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RESEARCH ARTICLE

Refining Technopoiesis: Measures and Measuring Thinking in Ancient China

Shan Wu[1]

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Abstract

Most recently, two distinctions—echoing the cross-disciplinary critique of the teleological and "quantitative" approach of human arts and sciences at the expanse of the "qualitative"—have been foregrounded by Amzallag (*Philosophy and Technology 34,* 785–809, 2021) and Crease (2011), respectively, between the modern understanding of "technology" (as technopraxis) and the "forgotten dimension/phase of technology" (called technopoiesis) and between the ontic and ontological measurement. *Pace* gently the denotation of *technopoiesis* as a juvenile phase of technological development and the "ontological measurements" as logical and practical impossibility in the modern, mathematized metroscape, the paper reexamines the relevancy of the distinctions (ontic/ontological and po[i]etic/practical, both recalling Heidegger's "hermeneutical" critique of Husserl's phenomenology) in non-Platonic/Aristotelian contexts and, in the process, seeks to refine the vital notion of *technopoiesis* by looking at the intersection of these fuzzy domains. In particular, the ancient Chinese measurements and their understudied onto-poietic dimension in the shifting econ-political contexts may offer an alternative approach to the otherwise elusive presence of *technopoiesis* and its ontological roots. Arguing that the techno-ontopoiesis does not necessarily belong to the foregone Arcadian past, the paper proposes refined "signals" for recognizing the technopoietic as well as new "forms" of its presence—"interactive emergence" (the cross-stimulating agonistic interactions between techniques of different "stages") and "poietic clusters" (poietic ideas and/or implements that survive as "cluster" into the future), calling for future investigation of technical inventiveness (even in modern times) that reveal the process of how technopoietic elements enter the lives of technology through least expected embodiment.

Keywords Technology · Onto-poiesis · Measurement · Ancient China

✉ Shan Wu
shanwu@g.harvard.edu

[1] Committee On the Study of Religion, Harvard University, Cambridge, MA, USA

1 General Introduction

For a long time, the quest for the absolute measure has been recognized as one of the key themes in human intellectual history. We still hear, as if, the whispered words of the measuring-rod- and bridle-holding Nemeseis of Smyrna ("We must do nothing beyond measure…") and the buzzing sound roused by the intertwined twin cosmogenic spirits of early China, often depicted as rotating and rejoining the try-squares and compasses, making circumscribed squares (an early formula by which to measure the diameter of a circle).[1] In many ways, the still living, but time-honored search of the (a) measure—which is not really attached to the strictly quantitative framework of objectivity—marks the very "births" of many fascinatingly variegated modes of thought and ways of relation. Indeed, the evolutions of the idea of measure have been accompanying and activating the many summers of the fruitful life of transformation of *technology* (and our definition and expectation of which). In more recent times, the perfection of measuring techniques and tools allowed scientists to access the so-called "absolute" more easily, shaped socio-cultural institutions through changing the ways of the production of knowledge, the relation between the observer and the tool, and how we approach the technical activity of measurement as well as our own behavior (Sterne, 2003; Canales, 2009). In the process, the classic social scientific understanding of technology that concerns first machines or mechanical applications is supplemented by a new one that emphasizes the problem of choosing the most appropriate ways for achieving desired ends or goals (Luhmann, 1998; Weber, 1978). The techniques of data-mining, for instance, represent one of such "ways" (becoming a "Way of Life") that did not emerge from the ambient culture of the precedent statistics and machine learning but with a self-assertive new identity and purpose (Jones, 2019, 314–315).[2] In observational situations, too, the impact of the conclusion tends to be registered as the most significant factor, as the background information—more messy "real-world," "raw" data—remain largely tacit.

Reflecting on the theoretical and practical bias for conclusion, contemporary critics seek to reveal the subtle interplay of the background information and the end-product. Along more general lines, the maturing of the material technology (such as precision devices) and measuring techniques (technoscientific, administrative, or artistic) has long amplified the tension of dialectical and historical oppositions between (or replacement of) "what really is/happens" and (or by) "mere representations": place and space (Mitchell, 1994), "local customary" and "modern state" measures (Scott, 1998; drawing from Kula, 1986), the ontological and ontic measurement—echoing the difference established between "proper" and "improper" measures of "reflective/meditative thinking"

[1] Anonymous epigrams in the *Greek Anthology* 1968: 16.223, also 12.193 ("Nothing beyond measure"). For early depictions of the ancient Chinese deities and their relation to early mathematical treatises, see Tseng 2011, 50–55; for the cosmological and methodological importance of the circumference squares and early method/device to determine the diameter of a circle, see Cullen, 1996, 62, 83–84, 181–82.

[2] Such as the converting of theoretical algorithms and high data into everyday practices and actionable knowledge.

(*das besinnliche Nachdenken*, through which the meaning of Being hidden in technology is disclosed) and "calculative thinking" (*das rechnende Denken*) by Heidegger (1966, 55–56)—of the shifting city-scape, "timescapes" (Adam, 1998), "metroscape" (Crease, 2011), and sense-scape. The present work critically relates to the distinctions foregrounded by Amzallag (2021) and Crease (2011, 270), respectively, between the modern understanding of "technology" (as technopraxis) and the "forgotten dimension/phase of technology" (called technopoiesis) and between the ("modern" techniques of) ontic (i.e., bringing together two actual objects or properties in quantitative comparison) and ontological (i.e., comparing oneself or one's production "with something in which our being is implicated…such as the good, the just, or the beautiful," and experiencing, via Plato, what is "fitting" or "right") measurement. While the reference to Heidegger is downplayed in both of the preceding works (Crease and Amzallag), it is important to locate these distinctions in his hermeneutic phenomenology (Heidegger, 1962, 31–35), a landscape into which a lifelong, karmically intense contemplation on the problematic of the sacred (and the gods) and a (the) "measure" (devices and the process of standard-setting or measure-taking, die "*Maß-Nahme*") in terms of ἀλήθεια ("disclosure")—starting with *Being and Time* and, above all, in the interpretation of Hölderlin's poetic formula, by which he argues "the essence of the poetic is…in measure-taking," prepared for the architectonic of "poetic dwelling" (1971, 34–35)—was projected and dialogically reflected, in multiple resonance with early Chinese (e.g., proto-Taoist) thinking on experiencing (measuring) tools and instruments as poietic clusters of *Wohnzeug* or living-utensils/-things (Parkes, 2022, 15–17).[3]

The making of these oppositions—where the doctrine of one tends to collapse into the paradox of the other—belongs to a long-standing preoccupation with separating or recovering a concrete, complex, sensuous, and to some extent incommensurable human experiences from the abstractions of mathematical mapping, depiction, and measurement. Under the predominantly end-driving impression of different technologies, the nature of physical reality, language, economy etc. as well as the experimenter's ability to measure with certainty are fundamentally questioned in the development of the combined data/model (Desrosières, 1998, 290) and quantum (Lundeen et al., 2011) technologies, the concern of rethinking technology—and its *onto-poietic* dimension—becomes ever more pressing.

2 Dual Conception of Technology and Application

More recently, the teleologically deterministic orientation of the modern study of social science and science and technology has been problematized (Hodder, 2011; Ingold, 2010). Specifically, the definition of technology that characterizes it as a

[3] For this point, we are especially grateful to an anonymous reviewer for indicating the need to address the Heideggerian reflection on the ontological measures and measuring, preferred in the historical world of Dasein, especially in the context of oriental philosophy. Unless noted, we use the terms onto-poiesis in the same trajectory as the Husserlian (and Heideggerian) discourse. See also n. 5 for further clarification of the use of terms.

teleologically oriented utilitarian activity towards accomplishing recognized purposes or end-products (such as defined by Li-Hua, 2009, 20) is challenged by scholars who attend to the "juvenile phase" of the development of techniques. In the article of primary inspiration for the approach made in the present analysis, Amzallag accounts for the early phase of development of a group of new techniques in pre-modern and ancient times, highlighting the technical process that is "motivated by factors and considerations other than the perspectives of use and practical applications": "Whereas technology is a relevant concept for approaching the mature phase of the development of techniques, another referential might be necessary for approaching the *juvenile phase*, its *nature, expression, motivations and cultural resonances*. This missing concept…accounting for…the phase of their *emergence and early development*…. [is] here defined as *technopoiesis*" (2021, 788; italics added). In the paper, *technopoiesis* produces artifacts that are first of all approached as a representative of the process bringing forth to its emergence, in contrast to *technopraxis*, where the process is relegated to secondary importance (or even complete insignificance) below practical uses. In addition to the necessary characteristics deemed relevant to the two conceptual frameworks (to be examined later), the argument implies a seminal criterion through which the two notions differ, that is, the embeddedness or *dependency* of the artifact(s) on the production process of their emergence (*technopoiesis*) or the state (or status) of dis-embedded *autonomy* from the process (*technopraxis*).[4] With the "forgotten dimension" of "early technique development" (*technopoiesis*) being currently ignored or suppressed, technology is generally identified as technopraxis.

Can we apply this "forgotten dimension of technology" to the methods, techniques, and exercises of measuring science in a particular time and place? Do they fall between the onto-poetical and other modes of technology? This paper aims to enrich the dual conception of technology by evaluating its relevancy in the measuring techniques, devices, and philosophy in early and classical China, highlighting recent archaeological and other sources that show the possibility of coexistence and entanglement of the two "modes" (a modified version of Amzallag's original definitions) in different contexts. Firstly, the original dual conception is analyzed in its necessary but insufficient conditions that are mainly suggested by Amzallag: [1] staged development, from the emergent and/or juvenile phase (*poiesis*) to the mature phase of the technique's mastering (*praxis*); [2] practicality, that new technology emerges not from "practical exploitation" but from non-practical purposefulness, such as the will to understand the cosmic order; and [3] has individual agency, that the cultural importance of *technopoiesis* have a special influence upon the whole society, while its impact is exclusive for the experts at the later *praxis*-stage. We then turn to measurement in ancient China, showing that, while the unified and standardized measurement is seen as a logical necessity supporting political imperatives, the history of its transformation saw a variety of measuring techniques and products that possess (self)transformative, (techno)poietic properties. As measuring concepts,

[4] Note that, thanks to the insight of one anonymous reviewer, the critical terminologies (autonomy, dependency, embeddedness, state) are used by us to paraphrase (and interpret) Amzallag (2021)'s theses.

they are neither conceived to substitute for human labor nor simply components of social semiotic deprived of subjective inventiveness. As active elements of the discourse of techniques, they co-exist in *interactive emergence* with other techniques that belong to distinct timelines or exist as "poietic cluster(s)" in the long course of development. Based on the analysis, the last section rethinks the *technopoiesis* and its function as (self-)transformative agents, zooming in on the juncture of time closely before and after the standardization of the measurement system in ancient China.

First of all, this distinction between the two frameworks of emergence, development, and uses of techniques—coined as *technopoiesis* and *technopraxis*—is based explicitly on Aristotle's concepts for two types of practical activities, namely, *praxis* ("action") and *poiêsis* ("acting on") in the *Nicomachean Ethics* (1094a1–8). Unlike the conventional use of the tripartite division (*theoria*, *praxis*, and *poiesis*) as different types of knowledge or ways of knowing that may overlap (Nilson Hammar, 2018, 114–124), Amzallag (2021) uses *poiesis* and *praxis* to denote distinct anthropomorphic stages of the life of techniques. In this formulation, technology (in its modern understanding) is a *technopraxis* that expresses a mode of production guided by a specific desired issue or finality. This understanding of technology is associated in complex ways with the engineering and industrial context and emerging technoscientific empires towards the end of the nineteenth century (Schatzberg, 2006, 487–489). In contrast, *technopoiesis* expresses the importance of the technical process per se, primarily motivated by the non-practical human wish (e.g., to display skills, to enable mastering of technique, to evoke, materialize, exhibit, and manipulate reality) without the ever-presence of an end-product. For example, the invention of gunpowder was seen as a process accompanying the alchemists' search for the ethereal principle (or *qi*), rather than the understanding of the practical application of the explosive reaction precipitated by the combination of saltpeter, sulfur, charcoal, and fire; the early use of gunpower, too, is confirmed to be "impractical" (Needham, 1986, 111–117, Winter et al., 2012, 134; cited in Amzallag, 2021, 790).

