior to and during the period of invention I have been discussing, from about 1350 or 1375 to 1450 and up to the end of the century, various developments in metaphysics and logic bear on the invention of technologies for making multiples of texts and images in this period. The relevant concepts are among the chief themes of contemporary conceptual thought in Europe. They include: time, as a form of temporality separated from eternity by its plurality; memory, being the form in which the external world is replicated in the mind; impetus, which is the capacity of initiating force to be replicated in successive objects; individuation, the notional process by which one exemplar appears in many copies; and regeneration, the fundamental power of organisms to reproduce themselves in altered form. Philosophical and theological developments of these concepts lent a greater richness than hitherto to the manifold of the finite world, through which impelled force extends in the continuing creation of real individuals and in the continuing extension of accumulated human knowledge. For example, under nominalism eternity was dramatically divorced from natural time, allowing for greater focus on the ways in which we extend knowledge by reason and action. The changes in these ideas were due to both the continued influence of deep strains in Western philosophy, such as revivals of Platonism, and the new philosophical developments, often contrary to the older conceptions, such

as those of William of Ockham and other late Scholastics and early Renaissance thinkers.

Second, this history of concepts of course occurred through many relationships among practices, disciplines, schools, communities of many kinds, and individuals. Their work and thought played into philosophical work, and vice versa, notably in natural science, especially in light, optics, and perspective; in the growth of machinic power, such as the invention of escapement movement for clocks, and through the work of the engineers of the early fifteenth century, some of whose notebooks remain;[39] and in devotional practices that affected emotionality and imagery.[40] Of these latter, the efflorescence of the veneration of relics from the high to the late Middle Age through ever-varying and intensifying visual rhetoric are especially apt for showing strength of the metaphor of the impress of the originary onto copies that maintain or sustain its truth or goodness as transcendently valuable. The truth is what authorizes a person to make copies and gives the warrant to those who make or receive multiples to distribute them. The footprint, the trace, the memory, the reflection, the illumination certify what we disseminate with this validity, without which it might be lost or misunderstood.

Finally, and most broadly, this is the ancient pursuit of a ground for human knowledge in the more-than-human, transfer of the true and/or the good from its creative source to our knowledge and our actions, and of presence of the divine in the worldly and the human. In countless variations this spins back through Western thought — through Thomas Aquinas and Bonaventure, to Augustine, who says the God imprints the righteous law on the soul as a ring leaves its image in wax;[41] and from Augustine, back through the stages of later Greek thought to Aristotle and finally to Plato, who says that the memory is like a wax tablet on which the things we encounter leave their images.[42] That our memory can through its inner representations transmit truths into safekeeping and thence disperse them into other minds and memories by means of their impressed expressions propelled into our world is the master metaphor for the communication of knowledge through the technology of distribution by copying.

It is possible here merely to point to, rather than to investigate, these rich and complicated histories of philosophical, artistic, scientific, and religious concepts, and to argue for the importance of this research. It will be through the study of them that we can place more deeply than hitherto the revolution in the distribution of text and image

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that began on the Frankfurt river dockside 564 years ago into the context of the times and into the ancient endeavor to secure and to distribute truth.

_Endnotes

[1]   Books were shipped unbound in barrels; the man at the fair might have been Gutenberg himself, or Peter Schoeffer, or even his partner Johan Fust, who lived in Frankfurt. See Peter Gossage, trans. C. M. Gossage and W. A. Wright, A History of the Frankfurt Book Fair (Toronto: Dundurn Press, 2007), 19–25. For the evidence for dating these early actions, see Eric M. White, Editio Princeps: A History of the Gutenberg Bible (London: Harvey Miller, 2017), 23, 43. White's bibliography is the most complete to date; I will use his work here in place of citing other Gutenberg scholarship for the most part.

[2]   White, *Editio Princeps*, 53. These early buyers were mostly bishops and abbots for cathedral and abbatial libraries in the Rhine Valley.