Perhaps the most interesting and most puzzling feature of the distinction that digresses from the Aristotelian formulation is the mutually *exclusive* periodic alternation of, on the one hand, creation as a production process (for *technopoiesis*) and, on the other hand, the presence of desired end, from beginning to end (for *technopraxis*). For Aristotle, practical thought (a disposition with respect to doing or *praxis*) governs productive (*poiêtikê*) action. Just as *praxis* whose end is found in a specific desired issue, the poietic process (*poiêsis* or making) of a technique necessarily comes to an end, in its own terms (Amzallag deemphasizes this similarity, 789); it denotes a process of "acting on" or interaction within the subject–object conceptual framework (*Nicomachean Ethics* VI, 1140a1–20; 1094a5–10; see also Parry, 2014). From the point of view of the proposed dual-conception of technology, however, the sort of end-product-driven process is by definition incompatible with any genuine notion of creativity and innovation, while *technopoiesis* ignores completely the potential for the use of the outcomes. The specific modernity underlying the interpretation on the sources (Friis et al., 2013, 233), such as its "end-product" or "purpose" needs to be addressed.

Before verging towards a more "refined" (in some ways, more tolerant *and* tolerable) in-/(re-)ception on the "new" vocabularies (onto-/poiesis, techno-poiesis, techno-praxis, and *technology*) resonating with the established distinctions (ontic/ontological and po[i]etic/practical) seeded by expert gardeners of various philosophical and scholarly traditions (above all, Heidegger), we have to reconsider the proposed definitions that appeal to the non-coexistence of the two conceptions of technology. Take the technology of perspective, for instance. As a matter of mathematical (instead of artistic and "free") matter, the purpose (and end-product) of this technology is the production of the illusion of space on two-dimensional surfaces. From this view, ancient perspectival construction would be tantamount to a technology *and technopraxis* (even though the ideal purpose is never fully achieved)—two terms used interchangeably in Amzallag (2021)—according to the proposed definition.[5] However, as Erwin Panofsky points out in the seminal study that differentiates antique and modern perspective systems, perspective was historically seen a matter of style and self-expression (and even as a factor of value). In fact, it is considered first and foremost as a *symbolic form* in which spiritual meaning finds concrete and material expression (Panofsky, 1991, 40–41). Belonging to the domain of technopoiesis, its *purposefulness* can be found on the audience as well as the artist, who desired to render visually represented space symbolic (Damisch, 1994). In specific cases when the purpose of establishing space according to this system is weak or meagre, such as in Artemisia Gentileschi's painting *Susanna and the Elders* (1610), the purposefulness to construct discursively "a world and a way of establishing an ideological relation to that world" is nevertheless strong and ever-present (Pollock, 1999, 113). From one reading, Gentileschi's painting seems to display neither *technopoiesis* nor *technopraxis*: the minimal representation of realistic space in the painting suggests a lack of initiation to establish space according to the theory and praxis of perspective, a technology that the painter was to study with Agostino Tassi. Upon closer look, however, one may argue that Gentileschi's use of perspective displays characteristics of both conceptions of technology: through enacting the technique of representing relative position and shape of objects (*praxis*), a radically compressed yet profoundly affective and ambivalent space is brought into being that did not exist before (*poiesis*).

[5] For the clarification of terminology, Amzallag's paper argues for a dual conception of technology—technopoiesis (the mode not guided by an exogenous finality, in which the production process is more important than the end-product) and technopraxis (the mode of technological production conditioned by a specific desired end-product, whose representation exists before the action of transformation). Having adopted the major differences that exist between the two conceptions in the brackets, the present analysis differs from Amzallag's implication by using "technology" and its practice neither as a synonym of the mature phase of the technological development nor as a quantifiably essentializable concept (but more broadly, as denoting the "entire" duration of the discourse of a given group of techniques, whose periodization is contestable under different terms). The neologisms such as "onto-poietic" and the implied onto-poietic technology (echoing the phenomenological discourse but *sans* the connotation to reified essences) are intended to highlight the commensurability (and specific modernity) of the theoretical distinctions made *in* (such as the ontic vs. ontological measures) and *around* (life, language, or poiesis vs. material object, physical movements, and praxis) the "many ontologies" (depending on the scientific perspective on the account) rather than for reifying/over-generalizing or removing the tangential planes between different conceptions of technology or ontologies.

2.1 Poiesis Periodized

The original distinction between the dual conceptions of technology seeks to map out the chronological development of techniques, based on the idea that complex technical achievements develop through a pattern of distinct stages over time and that these stages can be distinguished based on their characteristics. In the staged view of the dual-conception, techniques emerge from contexts without the perspective of practical exploitation to a "mature phase" dominated by the end product (Amzallag, 2021, 790). In this order of temporal succession, later stages integrate the technical achievement of the "juvenile phase," but not its process of creating (*poiesis*). Technology is seen as a universal process of chronological development measured in terms of anthropomorphized stages—from juvenility to maturity, *poiesis* to *praxis*—rather than a plurality of expressions representing the patterned developments of distinct qualities.

Following the approach, the technopoietic aspect of a technique has an increasingly marginalized role in its evolution over time as it only facilitates the non-practical primary function in the emergent phase. We may find the parallel, general scheme of phases of development of the concept of measurement and measuring, from being *onto-poietic*—a matter of pure proportions in ancient and Renaissance period—to one of *ontic-praxis*—a matter of magnitudes (e.g., absolute numbers of Henry Dreyfuss' scheme) in early modern period.[6] Before measures become codified and even uniformed, the technique is still a generative one in the early stage where each attempt of measuring entails an act of creative investment into the specific situation. This applies typologically and historically to the emergent phases of the absolute measures, constructed from examples of conventions from a variety of traditions. Later, the technicians of measures cease to take an active part in its (re) creation; the primary motivation in measuring is to subject a given entity or idea to the crucible of social or technical standards. Measuring, as Deleuze and Guattari suggest, are external acts that impose homogeneity by their exterior standard.

The immediate question with identifying *poiesis* as a property exclusive to the early phase lies in its evanescence. While the (poietic) inventiveness provokes the technology to enter a new state (from technopoiesis to technopraxis), "the technopoietic phase of development of a technique, when it truly exists, may be very limited in both time and space…[which] renders difficult the identification of *technopoiesis* in the early development of an ancient technique" (Amzallag, 803). The temporal anthropomorphized terminology itself (juvenility, *poiesis* [as a measure of self-renewal and beauty], and other "classic" evanescent qualities) could (rather

[6] Likewise, the technoscientific search for the (absolute) measure forms a narrative of the "juvenile(-archaic) phase" of ontological measuring (i.e., reflecting primarily the harmonious proportions of the universe or concrete living human experience, what is "fitting" or "right"; Crease 269–270) to the "mature(-contemporary) phase" of ontic measurements that abstract measurable entities from living experience or space. Nonetheless, as Jan Dijksterhuis, Scharff and others argue in the critique of Crease's distinction, such crude distinction ignores the historicity of measurement, quantification, and mathematization; measures such as the Euclidean and Vitruvian proportions involve both the poietic dimension of and the practical rendering of the form of things into quantity (Friis et al., 2013, 233, 235).

misleadingly) suggest that the search for such ideal, purposeless "technopoiesis" embodies a deep philosophical longing for a return to the Arcadian past of simplicity, immediacy, and—as the Greek says—true *poiesis*. While the success of the approach depends on a case-by-case analysis, such impression (that poiesis is found and only found in the "fresh start") holds vague promises not only in better describing *technopoiesis* and its innate properties but also in understanding the events and event-sequencing that announce its arrival and precipitate its disappearing. A similar problem would arise should we have accepted that one could date and distinguish—for instance, in the *entire* history of measurement from antiquity to most recent times—between the domains of technology in which human beings "produce" or make things (technopoiesis) and that in which we act or accomplish them (technopraxis), because even when we are able to locate a universally applicable definition of the dual-phased conceptions, the periodic models do not lend themselves easily to precise computation on a different scale of temporal reality. For one thing, to grant a phased reduction of *poiesis* in the development of technology is to ignore the sustainability of technical wisdom, or *mètis*—likewise a "forgotten" mental category that pervades the entire history of Greek culture—a type of intelligence that both masters the ship through the waves and builds it (Detienne & Vernant, 1978, 238; Jullien 191), a category that incorporates the artisan's gesture and its own history, that belongs not only to the "artisan" class but the Homeric king—such as Odysseus, who constructed his own bed (Vidal-Naquet, 1986, 237). What later thinkers called the "poesis" and "praxis" or the two "poles" between creative operation and technological action are not necessarily mutually repellent; in both the pre-Aristotelian Greek and classical Chinese contexts, for instance, they may be seen as interactive co-existence.[7]

A following question, not innate to the dual-conception but tends to arise as we apply it to specific cases, is how our recognition of *technopoiesis* may be influenced heavily by the received periodization, itself reflecting more of a "scholastic habitus" than an accurate representation of the past.[8] In recent studies, the model of the circulation of knowledge that presumes an earlier theoretical stage before its submission to practice, for instance, is criticized as "the (implicit) interfolding (*pli*) of theory–practice" (Jullien, 2003, 2–4). Similarly, in cases of ancient Chinese (measuring and curative) practices, it is often *after* this established *praxis*-phase of measurement that the theory of the production of the vessels for standardized measurement (coined the [*Yin-lü*]-*du-liang-heng* system, a concept to be explained later) becomes fully-fledged.

[7] Notice that, it is not *poiesis*, but *mètis* that characterizes the "early phase" (pre-4th c. BCE) of knowledge production in Detienne and Vernant; its conspicuous absence in later history is attributed to the predominance of philosophical intelligence (5). In the traditional field of the history of ancient Chinese science and philosophy, the co-existence of "polarized" modes of thinking and operation such as the "experiential" and "experimental," the "intuitive" and "rational," and the "temporal" and "spatial" (but not necessarily technopoiesis and technopraxis) has been approached systematically since the coining of the so-called "intuitive-associative" or "coordinate thinking" (Needham, 1956, 280–281). For a further discussion of the historicity of specific synthetic views, see Scheid (2016).

[8] For a discussion of the problems in received periodization of China, see Zhang, 2021.

In the case of ancient "metrology," the periodization of its development is informed by major political periodization, especially when the same period of a major reform of political standards typically overlaps with that of the pursuit of technic standards of all sorts in the history of ancient China: measuring techniques and land partition, the production of weights and measures for commerce and construction, theories in musicology etc. (Theobold & Vogel, 2004). Based on the general observation, it may be tempting to follow Crease's example, arguing that the true *poiesis* is lost after the standardization and unification of weights and measurements. And yet, their coordination and unification are explicitly connected to the moral and intellectual ingenuity in the idealistically simple past in early texts emanating from the intersection of technology and philosophy (the *Yi jing*, *Mozi*, *Zhuangzi*, the *Huang Di nei jing*, *Su wen*, and the *Tiangong kaiwu* etc.), while some of which, noticeably the *Shi ji* and *Huainanzi*, documented important change in the conception of basic measures (such as musical standards, see 4.1). The strenuous inventing (or introducing), manufacturing, and application processes of some of these elaborate products (pitch-pipes, mathematical tools, lever machines, such as the balance and scale and the crossbow trigger) are symbolic of virtue and self-cultivation, while the processes of making and using the others (such as the well sweep and the trebuchet) define the continuity of strategic action at the level of different scales in ancient Chinese philosophical and technological traditions (Zhou, 2019, 31–35); a symbolism that is, as Sinclair argues for the case of the laurel leaf lithic artifacts of Western Europe, embodied in the techniques of the manufacturing process itself, rather than in the late stage (Vogel, 1994, 142–143; Sinclair, 1995, 60, cited in Amzallag 793). To complicate the problem, the periodic phases of different technologies do not tend to coincide: one identified as the *poiesis* phase may well interact meaningfully with another at the *praxis* stage. In one single discourse of techniques, as we will show in the next chapter, the threefold division between theory, poesis, and practice may co-exist in any order or combination, constantly reinforcing each other as constituent parts of technology.

2.2 Practical Impracticality

The original dual-conception of technology supposes that the productions of the juvenile-phased *technopoiesis* emanate from non-practical concerns (e.g., the process itself, symbolism, the exhibition of the technique), while *technopraxis* presupposes an ever-present practical use of its outcomes. While Amzallag has already complicated the view by suggesting that practical use may exist for producing tools and other implements in the ("phase" of) *technopoiesis*—most remarkably, in the case of the status of prestige artifacts—it coincides with other emphatically "unpractical" dimensions (such as cosmic resonance) (788). As we have argued in the previous section, this definition of *technopoiesis* as the emergent phase may prevent us from recognizing the broadly speaking poietic agency of new techniques originating almost exclusively from practical constraints.

The ingenious double cropping (a combination of wetland rice cultivation and dryland grain cultivation) techniques and use of fertilizer in early Medieval Japan,

for example, were undoubtedly motivated by the practical goal to circumvent the rigorous rent-collection system. Belonging to a centuries-long overall socioeconomic and legal movement, the agricultural innovation marks a starting point of the emancipation of the low class of workers, including pheasants, serfs, and slaves, and the new right to for farmers to exploit their holdings (Souyri, 2001, 87–88, 91). Simultaneously motivated by a rising Buddhist value and practice that prohibits the killing of animals and the consumption of meat (93), the innovation of the agricultural (including food processing) techniques could be seen as, from the very beginning of its making, both practically motivated *and* poietic (or self-renewing, i.e., through the kinesthetic and spiritual transformation of the body engaged in consumptive wildlife use into vegetarianism).

During approximately the same period (the twelfth and thirteenth centuries), an unprecedentedly intense awareness of the semi-divine or numinous "consciousness" of plants and especially trees arose in the Buddhist beliefs (such as the new cults of sacred trees), popular literature (the miraculous tales, e.g., the identification of the wood used for ridgepole as the manifestation of the major deity Kannon, following an ominous description of the on-site processing and logging of the tree before it was sourced as construction material for the Sanjūsangendō temple in Kyoto; Rambelli, 2008, 301, n. 89), a peculiar form of the visual and sculptural representation of divine entities (the *kami*, the buddhas) began in the Heian period by which the wood-carving process is symbolically exposed in the semi-finished state (in appearance), "clearly displaying the raw tree material our of which they are made—known as *tachikibutsu* and *narabori*" (143), as well as the esoteric Buddhist promotion of the technology of sericulture (intimately linked to the use of mulberry tree) and new wood-processing techniques of therapeutic food, *materia medica*, and other tools ("milk" substitute, decoction, cordial, tea, rosary, and pillow etc.) by prominent monks such as Yōsai (or Eisai; 1141–1215 CE), traditionally esteemed as the introducer of the Rinzai (Chinese, Linji) school of Zen and is placed among the major figures of Kamakura New Buddhism (Macomber, 2022, 3, 6). These cultural phenomena may be *coincidental*, if not seen as unequivocal proof of mutual causality, with the new techniques that enable agricultural development (including the introduction of chestnut, mulberry, soybean, and wheat to create more technically and financially profitable fields of cultivation; Rambelli, 2008, 157) and development (often exploitation) of heavily forested mountain regions for the growing supply and management of natural resources (including deforestation and preservation skills). Nonetheless, the transformation evoked by the key technology of (de)forestry and sericulture—whose production processes were stimulated and advocated (instead of restrained and tabooed) by the ambient and emergent esoteric and Zen systems of beliefs (e.g., Macomber, 2022, 5–8)—are seen as key conditioning factors in the new discursive formation of Shinto religion with strong Nativist components (Rambelli, 2008, 130) and the emergent artistic genre of bare-wood divine images that emphasizes the agency of half-processed material itself. While the references to the combined forms of religious identifications and relations with the innovative techniques may not suffice to prove the most salient principles underlying Amzallag's idea of technopoiesis (the dependency of end-product from the process of emergence or the horizons of

use), the mutually-stimulating roles played by the land managers, (soldiers-)technicians, villagers and the Buddhist (mainly Shingon and Zen) and/or (emergent) Shinto thinkers and founders—all driven by "practicalities" (power, economy, even ecology)—unveils an almost unpredictably creative, intertwined dimension of practical uses, spiritual sensitivity, and material processing. For religious studies, the attempt to identify technopoiesis may offer a fine framework to account for the curious fact about the semantic *weight* carried by detailed descriptions of production processes, e.g., the relation of the production process (grinding, dissolving, and measuring) of new (sugar [*shimi*]-refining and sweet tea-making) techniques—introduced from India by Chinese Buddhist expeditions in the seventh century CE—to metaphoric referents in Buddhist scriptures (such as Xuanzang [602–64 CE]'s travel accounts and biography) (Kieschnick, 2003, 257–258, 276, 280) beyond gesturing towards purely (in modern understanding) practical issues.

Before labeling *technopoiesis* as motivated *not* by perspectives of practical application, therefore, we ought to recognize the specific historicity underlying our understanding of (im)practicality: the purely theoretical, esoteric, and even absurd ambitions were likely experienced as basic knowledge, techniques, and instruments of "everyday action" with strong utilitarian connotation in the historical setting, just as the modern "practicalities" would likely seem inconceivable and unpractical in the subjective experience of the past.[9] In the history of astronomical measurement, for instance, what we understand as inconceivably "impractical" distance between celestial bodies is described as "monstrous" by Kepler, whose understanding of the impracticality of a theory clearly reflects a cultural, socio-religious, and even theological concern (Bonner, 2011, 103; Rothman, 2011, 125–126). In Chinese historiography, the conditioned view of "impracticality" has led both imperial historians such as Sima Qian, the grand historian of the 2nd c. BCE for the Han court, and early modern scholars (including Guo Moruo) to the view that cowrie shells in early China were brought from "within" (for the early modern common view, from the South China Sea to north China). Recent studies, showing the economic and cultural connections, networks, and interactions over a longue durée and in a cross-regional context, show that they came from the Indian Ocean (Yang, 2019, 127, 137).

The practicality that is used by Amzallag is based upon a modern conception of the state of technical action (*praxis*) in which feasibility and results are indicated as the main considerations. The classical ideas of action, both *praxis* (to *prakton*, literally "doing" or "effecting") and the Chinese *xing* 行 (literally to be "traversing/traversed") embody an ethical, cultivational, and even heuristic dimension. In contemporary times, the concept of action changed from being in and part of the experience, exploration, and practical implementation to one of purpose-driven, instrumental reactions and activities—"efficient action on matter" (Latour, 2002, 248), producing a form of knowledge that is simply "in the heads" of practitioners (Kemmis, 2012, 147). Amzallag does not seem to highlight the transformation when he describes the pioneering development of gun-power and electricity as non-practical

[9] For specific cases of the "impractical" (to modern subjectus) praxis with intense practical purposes in the historical setting, see e.g., Chinese popular divination techniques (Kalinowski, 2009; Lackner, 2018).

but motivated by the search for the cosmic force of *qi* and "by the wish to materialize, exhibit, and manipulate this subtle and evanescent reality" (792). In the former case, the modern scholastic division between a "pure" philosophical and a religious-practical Daoism (Taoism) is shown to be "essentially meaningless", as ritualistic and operational practicality is inseparable from the mystical individualistic contemplations (Robinet, 1993, xix-xx).[10] While the differences between the practical and impractical motivations are clear in the modern context (especially social studies), we must recognize the innate difference in the symbolically charged, sensorial, self-cultivating, and connection-seeking *praxis* or Chinese *xing* (or *yong*) in historical contexts and what we commonly mean by "practicalities" of everyday life (to be differentiated from the "quality" experience).[11] Furthermore, as Husserl, Habermas, and others argue for the phenomenological concept of the "lifeworld," the *praxis* of everyday life is preoccupied with the world as it is experienced and lived.

As we will demonstrate, the theoretical and extra-theoretical grounding (Husserl, 1978, 142) as well as communicative and moral purposes (Schutz & Luckmann, 1972) of the "practicalities" of everyday technical action can be confirmed in the discourse of measuring techniques of ancient China. Hence, while the condition of "impracticality" alone cannot define or necessitate technopoiesis, for ancient studies to better understand the poietic dimension of techniques or technical action, it is important to note that while our understanding of *praxis* and practicality may be contemporary and rather static, the correlation between the technical materiality, action, and poietic experience is not. For the same reason, what we deem as "unpractical" context is not reserved only for the ab initio and facultative stage of emergent techniques, which makes "(im)practicality" less of a truly *practical* evaluative measure in the search for *technopoiesis*. As Latour recounts vividly: "the hammer that I find on my workbench is not contemporary to my action today: it keeps folded heterogenous temporalities… When I grab the handle, I insert my gesture in a 'garland of time' as Michel Serres (1995) has put it" (Latour, 2002, 249). Every technology, borrowing the terms by Horace in *Ars Poetica*, is potentially a beginning *in medias res*, in "the thick of things," defying the specificity of context.

2.3 Scale of Participation

In the original dual-conception, the recognition of the "technopoietic phase" is inevitably an interpretive process, but no more so than the recognition of the evaluative signals. So far, we have questioned two of these "signals," arguing that technopoiesis, when it truly exists, should not be confined only to a linear or dialectical temporal no-return, emerging out of a fundamentally impractical context. The third

[10] Citing ethnographic studies of metal production in traditional societies from western Afirca, Amzallag also notes that their "cosmic and practical dimensions of the produced artifacts become inseparable" (788, n.3). However, the inseparability is seen as restricted to the facultative stage of development.

[11] For the modern use of "practical time" vs "quality/experienced time" in the method of social studies, see e.g., Shir-Wise, 2019, 100–101.

"signal," if refined, may be indispensable for the search for the poietic element of a technology.

The third distinction implied by Amzallag is that technological developments and practice in the domain of *technopoiesis* yield cultural and technical meaning whose influences extend to the whole society (mostly of non-specialists), whereas such meaning-construction is unexpected at the praxis-stage, where the practical aspects of the technology may yield general cultural influence but the more obscure aspects of technology are accessible only to the craftsmen/experts (that is, when specialized knowledge, hence the appreciation of such, becomes reserved only for its producers). While Amzallag's interpretation is advanced confidently in his case studies (early development of metallurgy, ab initio a ritually and socially impactful practice for both the craftsmen and non-specialists), such judgment once again rests on a particular understanding of the "craftsmen" as opposed to the (members of) "whole society" (788), contingent on a clear distinction made (one may say after Heidegger) between the poietic (truth unveiling) and the artisanal, mechanical, and instrumental (acting with one's will, see Agamben, 1970, 69): just like a poem (the poietic embodied) must (no matter how reluctantly) come to an end, the true *poiesis* must also come into existence, the end-product, however, is not precisely poietic but at best a result of poiesis.