[3]   The discovery that Gutenberg probably did not use distributable cast type, which began a new era in Gutenberg studies, was made by Blaise Argüera y Arcas, in association with Paul Needham, in "Temporary Matrices and Elemental Punches in Gutenberg's DK Type," in *Incunabula and Their Readers: Printing, Selling and Using Book sin the Fifteenth Century,* ed. Kristian Jensen (London: The British Library, 2003), 1–12. Needham establishes a chronology of Gutenberg's experiments in a number of papers, summarized by his article on "Printing" in *Medieval Science, Technology, and Medicine: an Encyclopedia*, ed. Thomas Glick, Steven Livesey, and Faith Wallace (London: Routledge, 2005), 418–422. For a general survey of Gutenberg's technology, see Cornelia Schneider, "The First Printer — Johannes Gutenberg," in *Gutenberg, Man of the Millennium: From a Secret Enterprise to the First Media Revolution*, ed. Wolfgang Dobras (Mainz: City of Mainz, 2000), 124–145; and White, *Editio Princeps*, 300.

[4]   Christoph Reske, "Hat Gutenberg das Giesseninstrument erfunden? Mikroskopischer Typenvergleich an frühen Drucken," in *Gutenberg Jahrbuch* 90 (2015), 44–63, argues that Gutenberg did invent the hand-mold for typecasting.

[5]   The common term is "movable type," but it is much more accurate and descriptive to refer to "distributable type."

[6]   Evidence from the first decades of printing, such as reactions to print and developments in philosophy, can also tell us something about what led to print. But by the 1470s the Renaissance had already intervened to change the view of the world and of the preceding era. The project I propose here is to use developments in the rich history of ideas in the background of the work of early engravers and experimenters in print.

[7]   I refer here first to the comments on the start of printing by Friedrich Kittler and others who pursue media archaeology and second to actor-network theory in its various forms.

[8]   A good example is the eminent book historian David McKitterick's "The Beginning of Printing," in *The New Cambridge Medieval History: Vol. VII c. 1415–c. 1500*, ed. Christopher Allmand (Cambridge: Cambridge University Press, 1998), 287–298. See also the relevant sections in David Finkelstein and Alastair McCleery, *An Introduction to Book History* (London: Routledge, 2005); Michelle Levy and Tom Mole, *The Broadview Introduction to Book History* (Peterborough, Canada: Broadview, 2017); and James Raven,*What is the History of the Book?* (Cambridge: Polity, 2018).

9   For example, Guy Bechtel, *Gutenberg et l'invention de l'imprimerie: Une enquête* (Paris: Fayard, 1992), 45ff., links the developing technology of replication strictly to economic matters from 1380 onward.

10   Note, for example, the abrupt transition from Asia to Gutenberg in White, *Editio Princeps*, 17–21.

11   See for example Asa Briggs and Peter Burke, eds., A Social History of the Media: From Gutenberg to the Internet (Cambridge, UK: Polity, 2005). Thus Michael Giesecke, Der Buchdruck in der frühen Neuzeit: eine historische Fallstudie über die Durchsetzung neuer Informations- und Kommunikationstechnologien (Frankfurt, Main: Suhrkamp, 1991), 56–88, 137–147, regards typography as a self-enacting media system as it changed from copying to precision casting.

12   White, *Editio Princeps*, 63–81.

13   Cf. the re-contextualization of another mid-century revolutionary in Rivka Feldhay and F. Jamil Ragep, *Before Copernicus: The Cultures and Contexts of Scientific Learning in the Fifteenth Century* (Montreal: McGill-Queen's University Press, 2017).

14   For an overview of the social history of medieval technical knowledge, see Liliane Hilaire-Pérez and Catherine Verna, "Dissemination of Technical Knowledge in the Middle Ages and the Early Modern Era: New Approaches and Methodological Issues," in *Technology and Culture* 47.3 (2006), 536–565.

15   Lucien Fevre and Henri-Jean Martin, *L'apparition du livre* (Paris: Michel, 1958).

16   In his *Selected Essays*, ed. Geoff Dyer (New York: Vintage, 2003 [1972]), 186–190.

17   Elizabeth Eisenstein, *The Printing Press as An Agent of Change* (Cambridge: Cambridge University Press, 1980 [1979]), followed by her revision of her thesis in *The Printing Revolution in Early Modern Europe* (Cambridge: Cambridge University Press, 1983). See Joseph Dane, *The Myth of Print Culture: Essays on Evidence, Textuality, and Bibliographic Method* (Toronto: University of Toronto Press, 2003), 16–31.

18   Michael Warner, The Letters of the Republic: Publication and the Public Sphere in Eighteenth-Century America (Cambridge: Harvard University Press, 2009), 5–10.