The criterion is deemed particularly significant because it prevents us from misidentifying the survival of technopoiesis whenever we encounter the metaphorical (i.e., symbolism seen as connected to the ambient ideology or beliefs) tethered to a production process—that is, if we take into consideration, again, the specific *modernity* underlying the understanding of the "technician" as a group of subjects who are *by definition* distinct from the "whole society," say, members of the urban societies. The presumption may prove especially problematic (and anachronistic) in the historical contexts (such as the early urban cities in Western Zhou China) where more recent archaeological studies show that the members of urban centers not only engaged in administrative or ritual activities, but were *in large scale* agents of craft-production and commerce sponsored by the elite/royal patronage, a view that is "in salient contrast" to the earlier view that craftsmen in the elite/royal-controlled workshops were mostly enslaved (corvée) laborers, i.e., distinct from members of urban societies (Sun, 2008, 95–99). In the case of early Chinese urban centers, the artifacts previously assumed to be prestige objects (such as the *jue* earrings) are now seen as utilitarian products, produced, circulated, and consumed by the (so-called) "commoners" as symbolically charged body ornaments, in a context of "independent rather than attached speciali[z]ation" (81). In such case, it is more likely the level of intensity of meaning-creator-consumers—human creators who operate in and, indeed, enliven and embody the production process, dispensable of the static divisions of identities (producer vs. elite consumer, craftsman vs. commoner)—that serves, albeit insufficiently, a "minimum determination" basis of techno-poiesis.

Do our historical subjects make comparable, positive distinction between *poiesis* and *praxis* as such, do they share this poignant view of the becoming (therefore ending) of the poietic? Unlikely so. Here, the commonality (and even sameness of identity), between the so-called technician or workman and the intellectual (the researcher/experimenter or the equivalence of such) suggests again the *historicity* of

the requisite standards or impressions of novelty, inventiveness, urgency, and practicality. The overlapping of the distinct roles is implied in the abovementioned concept of *mètis* and more explicitly in ancient Chinese philosophical texts on science and technology (such as the *Huainanzi*, *Kaogong ji* [the Artificer's Record], *Jiuzhang suanshu* [Computational Procedures of Nine Categories], *Haidao suanjing* [The Sea Island Mathematical Manual] and *Huangdi neijing* [Yellow Emperor's Inner Classic] etc.). Among which, the collective composition of the *Huainanzi* (Book of the Master of Huainan,attributed to Liu An, d. 122 BC) is motivated by the ancient technician-philosophers' attempt to recreate the unity that existed in the past, between the two sides of civilization: the progressive growth of technical knowledge and control and the degenerative break from the rest of the cosmos. Synthesizing practical technicity, political philosophy, and cosmology, the text speaks its own purpose: to build upon the technologies ("inventions of sages") and bringing them together back into a unified system (Puett, 2014, 288–30), and is used as much as a source of moral and ritual (Daoist) authority as a scientific and technical encyclopedia (Vankeerberghen, 2001). In a way, it is precisely the supposition of the nonduality of (the origins of) specialized and non-specialized forms of knowledge that makes these texts socially, culturally, and historically influential. It is therefore not the identities of those influenced by/influencing the technique, but the scale of participation that may help us identity *technopoiesis*—not of pre-measurable variation, but on a continuum of epistemic intensity. As much as this sounds like an odd measure of technopoiesis, the rest of the paper shifts to the actual measuring techniques (first more broadly, followed by ancient China), testing the eligibility of the readapted "signal(s)."

3 Measuring as an Onto-poietic Site

We have accepted the central (insufficient but necessary) criterion of technopoiesis as the situation of embeddedness or dependency of the end-product from the process of its emergence. In the process, we also propose more modified signals of identification, including a sense of immediacy and purposefulness, in place of the practical telos or use in technopraxis, as well as an intense (large scale) participation of "meaning construction" by the producer-consumers.

Having refined the ways of not just identifying—but speaking of—the otherwise phenomenologically amorphous notion through its main prism of the previous definition and emphasis, the rest of the paper seeks to further understand the technopoietic dimensions of technology as well as its gradual evolution, in which the semiotic, semantic, and practical autonomy of the end-product arise synchronously and gradually. The expression "onto-poiesis" was employed to suggest that the relation—movements and titillations—between different representative "modes" of technology implied is not just physical, but in an "poietic" (creative and unhindered) sense more broadly ontological. Rethinking technology in terms of onto-poiesis (instead of just ontology) is, in the present proposition, a key to a non-essentialist notion of "things" and their measurability.

As far as most modern studies are concerned, measurements had been fixed and strictly controlled by authorities and thus provided a standardized and universal

reference in various contexts. Modern measuring techniques—inscribed in the discourse of metrology—are typically seen as "an enabling technology to control manufacturing and processes" that creates opportunities for inventiveness (OECD/BIPM, 2020, 13), while itself remaining conspicuously non-poietic. In the ancient studies, as much as we are encouraged to investigate the emic dimension of techniques rather than focusing exclusively on broad generalizations of the meaning of technological products and production processes, the science of measurement epitomizes a site of activity where the culturally informed technical choices and their outcomes yield limited influence over their practical function. Compared to other technologies that are studied from their cultural and symbolic backgrounds, the measuring science receives relatively little attention in terms of its symbolic, expressive, and poietic aspects. Rarely, when it is indeed interpretated as a creative form of art, the search for measures is told as a story of pan-cultural, human subjection of the world (supplemented with a regional/national perspective),[12] a modern tale of the invention of ontic technoscientific devices (in contrast to e.g., the ancient and Renaissance search for the ontological standards of beauty and proportions). Within the few and scarce proposals that do call for a "renaissance" of the notion, "measure" was exalted as a singular principle of valuation "of all things," an "onto-ethical" "pillar of life," and therefore a panacea that promises to cure the disorder in which the authors (representing the "disoriented humanity") find themselves.[13] Ironically, it is the promotion of "measure" and its techniques to the high principle that maintains the (personal, societal, and natural) "existential equilibrium" that makes it a teleology that provides a benchmark of human development, rather than a poietic practice or *poiêtikê technê*.

One of the reasons for our reticence on treating measuring techniques as a site of *technopoiesis* may be that they are tacitly acknowledged to be motivated by (in modern understanding) practical need, e.g., the enhancement in quality and rate of production and standardization. As a discourse of techniques that have material consequences that are tangible and predictable, measures (and measuring ways of thinking and acting) are not expected to tell us anything more about the individuals or "things" involved in the action than we already know in the socio-cultural history, thereby constituting a classic *technopraxis* (or modern definition of technology). This view accords with not only the teleologically oriented approach of techniques of production in the study of science and technology (as and *only as* technopraxis), but also a long-standing bias in the study of cultural practices, where

[12] For instance, the history of Rome introduces the chapter on measuring and writing as such: "The art of measuring brings the world into subjection to man; the art of writing prevents his knowledge from perishing along with himself; together they make man–what nature has not made him–all-powerful and eternal. It is the privilege and duty of history to trace the course of national progress along these paths also" (Mommsen, 1913, 263).

[13] See for instance Anna-Teresa Tymieniecka's 2000 works, *Impetus and Equipoise in the Life-Strategies of Reason*, Vol. 70 (Dordrecht: Springer Netherlands), especially "Part One, Chapter Two, Section IV/ The Logos Projecting Its Rails of Unfolding: Measure, Order, Timing, Spacing'' (p. 489 sq.) and ''Part Six, Chapter Three, Section III/The Measure: The Moral Apparatus and the Elemental Passions that Prompt It'' (p. 581 sq.). And yet, as much as the project is authentically motivated, it exploits the malleability of the concept of measure by making it a synonym of "Life" or "Morality," flattening its intricacies in the name of the salvation of humankind.

"rituals"—symbolic statement of individual agency of ritual participants—are defined *against technology* as formal conventions interspersed with technologically superfluous frills and decorations in traditional societies (Leach, 1954; see also Rappaport, 1999, 47). In this view, technology is an inside-and-out, teleologically oriented *technopraxis*: it is functionally essential to the "everyday action," without creating new meanings.

As a result, measurement as *technopraxis*, rather than a site of creativity, self-expression, and practical "impracticalities," yielded dominant views on the subject in the studies of East Asian science and technology. Deleuze and Guattari's usage of (ancient) Egypt and China reflects this view, as they define the archaic State formation of Egypt and China by the overcoding, centralization, and casts of functionaries by the despotic State (Deleuze & Guattari, 1983[1972], 152–3). Measurement, in this regard, is part of the signifying marks used by the regimes of power to inscribe on the surface—rather than the interiority—of bodies. In the dual conception of technology, the measuring techniques (especially the practice of commensurating different systems of measures) constitute *technopraxis*, whose making is stimulated by practical teleological motivations, the main *telos* being to increase the available time and space for designing (inventing) the authentic human life not given to us by nature (as Mitcham & Holbrook, 2006 shows). The measuring techniques increase the potential of human subjective inventiveness by putting reality into certain objective order, while themselves becoming regarded as an abstract universal function. Measurability is therefore seen as driven by incessant planning and counting of "calculative thinking" (*das rechnende Denken*) characterized by Heidegger and measurement—e.g., the measure words in modern language, semantics, and ideology—functioning as Deleuze and Guattari called an order-word (*mot d'ordre*), made not to be believed but to compel obedience (Deleuze & Guattari, 1987, 76), stripped of a much broader ambience of the onto-poietic arising. Consequently, as in the case of the state formation of ancient China, the use of the universal as an order-word becomes a political necessity of domination. This invites us to look at the so-called "emergent" technology of measuring and measurement production in ancient China: not for another "genesis story," but a time and place where measures, constantly resisting unified standardization, are primarily recognized as "practical aesthetics": a site where individual skills develop into art, creative freedom becomes spiritual freedom, and artistic appreciation becomes aesthetic transcendence (Wang, 2021, x). In early Chinese philosophy, measurements (and measuring techniques) constitute important onto-poietic metaphors and abstract concepts (no later than they become the material expression of utilitarian needs), so much so that, more often than not, their extraordinary employment and development in philosophical treatise (most famously, the redefinition of *liang* [capacity measuring] concerning the continuous change and infinite division of experience and phenomena in the *Zhuangzi*; Li 2000, 95–100) playfully conceal (or completely ignores) their common definition in *technopraxis*.

3.1 Interactive "Emergence": Practicing Poiesis

We argue above that the anthropomorphized, staged framework of technological development eclipses the fact that, on different scales of intensity, the element of

poiesis (and even *praxis*) may (co)exist in different periods of the course of technology. Based on the critique, we propose a modified version of *technopoiesis* as a domain/concept of history from the inside and "outside," i.e., not only about a computable temporality but a quality which intensifies meaning-creation. Somewhat uncannily, the same rhetoric can also apply to our preoccupation with the measuring the immeasurable (e.g., the transcendent temporal metaphors) likewise *beyond time*: the emergent and the primordial.

As Amzallag noticed, scholars of ancient techniques often find the material remains hardly "speaking" for their own motivation and contexts. In ancient Chinese studies, we have another parallel issue. The written sources that do narrate, ab ovo, the origin of techniques in antiquity typically come into being much later (in the "mature" stage of development of the practical use of outcome). The variegated curative techniques of early China, for instance, do not have a coherent origin story until a few centuries later (Brown, 2015). Indeed, one can never be too cautious with sources in taking up the task of the philosophical and technological reconstructing of the *poietic* world, within which the legendary technician-philosopher was enmeshed. Still, the critique of the negligence of the emergent phase of technology is relevant, particularly when the investigation of the pre-standardization measurement (or measurements that are "immune" to standardized quantification) is scant in the field. The heavily analogical and metaphorical nature of the traditional origin stories of, say, numbers, astronomy, and geometry, makes the knowledge of phenomena (e.g., precession of the equinoxes and solstices, represented by constant overlapping of symbols for consecutive ages) a separate domain from the science and technology of "exact" measurement. Instead of seeking for the "origin story" in the remote past, as traditional historiography has done, most modern studies anchor their realities of predominant measuring tools and the standardizing techniques in the first Chinese States, treating the period almost oxymoronically *as if* it is both an apex and the "emergent" point of illustrious discoveries and inventions.

By general agreement among scholars, the period from the Qin unification in 221 BCE to the end of Han in 220 CE represents the earliest unified Chinese states and the prime era of standardization and systematization of measurement. Aiming at forging regional cultures and institutions into a unified realm, the first emperor standardized weights and measures, the gauge of wheeled vehicles, and the script, in addition to building roads connecting the empire. These moves—including setting measures based on the unit of number six and scheduling the tenth month as the new beginning of the calendrical year—were supported by the five-phase (*wu-xing*) theory, presumably originated in early technical and measuring practices (Puett, 2002, 144; from the Five Notes or *wu-yin*, Kern, 1997,47). Deleuze and Guattari, for instance, were referring to this period of development of the metrological *technopraxis* as sociopolitical tools in China when they labelled the archaic State formation of Egypt and China as "imperialist barbarian" (Deleuze & Guattari, 1983[1972], 152–3). As technopraxis, it is primarily defined first as state-controlled, result-driven sociopolitical practices, only secondarily emphasizing technique and its mastering. Among other issues, the "apex" view sees the period of the Qin-Han unification as the *opening chapter* of a narrative of technology (technopraxis) that features the absolute (standardized and uniformed) measures as the *center* of the

story. In return, the end products (the manufacturing of measuring devices, surveying and demographic techniques, etc.), through techno-bureaucratic measures, unify the states under the centralized ruling body.

This dominant view of "emergence," as we see, attempts to order the entire network of (the antagonized and antagonistic "juvenile" and the "aged") techniques and their dynamic interlocutive action in relation to the (emergent) measurement system itself, therefore failing to underline the poietic dimension to these measuring techniques, most of which existed long before the first unified States in different regional cultures. From the new perspective of *technopoiesis* (one that does not assume the given technique as the absolute center of the story), the most inventive and self-adaptive aspects of measuring techniques are more easily found—contrary to the dominant view of ancient technologies—outside the emergent narratives. In the following, we use the mutually stimulating development of various practical methods (measuring and farming techniques) in the Qin-Han period to show the imperfection of the antithesis of the temporality of technology ("young/emergent" vs. "old/mature," hence *poiesis* vs *praxis*), arguing that *technopoiesis* lies in the interwoven state of the two cardinal modes.

The same period of Qin-Han that saw the unification of measures also witnessed a new wave of innovative agricultural technologies, motivated *both* by utilitarian and pragmatic ends (food production, political, and economic concerns) and "impractical practicalities," such as the reenactment of imperial farming ceremony that restores the "gift exchange" between Heaven and a ritually renewed State that emphasizes the archaic virtues of ploughing, weaving, and storing up harvest (Hsü, 1978, 158–160; Sabattini & Schwermann, 2021, 148–9, 330). Among the variegated agricultural innovations such as soil preparation, weeding, application of fertilizer, irrigation, and harvesting described in the chapters on farming in the 1st c. BCE agricultural treatise *Fan Shengzhi shu* (Writings of Fan Shengzhi), the "alternating fields method" (*qutian fa*) and irrigating method (*soutian fa*) are especially outstanding in technical details. The former method changes the custom of planting seed on the ridges, to plowing wider furrows for the course of seeding. The earth falling from the ridges into the furrows creates deep root systems against droughts. After field becomes level by midsummer, the positions of the furrows and ridges were reversed in the following agricultural yearly cycle (thereby "alternating method"). The new method, combined with the new irrigating technique, reduces the need for fertilizer or fallowing that leave fields idle and uncultivated for a long period of time (Lewis, 2007, 103–5). Furthermore, they better preserve the water and nutrition in the soil and prevents wind from blowing away the seeds (previously planted on the ridges). In practice, these productive innovations greatly enhanced the rate of production (especially yields from marginal lands), quality, and standardization of farming (Hsü, 1980, 118–9), allowing more flexible management of resource input (fertilizer, seeds, irrigation water etc.).

As the manual and other historical sources (such as the *Kao gong ji* [Guan & Hermann, 2020]) show, these farming techniques were innovations of the time. In the practical reality, the struggle for the hard-earned balance between the slow mechanization of the agricultural process and the reliance on the old-fashioned labor-intensive method (Lewis, 2007, 105) confirms the view in the text that emphasizes the

importance of techniques and their mastering over the practical uses of its outcomes. From the original dual-conception perspective, therefore, they seem to belong to the emergent state of *technopoiesis*. However, a close reading of the sources shows that such inventiveness is greatly indebted to (and interdependent with) the already existing measuring techniques. For example, the "Basic Principles of Farming" section advises for the implementation of farming techniques in strict accordance with the measurement of time, where knowledge of the (more or less) time measurement of the solstices, the coordination/timing of "breath of heaven and earth" (i.e., the naturally inherent temporal and spatial heterogeneity of the seasonal cycle and soil/crop conditions), and the recognition of specific "*qi*-nodes" in the lunisolar calendar scheme that reflects an attempt to coordinate harmony between different soil/field/crop conditions and the "heavenly" (seasonal, meteorological, and early ecological) considerations (for the cosmological and astronomical thinking and its connection to politico-religious concepts, see Pankenier, 2013). The section on the springtime seeding process, furthermore, requires precise measuring skills of the pole carpenter as well as specialized knowledge of the measure unit of the time (see Hsü, 1980, 280–282); all of which involve technical knowledge or action centuries-old and far from being "emergent" and "innovative." Moreover, as demonstrated by studies of imperial history, the seemingly "impractical" and non-purpose-driven considerations, such as the ecological condition and the problem of maintainability of fields etc., "no matter how [their] universalistic pretensions were proclaimed" can be read as part of a larger teleological agenda for the imperial enterprise (Pines et al., 2021, 18 and *passim*).

Measurement (and measuring) thereby provides for a fertile site of *technopoiesis* that admits select forms of theory and practice (and culture, disregarding each "age" or "stage of development"), casts them in the so-called "interactive emergence," as new techniques (such as irrigation, farrowing, and seeding) become more practically complex, and age-old ones (such as tool casting, time observation) become revitalized with new meaning.

3.2 Measures Reincarnated: Poietic Clusters

We have shown above that the cross-benefiting development of different kinds of interactive technologies renders the labeling of one as "emergent" and the other as "mature" inadequate. Taking up agricultural development as an example, the innovativeness of the techniques lies quintessentially in the attempt to manage resources and apply inputs *not* uniformly, as it is typically conducted in conventional farming, but more sensibly and flexibly—in both ontically and ontologically measured steps—aiming not only at maximizing yields of product but a more sustainable, so-called emergent "organic" (agri)culture. While in the long haul of Chinese agricultural history, this universalist goal seems virtually unattainable (Lewis, 2007), it is crucial to recognize the poietic dimension of the technology with specific, characteristically "unconventional" purposefulness. Shifting the focus away from Qin-Han agriculture, the section below invites the readers to consider another possible form of existence of *technopoiesis*, that is, when the earlier technopoietic items survive

and thrive in creative ways (hence "reincarnate") into later (presumably more technologically advanced) age in the form of "poietic clusters."

One example of the spectral and impressive "poietic cluster" in the site of measuring is measuring concepts that somehow resisted the early imperial period unification, traversing freely and creatively—poietically—between semantic, philosophical, historical, and religious realms. Trackable in both written and material sources, they are "words" not made to be obeyed but to be believed (juxtaposed with Deleuze and Guattari's *mot d'ordre* that are made to compel obedience). While grammatical classifiers ("quali-quantifiers" that are often paired qualitatively, creatively, and poetically with specific nouns and reveal their innate property or state of being, to be differentiated with unit words for numerical counting and measure words denoting merely the quantity of the named entity) are habitually *untranslated* in the interpretation of ancient Chinese texts (onto-poietic measures are considered redundant in modern rendering, as they are perceived as not contributing additional meanings to the expression), such practice conceals one of the most fascinating transformations of onto-poietic measures (and measuring practice) to metrological concepts. Their belonging to the poietic realm is not enough to excuse for their conspicuous absence in the critical studies: the transformation itself, as we show below, is accessible as "processes of grammaticalization which support a classifier system that carries obligatory information on number" (Xu, 2012, 12) that welcome (qualitative and quantitative) critical analyses.

To briefly illustrate the nomadic and ubiquitous existence of the "poietic clusters," we must first recognize the potentially poietic, cosmogenic dimension of measuring concepts (which Crease emphasized, 38–42). For ancient Chinese thinkers, arithmetic measuring (such as the harmonizing of musical pitch or *lü*, length or *du*, capacity/volume or *liang*, and weights or *heng* etc.) is the privileged site of the materialization (incarnation) of the pre-arithmetic ways of acting and reacting (and being acted), i.e., to be with the changes of cosmic Discipline (*lü*), lawfulness (*du*), measurability (*liang*), and balance (*heng*); all of which point to an ideal state of being for both individual human beings and their community or "states." Measuring tools such as the compass (*gui*), carpenter's square (*ju*), ruler, scale, steelyard, dipper, and time-measuring device (incense, arrow, early "clocks" etc.) regularly appear in philosophical and astrological-astronomical discussions, ritual and religious activities and their visual representation (see Olberding, 2014, 68). Belonging to a larger belief of the correlative operations within the internal (bodily) and external (environmental) correspondences, early measuring techniques are virtually and practically almost *uncontainable* within the boundaries of the standardized, static arithmetic measurement system. While they almost always represent a purposefulness and lawfulness in the legitimization of practical technologies and principles, measuring *termini technici* (such as *liang*, *quan* "weighing circumstances," "exigency," literally "weight of a steelyard" or *heng*, "balancing" lit. "balance beam"), constantly seek to defy its arithmetic function and purpose (e.g., to evaluate the degree of a quality laid out hierarchically like a scale), taking up unquantifiable ideas (such as plenitude, emptiness, intensity, analogic rhythms, efficacy or infinity) as its "objects." As *poiêtikê technê*, they are invested in the development of techniques of writing before print technology (Meyer, 2012)—whose semantic shift documents the transformation of writing and printing technologies stimulated

by cultural needs (e.g., the separation between the classifier words of *pian* "[bamboo] chapter" and *juan* or "[silk/paper] scrolls" indicating increasing dependence on silk and silk-processing techniques for writing during the Warring States and early imperial period, and the "extra-governmental" print technology that emerged from the need to produce devotional and/or calendrical texts; Zürn, 2020, 380; Tsien 1985, 152; Meyer-Fong, 2007, 793, n.12), as embodied mechanical metaphor for the ethical and military-political decision-making techniques (Zhou, 2019), and in curative practice such as pulse-taking, collecting, dosing, and weighing medicaments, and method of needling (Brown, 2015; Kuriyama, 1999) etc.; just like the classifiers and measure words, most of the practices are live, ever-evolving traditions in modernity.