19   In "What is the History of the Book?," in *Daedalus* 111.3 (1982), 65–83.

20   In his Bibliography and the Sociology of Texts (Panizzi Lectures 1985) (London: British Library, 1986).

21   Thomas Adams and Nicholas Barker, "A New Model for the Study of the Book," in *A Potencie of Life: Books in Society*, ed. Nicholas Barker (London: British Library, 1993), 5–43.

22   Adrian Johns, *The Nature of the Book* (Chicago: University of Chicago Press, 1998).

23   Paul Needham recognizes the long history of casting and molding as background to typography in "Printing," 421, as do Adams and Barker, "New Model," 8.

24   Erich Meuthen, "Ein neues frühes Quellenzeugnis (zu Oktober 1454?) für den ältesten Bibeldruck: Enea Silvio Piccolomini am 12. Marz 1455 aus Wiener Neustadt an Kardinal Juan de Carvajal," in *Gutenberg Jahrbuch* (1982), 108–118. See White, *Editio Princeps*, 23.

25   Peter Parshall and Rainer Schoch, eds., *Origins of European Printmaking: Fifteenth-Century Woodcuts and Their Public* (Washington: National Gallery, 2005); see also Peter Parshall, ed., *The Woodcut in Fifteenth-Century Europe* (New Haven: Yale University Press, 2009).

26   Leaves and fragments of leaves continue to turn up in the last half-century; see White, *Editio Princeps*, 290–299, 301–302. Of all incunabula as a whole, somewhere between two and four percent survives.

27   Peter Schmidt, "The Multiple Image: The Beginnings of Printmaking, Between Old Theories and New Approaches," in *Origins*, ed. Parshall and Schoch, 37–60ff., puts printmaking into the context of these crafts.

28   For some examples of letterforms in multiples see Geoff Egan and Frances Pritchard, *Dress Accessories c.1150-c.1450* (London: Boydell, 1997), 202–203, fig. 127, no.s 1095–1097.

29   See among many other examples Egan and Pritchard, Ress Accessories, 129, 151, 239; and Hazel Forsyth and Geoff Egan, *Toys, Trifles & Trinkets: Base-Metal Miniatures From London 1200–1800* (London: Unicorn Press, 2005), 26–31.

30   Goldsmiths had skills and money to contribute to early engraving and print. Such techniques as niello may well have come from goldsmithy, and there is more than one hint of the connection of jewelers to technologies of multiplication in the earlier fifteenth century; see Bechtel, *Gutenberg*, 203 (stating that Gutenberg was a jeweler in 1444), 211–212, 228–229.

31   As in the famous "Sion Textile"; see Parshall and Schoch, *Origins*, 62–67.

32   Isa Fleischmann, Metallschnitt und Teigdruck: Technik und Enstehung zur Zeit des frühen Buchdrucks (Mainz: Von Zabern, 1998).

33   See Hendrik J. E. Van Beuningen and A. M. Koldeweij, eds., *Heiling en Profaan: 1000 Laatmiddeleeuwse Insignes uit de collectie H. J. E. Van Beuningen* (Cothen, Netherlands: Stichting Middeleeuwse Religieuze enProfane Insignes, 1993); and Brian Spencer, *Pilgrim Souvenirs and Secular Badges* (London: Boydell, 2010).

34   For a press that stamped pilgrim's badges, see Van Beuningen and Koldeweij, *Heiling*, 20, fig. 3.

35   Cf. Bechtel, *Gutenberg*, 242–243. T. Craig Christy connects these predecessor products to typography within a solely technological framework in "From Badges to Moveable Type: How Gutenberg Came to Bring Mass Production Technology to the Production of Books," in *The International Journal of the Book* 8.4 (2011), 1–25.

36   Robert W. Scheller, Exemplum: Model-Book Drawings in the Practice of Artistic Transmission in the Middle Ages (ca. 900–ca. 1470) (Amsterdam: Amsterdam University Press, 1995), 70ff.

37   Blaise Pascal, *Pensées*, 483.

38   See his Burning with Desire: the Conception of Photography (Cambridge: MIT Press, 1997).

39   See Paolo Galluzzi, *Renaissance Engineers: From Brunelleschi to Leonardo da Vinci* (Florence: Istituto e Museo di Storia della Scienza, 1996).

40   Hans Belting developed this idea in *Likeness and Presence: A History of the Image before the Era of Art*, trans. Edmund Jephcott (Chicago: University of Chicago Press, 1994).

41   *De Trinitate*, 14–15.

42   Theaetetus, 191.