A preliminary investigation yields two types of such "poietic cluster(s)" tracible both linguistically and archaeologically: the first type involves words of measure that "resisted" centralization and unification by becoming unspecifiable unit; a second type is recruited in the standardization regime (e.g., listed and used in official documents for economic activities), while somehow nourishing parallel "lives" outside the early metroscape. Moreover, the same root word or concept may belong to the overlapping space of the two fuzzy typologies. Linguistically, this transition can be traced as they transform from measure words (roughly the period of Archaic Chinese, 11th–3rd c. BCE) to individuating classifiers (roughly, 2nd c. BCE-3rd c. CE), a grammatical category unique to Sino-Tibetan and other Asian languages.[14]

Specifically, the first group of words (and the thinking and action they imply) was able to survive in the original forms into and after the standardization period and become unspecifiable units—some as classifiers, highlighting the nature of being of the noun—by dropping its normative quantifiable expression as measure word (also called quantifier with the unit of measure in archaic Chinese grammar). One of such word and idea, *peng*, for instance, drops part of its original meaning of double-string (of cowries), as seen on the bronze inscriptions that mark the origin of the monetary system of late Shang (12–11th c. BCE) and especially Western Zhou (1045–771 BCE) (Goldin 2018, 336–348) during and after the imperial unification of measures. The archaic measure word *peng*, "strings of" (often occurring as enumerated nouns and as quantifier word, for cowries etc.), together with other contemporaneous words such as *bing* (denoting a collection of several horses) and *you* (a container for sacrificial wine) (for more examples, see Jin, 2019, 3–10), underwent such transformation both collectively and individually in the form of "poietic cluster." Originally describing the *state* of the set of stringed cowries (expressed graphically as *peng*朋), it became an early (pre-Imperial) measure unit that corresponded to a specific arithmetic value used by

[14] In Chinese linguistics, measure words are distinguished from unit word (used for numerical counting) and classifiers (that classify or categorize nouns by highlighting some salient or inherent properties of the noun and thus contribute no additional meaning). Measure words, on the other hand, play a substantive role in denoting the quantity of the entity named by the noun. While measure words are language universals quite common in Indo-European languages, the unique grammatical categories of classifiers have almost no Indo-European counterparts. See Xu (2012). The periodization is based on the rough estimation in Xu, 2012, 103–4 and does not necessarily reflect the historical reality of technopoietic changes of the measure words and practices. While non-linguistic studies (e.g., Zürn, 2020) tend to use "measure word" for both terms, we wish to highlight their innate difference.

the Shang and Zhou peoples.[15] A recent discovery of the Western Zhou Kang Ding inscription, where a jade in the exchange was valued "fifty *peng* (of cowrie shells)" has led scholars to interpret it as the prototypical use of the idea of purchase and exchange (Yang, 2019, 138–139). Later, its double meaning based on analogic thinking (from the state of being together of the strings to mean a peer, friend, pair, companion, or league) and standardized measuring thinking (such as "increase by ten double strands of turtle shells"; Shaughnessy, 2014, 5, 32) coincides in early text such as the *Zhou Yi* and *Chu Ci*: to "*peng*" is to recognize one's true companion and to be in the state of "being together" just as two strings of cowries (and realizing, in quantifiable expressions, the value of so doing). As part of the self-cultivation techniques of recognizing the value of and nourishing one's true other half (*peng*), *peng* becomes an important notion in early philosophy, e.g., a key point of Zhuangzi's critique of the Confucian philosophy: can the true state of being involved evaluating partnership in quantifying terms? After the imperial unification of measures, the analytically concise and deliberately paradoxical idea "drops" the standardized measuring connotation, as cowrie shells declined and disappeared in the Qin-Han period (Yang, 2019, 138).

Another example of the transformation of archaic measure is the term used for the counting large stones in masonry, *tóu* (*shítóu* later become the standard word for "stone" and a *tóu* monosyllabic localizer meaning "above" in standard Mandarin; Feng, 2014, 17) which appears in early (pre-Han) period inscriptions as a measure word for cattle, sheep, and sometimes people. However, archaeological evidence from the Eastern Han period suggests that it then became a classifier, found often in the tomb inscriptions or mason signature that lists the commandery, the name and occupational title of the mason, and occasionally the source of stone. In the longest inscriptions for the stone leveler/mason excavated in the tomb for Prince Xiao of Rencheng near Jining, Shangdong, a complete sentence "Mu Sun from Xuchang county has [completed] fifteen large *tóu* of stones. One *chi* [in thickness]" is carved in large and delicate, even individualistically variable forms of calligraphy (Li & Branner, 2011, 390–392).[16] Beyond the function of a standardized measure word (that only denote the quantity of the addressed entity), *tóu* (head) clearly highlights the inherent property of the noun (*da-shí*, large stone), therefore belonging to the grammatical category of classifiers or "ontological measures": in the hands of the stonemasons, the "stones" are given salient qualities that were once attributed exclusively to human and cattle; they become, as if, alive. Besides the seminal grammatical change, the quality of the inscription confirms the point we made earlier on the intersecting of the mastery of techniques (stonemasonry/drafting and literacy/art). Commenting on the esteemed status of masonry specialists in late Han, Li and Banner comment that, "Stonemasons, at least master stonemasons and master draftsmen, may have been some of the most literate artisans during the Eastern Han because of

[15] One *peng* equals two *chuan* "string," one *chuan* equals five *bei* "cowry/shell.".

[16] For a more literary translation, we added the meaning of the classifier "*tóu* of" to the original translation made by Li and Branner, who do not emphasize the grammatical distinction between measure words and classifiers.

their involvement in carving funerary epitaphs and stelae. The famous stelae appear to have been written first with brush calligraphy, possibly by a student or colleague of the deceased, and only then would the stonemasons engrave the calligraphy into the stone. Funerary epitaphs of lower- to middle-income persons would not receive such luxury treatment" (Li & Branner, 2011, 391). The observation reveals the agential exploration on the part of the technicians in the process of grammaticalization and meaning-creation.

The second kind of "poietic clusters" that retain both a standardized and metaphoric meaning and application features ubiquitously in Chinese history (a topic of the last section). For example, the same word for "stone" underwent both phonetic and semantic changes as it became a new standard unit of weight measure ("picul," pronounced *shí*, equals 120 *jin* "catties") and later a volume measure ("bushels," now pronounced *dàn*, equals ten *dou* or pecks). In astronomical and historical texts on observing techniques (as the means to identify the triaster or *sanxing* or Orion's belt), however, the word suggests analogically the planetary power to weigh in the balance, to establish laws and standards (instead of meaning a specifiable measure of the unit of the stars, Pankenier, 2013, 468). Therefore, to regard measurement as the first and foremost social devices primarily used to enable economic and socio-political organization is to disregard the strong cosmological dimension attached to measurement as *technopoiesis*. Beyond serving as managerial devices for transmitting skills and in achieving balancing socioeconomic values, initially (and throughout ancient China), measuring enables both a new level of technology and a new set of words and expressions with fine ontic and ontological differences, including classifiers, measure words, numerals, and unit words (Jin, 2019, 3). The examples above show that *technopoiesis*, as living clusters, may exist within forms of *technopraxis* (such as metrology) in various stages of development of different, overlapping *poiêtikê technê*, "impractical" practicalities, and philosophical considerations. Rather counterintuitively, we may be able to appreciate the creative dimension of standards (or attempts at standard making) better outside a strictly Platonic/Aristotelian framework.

4 Ancient Chinese Measurement

Since the beginning of the twentieth century, the concept of measure has been well-investigated by scholars of China in various fields, that is, if we take it as a normalized term in mathematics and science. The less abstract forms of measuring of pre-classical China can best be described as idiosyncratic: on the surface, the early experience with measures and measuring resemble our everyday default interactions with numbers and computations, so much that the two systems seem congruent. And yet, from the early period onward, measures/measuring retains a totally unfamiliar shape and implication, with sometimes agential and chameleonlike force, an aspect that has been suppressed in the academic studies until most recently in cultural studies. Traditional scholarly convention treats them as a holistic metrological idea for the standardized, uniformed, and systematized measure units (often, in liaison, called the *duliangheng* system), an approach that fails to see the studies of ancient measuring techniques as a subject beyond historical anticipations of modern precise

sciences. Following Amzallag's critique and a new notion of *technopoiesi*s, the rest of the paper shows that the conventional approach to the (*yin-lü-*)*du-liang-heng* may be inappropriate for accounting for the end-products (here measurement of musical notes/pitch standards, length, capacity, weights, measuring apparatuses, their manufacturing and application) embedded in the process. Parallel to the analysis of *yin-lü*, they—as technical terms—represent both an embracing of standardization during the Qin and Han as well as a continuous philosophical suspicion of both quantitative graduation and standardization. As technopoietic ideas, however, they may stand for the interdependent facets of ancient Chinese measuring *thinking*, co-existent in harmony and tension to the dynastic, symbolic reform of the standards of measures from the Han period and on: the primordial and hidden *yin-lü* (and to some extent, *shu* or "numbers"), the ontic-ontological *du-liang*, and the balancing *heng*. Expressed in numbers and units that are unreducible to metrological rubrics of a metaphysical order of enclosed cycles of correlative sets (Morgan & Chaussende, 2019, 4), the measuring concepts had real-world effects; their story, told linearly, is a linearity of "a line of becoming that has neither…departure nor arrival, origin nor destination" (Deleuze & Guattari, 1987, 293).

In the studies of the history of (pre)modern technology, the vitalizing aspects of standards are often underestimated (for its importance in the early electrical industry in the West, see Schaffer, 1992). The narrow denotation of technopoiesis as a juvenile phase of technological development and of "ontological measurements" as a logical and practical impossibility in the modern, mathematized metroscape makes narrating the stories of ancient Chinese measurement almost ironic: as Scharff noted, the irony is probably unintended (Friis et al., 2013, 237), as Crease's global history of the quest for absolute measures comes from an impassioned introduction to "not just Lockean tools but (devices of) art" (i.e., the Chinese chime bells and flutes, the West African gold weights etc.) and arrives at universally standardized metrology, "one of the greatest triumphs of modern civilization."[17] The unintended irony can be deepened, if we scale down to the section on ancient Chinese metrology: as much as the measuring implements are considered creations of true art (onto-poietic), Crease's story nevertheless is one of a galloping linear progression towards the two-thousand-year-long unification enterprise from the first emperor of Qin onto his generations of political successors. The enterprise of creating a metrological empire seems so successful that the reader may wonder whether the "ontological measurement" is an Arcadian dream after all. Hence, the alternative trajectory of study: instead of measuring the historical objects and practices against us (and our modern understandings of "practice/practicality," creativity, "metrology," "measures" etc.), why don't we let the words and devices speak for themselves, measuring (and being measured), as much as possible, by their own standards? While a fuller answer certainly deserves a separate study, it suffices to discuss the ancient and surviving system of metrological units, the (*yin-lü-*) *du-liang-heng* in two small sections.

[17] Crease's storytelling is largely informed and influenced by Qiu Guangming, whose publications on the *du-liang-heng* system based on modern measurements of actual surviving measuring devices include *Zhongguo lidai du-liang-heng kao* [Researches on measures of length, capacity, and weight in the successive Chinese dynasties], Kexue chubanshe: Beijing in 1992 etc.

As aforementioned, not all measuring techniques and concepts are co-extensive with the development of (the technology and statecraft of) metrology. In fact, the onto-poietic nature of some of these ideas constantly threatens to challenge instead of to reinforce the very foundation of metrology and the construction of universality. Nonetheless, if we *do* focus on the metrological units (the measurements for pitches, lengths, volume or capacity, and weights, in classical Chinese, summarized as the categories of *yin-lü*, *du*, *liang*, and *heng*), their equivalences, and origins, it soon becomes clear that even these seemingly immutable ideas foretell their own (future) stories by virtue of having a highly dynamic "past"—one that digress greatly from the neat "origin story" as preserved in the imperial "Lü-li zhi" chapter of the *Han shu* attributed to Liu Xin (ca. 50 BCE-23 CE), from the creation of the *huangzhong* chime pipe in high antiquity that represents the sound of phoenix (which serve as the basis of pitch or *lü*) to the Five Length Measures (*du*), the Five Capacity Measures (*liang*), and Five Weight Measures (*heng*) (Morgan & Chaussende, 2019, 19–20), a historical period of rich (and to some extent unsolicited and hampering) information when the quasi-"data" scientific and philosophical interests in the calendrical, cosmological, cosmogenic "dating" techniques threaten to override the blurring of important distinctions between (again, in Heidegger's terms) the "calculative" and "meditative" standards of measurement in classical technologically oriented texts such as the *Han shu* and *Huainanzi* (above all, between musical notes and pitch standards, see 4.1) within the overall entanglement of creativity (*poiesis*), theory, and practice of musical perception.

In accordance with the measuring words and techniques introduced above, the locating of the basic notes (*yin*) and twelve standard pitches (*lü*), that is, to coordinate the pitches of different musical instruments in an ensemble, is ritually analogous to the art of ruling in early China. Unlike the modern perspective that views the function of the *yin-lü* as merely complementary to that of the notes, the technique of making the *lü-zhong* (chime-bell for the accurate pitch) and playing the chime-bell (*zhong*) are regarded as the primal category of the art of measuring, followed by the searching for the measurements where the efficiency and reliability of the outcomes are frequently ignored. The process, involving the active participation of priest-technicians (and to much less intensity, the whole community), is not characterized so much by a "presence of end-product" but by a *purposefulness* (e.g., a keen wish to restore the cosmic harmony of the stability of the pre-technological world and changes vocalized in early texts such as the *Huainanzi*) and a sense of immediacy and *preparedness*; both often mistaken as "impracticality," as we have argued in the first half of the paper. Additionally, both the searching for the proper *yin-lü* and the creative process of inscribing the bronze bells seem to fit with Heidegger's account of the proper measure that assumes the appropriate or fitting (*anmessende*, containing the notion of *Maß* or measure) use of and attitude to the thing involving a kind of adjustment that conforms to what is most proper to the used thing (Kleinberg-Levin, 2005, 229). Except for the macro-scale, two-thousand-year "development" of the art of measuring and calculation of imperial history, however: the measurement system elaborated in a technopoietic context is exploitable by both the centralized authority and individuals for the will to control and dispose of things (and to complete the mercantile goal), thereby dismissed from the generative constraints inherent to the original onto-poietic context.

Based on this refined understanding of *technopoiesis*, the first subsection surveys the late Bronze age culture of chime bell and shows that, the Western Zhou

cities—center of not only the cosmological (celestial) and political (terrestrial) domains (of imagination) but also home to design and production of "higher-tech" items (including highly elaborate bronze vessels and bronze-fitted chariots) and agricultural labor force—constitute an ideal site for the context of *technopoiesis*, followed by a broad introduction to (and conceptual experiment with) the (*yin-lü-*) *du-liang-heng* system. While a full discussion befits only a separate presentation, we argue that it is precisely towards the "incomputable" that many of the ancient Chinese "measuring" thinking and techniques (broadly speaking, including "free" movement such as a way of finding and following a "path," as in divination and self-transformation) are purposefully directed, in which the ritually or metaphysically transformed "self" are enabled to *measure in experience* the (otherwise incalculable) states of interiority and potentiality with sets of living (in Heideggerian terms) measuring instruments (*Messzeug*), such as the categories of the (*yin-*)*lü-du-liang-heng* devices. There is never just one of such "things" or (*Wohn-*)*zeug* in Heidegger's ontological-categorical definition of something on-hand (*vorhanden*) and what-is (Parkes, 2022, 17), and so is there hardly one of such (measuring) device (and its specific technological circumstance) in early China that is not in conversation with the *Umwelt* of other basic "things" or tools.

4.1 Chiming and Discipline

One of such living and enlivened "measuring" devices are *sets of* bells (including the bell-stand), whose production and devising are fine examples for the "measuring" instruments that embody the phenomenological distinctions between the ontic/ontological and po[i]etic/practical (as well as their entanglement and non-dualism). Cruriously, it is not so much the sound itself, but the connection between the phenomenal material and the cause-effect of the setting-up of the technological "clusters" and bell-ring that seem to draw the attention from the early thinkers.[18] The most ancient periods (particularly the Zhou [c.1045–256 BCE] dynasty) of China are often characterized as a culture of bells (Lehr, 1985; von Falkenhausen, 1993).[19] Owning to the discovery of

[18] For instance, Parkes (2022, 32) referred to an influential episode in the *Zhuangzi* about the craftsman of bell stand, Qing, whose lived experience and self-narration of "observing the nature of the wood as heaven makes it grow" and waiting for "a complete vision of the bell stand" before picking his tree and creating a "daemonic" work were analyzed in relation to the attitude toward technology recommended by Heidegger in *Gelassenheit*. In the same veins of "daemonic" craftmanship, the creation of the patterns of logic and phenomenal-material correspondences between the sounding of metal/bronze bells (generic term, *jin*), drums, and jade chimes were important analogies used in early Confucian texts (such as the *Mengzi* 5BI) on the technological experience of the archery schema, which is projected onto the domain of moral experience opposed to mechanistic strategizing (Zhou, 2019, 29–30).

[19] Small bells (*ling*), often found with turquoise inlay plaques near the chest, waist, or pelvis of the body in graves, are the first large objects in bronze found in Erlitou—major site in Chinese Bronze Age archaeology with specialized industries such as bronze casting (Thorp, 2006, 40-41), its homonymous Culture (c. 1900-1500 BCE) beyond the site marks the beginning of stereotypical bronze ritual assemblages in early China (46). While links have been made between the ritual usage of these early bronze bells or jingle-bell (*luan*) in Zhou inscriptions, produced and used in various styles in different geographic regions, the term "bell culture" here refers to the chime-bells (*zhong*), often with elaborate inscriptions on the outside (a rarity for bronze inscriptions), serving not only as auditory and visual instruments but also as injunctive tools for written pronouncements (Kern, 2007, 141; Li, 2018, 80-82).

the harmonic ratios between the notes in a musical scale, rows of chime bell (*zhong*) were manufactured in various parts (particularly in the southern State of Chu and nearby Chu cultural regions) and regularly used with other instruments (particularly the flutes and the drums) in formal ritual ceremonies (*yi*) (Major, 1994). Beside musical performance, bells—up to the heights of 1 ½ meters—were used for all kinds of purposes, including setting the right pitch (*lü*) and preserving written information. Ever since Shang times and especially towards the late-Western Zhou, the belief that the preservation of *yi* or ceremonial decorum was the primary obligation of the ruler became increasingly important (Pines, 2002, 92–3). In the musical (bell, flute, drum etc.) rituals, the ruler or the head of the lineage held primary responsibility for ordering the performance, thereby serving as inspiration for his subjects. As a unique media for representing historical "data," a study of the inscriptions on different Western Zhou bells (such as the late Western Zhou Liangqi *zhong*) with varying layouts (such as the large ones in a graded chime vs. the smaller ones) and other vessels shows that they were often rendered creatively by craftsmen with the so-called "blueprints," i.e., a kind of exemplar manuscript employed directly in the technical process of the bell and other inscription-making (Škrabal, 2019, 296–301), a subjective process of selecting, representing, reformatting "what an inscription is going to say" (275, 281–282, n.23).

The crucial links between the cosmological arising of concrete phenomena, the important idea of (*wei*)*yi* or ceremonial decorum (prescribed by hierarchic order of time and lineage), as well as the arduous process of locating the onto-poietic, "muddy" and unprefixed musical pitch (*lü*) and the explicitly stated *yin* ("tone[s]," i.e., modern solfège terms) names are evidenced by the inscription on the *Lü-zhong* bells and other ritual musical/measuring vessels (von Falkenhausen, 1993, 300). The first mentioning of the term *weiyi* (prominent idea that referred to the precise, orderly, and awe-inspiriting ritual performance and its outer manifestation), dated to King Li's reign (r. 857–842 BCE), appears in the inscriptions on the Late Western Zhou Guo Shu Lü-*zhong* chime-bell (Shirakawa 1962–1984, vol.26, no. 155). As the ritual display, the musically expressed *weiyi* involve prescribed movements of "grasping" the transmitted virtue, a process perceived as "heart/body-stretching" for the "youth" and their education (Cook, 2011, 308–9). Literature from the period (the *Shi jing* or Book of Odes and the *Yi jing*) associates the orderly arrangement of the instruments and the blending of their notes as the heaven-sent blessing of cosmic harmony, and the technique of refining the "(musical) standards" or (*yin*)-*lü* is placed as the primary category of the art of measurement. For the longer duration of historical development, the technological, ritual, and political practice that operate within the overarching cosmology that sees the "(five) tones" or (*wu*-)*yin* as the concrete phenomenon embodying the primordial cosmic harmony is shown to be carried forte into the Warring States and Han periods, when it was widely believed that the *yin* musical notes testified to the possibility of a harmony inherently generated and strengthened by the generative force of constant "change" (Cook, 2020, 220; Kern, 1997, 44).

Before the time when powerful computers enable predetermination of the shape of the bells with different overtones, both the shape as well as the extent to which the end product is adjusted were assumed to be almost entirely empirically determined. While little details of the technical (or techno-poietic) expertise were recorded in

received literature, the meaningful presence of the process of emergence can be seen on the excavated bells (e.g., on the famous Marquis Yi set-bells) whose inner walls carry traces of the post-model-casting tuning techniques that facilitate the fine-tuning (von Falkenhausen, 1993, 118–21). The high degree of pitches accuracy and acoustic quality of Chinese Bronze Age chime bells, such as the sixty-five bells found in the rich grave of the Marquis Yi (433 BC or shortly after) suggest the success of technological creativity with empirical knowledge (79). Sharing some of the basic casting techniques with other bronzes, these early bronze bells were likely cast at the same workshops as other ritual bronze vessels (many of which are measuring tools and devices), as evidenced by the bell-casting molds and other archaeological remains of the bronze foundry of the State of Jin at Houma (Shanxi).[20] The application of these common casting techniques, represented by shared practical function and (what von Falkenhausen termed) the standardized decoration scheme on the appearance of the bells, coexist with astonishing regional and case-by-case technical variety (von Falkenhausen, 1993, 254–255, 376–377). In the case of Marquis Yi's *yongzhong*, for instance, more than one hundred separate pattern blocks per bell were carefully selected (Hua, 1981) in a way that the 72 three-note consonant chords could be easily struck by five professional musicians (for the mathematical structure of the frequencies of this set-bells, see Okamoto, 2007, 344–345). Furthermore, the flexible mnemonic formula for technicians that describes the dynamic relation between bell shape and timbre (and perhaps pitch) in early manuals supports the view that the design of the *zhong* is often a collaborative empirical investigation by different producers or workshops, an important characteristic attributed to *technopoiesis* (Amzallag, 2021, 804).[21]

Here, regarding the foregoing analysis on the insufficiency of cosmological and other cultural considerations for identifying technopoiesis, should we move beyond the restricted search for only the embryological phase of a technology, a further path of investigation that may yield more vibrant and refined results would be to look at the different distribution of the process of a technique (such as the search for the most fitting [measured] arrangement of keys originated in the pitch standards of *lü*) among different typological groups—potential "poietic clusters"—of the end-product within the overall context, where elements of techno(-onto)-poiesis and -praxis may convene. In the case of the *yong*-bells sets, as we have discussed, the method yields intriguing evidence for the onto-poietically inspired tone-definition distribution patterns made by the early *Yin-lü* ("Musical Standards")-technicians: in terms of the named keys among different groups of bells within the *yong*-set, the groups of bells of the middle-tier have the *lü*-measure adjusted to the measure of *yin*, whereas the bells that belong to the third group of that tier have the *yin* adjusted to the standard of six primary *lü*. In fact, the interplay of the two standards is so vital, that "the *dual pattern* of tone-definition distributions in the Zeng [i.e., the Marquis Yi of

[20] Original archaeological report published in *Wenwu* 1960 (8/9):7–14, 1961 (10):31–34 and *Kaogu* 1962 (2):55–62.

[21] *Zhou Li: Kaogongji* "*Fushi zuo zhong*" (*Zhou Li Zhengyi* 78:15a-16a) and Chun'guan "*Diantong*" (Ibid., 46:1b-4a; cited in von Falkenhausen, 1993, 79).

Zeng] inscriptions…is *built on this very tension* between the *yin* and *lü* dimensions of each tone" (von Falkenhausen, 291–96, 300, italics added; further discussed in Cook, 252–53, n.52).

One way of interpreting these intriguing findings is that the technique had been nourishing the co-existence of fundamentally different standards of measurement that are respectively "appropriate" (albeit not exclusive) to and dominant in the so-called technopoiesis and technopraxis (under our modified understanding), until the "semantic shift" which von Falkenhausen reckons to be "sometime in late Warring States or early Western Han times" where the distinct conceptions of the *yin* and *lü* (301–306) got conflated, one that finds "parallel" to the blurring of distinctions between notes and pitch standards in modern practice (299, n.38; e.g., as the earlier solmization systems of do- [ut] re- mi- or C-D-E were supplanted by notes designating fixed frequencies). Indeed, tens of centuries later, regarding the radical shift in understanding the basis of musical notation, to which the techniques in learning and creating music have been exposed—from the medieval, interdependent "congeries" to a *frequency-biased* notion of the pitch—we are still searching for the answer to the same question that prompts and permeates the present analysis: "[I]f it is true that 'paper' modal assignations may be disconnected from realized sounds…are we not further overlaying modern prejudice on early music by assuming that in order to be 'coherent' it must conform to *our* standards of long-range tonality (and frequency)" (Bent, 2002, 215; italics original)?

Different conclusions again arise as we apply Amzallag's dual conception of technology to the case. If we understand *lü* as a technical term for one of the twelve standard pitches, the technique of casting the *lü*-chime-bells reaches its "mature" stage approximately during the mid-Western Zhou period. Conceptualized as tones of fixed frequency in Western musicology, however, the technique does not develop from a truly mature stage, as the idea of frequency was not established at the time and the pitches never reach technical perfection. In fact, the development of the technique during the Shang and Zhou may be told as a story of an often futile but tireless searching for the "perfect" *lü*-standards. Centuries (even millennium) later after its first conception, it still emanates features of a strong cosmological dimension typical for the so-called "juvenile" stage of technique as Amzallag proposed. Running parallel to this search for the onto-poietic measurement of "primordial cosmic harmony" and material means to quantify its expressions is the, rather surprisingly, slow trajectory of technological relapsing (one that is capsulated in the historical Needham's question of the past and future of Chinese technology and science). On a larger scale of time, the history of the bell-casting technique is one of regression, rather than progression: in the subsequent ages of "development," the end product became significantly acoustically inferior to the early counterparts.[22] How shall we account for

[22] As Falkenhausen noted, "…the post-Qin chimes contrast most markedly with those of the Bronze Age in terms of wall thickness and its correlation to different sizes of bells. Both the perceived pitch and the timbre in the Bronze Age chimes, whose wall thickness is held constant while the shape of individual bells is exceptionally well-suited to their intended function as graduated chimes, are technically far more superior to that in later chimes, typically consisted of sixteen round bells of identical shape and size, but with difference in thickness." See von Falkenhausen, 1993, 95–6.

what seems to be a lingering presence of the "poietic" spirit, one that gradually deals away with practical wisdom or *mètis* that precedes the antithesis between *praxis* and *poiesis*? Perhaps (as Amzallag relates to its transient existence), when the emergent (techno)poietic dimension fails to interact sufficiently and effectively with other more mature technical and practical skills, its material expression ceases to be techno-poietic, but a mere resultant of such. It becomes, in the light of the deterioration of the quality of the act (and art) of chiming (*lü*) in early and Middle Period China, an *undeveloping*, with an empty purpose without *purposefulness*, defined to never achieve or end. Perhaps this explains the curious historical development of the measuring concepts, as the creative, chiming technique of (*yin* and) *lü* became hidden from the formulaic expression of the *lü-du-liang-heng*-system, while *lü* meaning code/coding endures through subsequent histories. Nevertheless, the importance of contained but not-fully-enclosed space (embodied, e.g., by flute, or *lü-guan*)—survives with the notion of *lü* (as a harmono-metrological idea, the physical pitch-pipe, regulator-tube, or tubal regulator) (Morgan & Chaussende, 2019, 53, 54).

4.2 The (Yin-Lü,) Du, Liang, and Heng

Taken at the face and universal value, the note-pitch, length, capacity or volume, and weight measurers (the *yin-lü* [*shu*], *du, liang,* and *heng*) are to be labeled "ontic" (concerning real entities and devices) in the dual (ontic vs. ontological) conception of measurements. However, a closer look at its extensive and *poietic* application in philosophy and religious thinking suggests that this is not the case in the ancient Chinese setting. No longer taken as one holistic phrase (e.g., the *duliangheng*, simply taken as "weights and measures") that suggests the unification of standards, but as interdependent, collaborative, and interactive clustering of concepts, we see both the ontic praxis/practice (*du,* and to less extent *liang*), onto-poiesis (*liang*, to less extent *du*), and the "traversing" and orbiting *heng* (literally "balancing beam"), intervening in *neither* of the conceptual domains, and the hidden, "muddy" *lü* ("pitch standard," which has both properties, but verging towards the domain of *liang*)-*Yin* (notes) and the qualitative-quantitative *shu*-numbers; the three were employed as normative *theôria*. In other words, the three (four) aspects of measurement—constituting the four-cornered propositions or tetralemma[23]—both observe and, at the same time, question the clear boundaries between the set, antagonist categories of ontic/ontological and po[i]etic/practical (Fig. 1).

Perhaps the most intriguing historical observation left out in Crease's narrative of the ancient Chinese metrology is again the "forgetting" and hiddenness: in the ages that followed the creation of metrological units, the idea of *lü* became hidden from the formulaic expression of the (*yin-lü-*) *du-liang-heng* (Wu, 1957, 2–3). We sense a poetic element in the transformations of the idea of *lü* in subsequent times: as technical terms, such as in the Sui (581–618 CE) official literature *zhi* (treatise) on various

[23] One may, coincidentally, recognize such tetralemma pattern that overcomes dualities and resists the tendency toward reification in the (South Asian, Buddhist, and other) "four-proposition" traditions of truth(s) and realit(ies).

subjects (legality, astronomy, geography, and metrology), it became a generalized, ultimate, and symbolic legal standards qua *étalons* (astutely translated by Morgan & Chaussende, 2019), against which the particular is weighed on public scales. At the same time, its onto-poietic dimension makes *yin-lü* a true nomadic subject (echoing Deleuze and Guattari's formulation of nomadism): its hiddenness from the *du-liang-heng* system marks its curious "return" to the realm of mytho-ritual-techno *poiesis* (and, in a sense, forming a "poietic cluster" all by itself). In cultural and religious practices, the *lü* becomes part of the famous verbal formula featured frequently in later Daoist mystical techniques (Robinet, 1993, 37), whose "impractically practical" *poiêtikê technê* led to the chance discovery of the formula of gunpower and other medical practices. As a poietic concept, it becomes an embodied, rhythmical analogy to the injunctive and disciplining force of cosmic order. Meanwhile, a tripartite measuring conception is cast in the model of (*yin-*)*lü*: the *du*, *liang*, and *heng*, all of which simultaneously invested as technical terms as well as legal, astronomical, and philosophical concepts. The *shu* "number"—by definition torn between (and defying) the crude polarity of the "quantitative" and "qualitative" nature (made well-known by Granet's *La pensée chinoise* 1968 [148–166])—itself a rich topic beyond the purpose in the chapter, makes another key nomadic, Samsaric agency (of Deleuze and Guattari).[24] In the overlapped area, we find a special set of measuring tools and concepts based on the mathematical procedures (*suan-shu*). For instance, the gnomon (*biao*), a proportional tool for the indirect measurement of celestial and terrestrial distances, differs both from the more "ontic" measuring tools and techniques (*du*) for its dual functions in philosophical and technological texts and from the more "onto-poietic" measures (*liang*), for its "normative" (generic conception of objective standard or model of techno-praxis) and "constructive" functions. Based on its metaphorical and technological application, the varying images or "shadows" are perceived in early Chinese thinking as ontologically and epi-phenomenally congruent with other phenomena such as "light" (Zhou, 2022, 550, 551–555, 560) through the gnomon's optic (and *techno-onto-poietic*) observation.

Among the other major "measurements," the *du* ([the act/resultant of determining] a "span" or "measure" length or limit) is closest to the so-called ontic measurement and technopraxis (that implies the bringing together of the properties of measuring device and that which is measured). The common *du*-measures by Warring States standard include *zhang*, *chi* ("ell"), *cun* ("inch"), and *fen* ordered hierarchically from greater to lesser degrees. Still, it differs from the modern understanding of "(measuring) length" as it incorporates both real, specifiable standard measurement of length

[24] Traditional discussions often evoke "Chinese number theory" (i.e., as the pandiagonal squares of *hetu* and *luoshu* as well as the number eleven of Dao, not in the quantitative ten plus one but signifying the unity of the qualitative number in its wholeness), on a par with other cultural products (e.g., the cult of Abraxas, the historical mandalas, Hindu astrology, the Pythagorean and Mayan numerical models) to exemplify theories in psychology and psychoanalysis (such as synchronicity or collective unconscious theory of Carl Jung). Such biased method ignores the computation artefacts/implements and their processing involved in such processing. For the methodological focus on mathematical tools and the expression of shu in material forms, see Volkov, 2007, 2014.

(that varies in different times)[25] and a potentially real (but not yet unrealized), specifiable (but not yet unspecified), and even numerologically expressible quality. Beyond its metrological implication, e.g., in astronomy, the *du* indicates a linear measure of the circumference of a circle, where one du equals the distance covered by the mean sun in one day and, in omenology, a degree of acceptable variation in *chang* (constant/regular) phenomena (Morgan and Chaussende, 21). This multi-dimension of *du*, invested long before (and during) its being a metrological unit and almost never utilized within the du-system (on a par with the measuring unit of length, e.g., *chi* and *cun*), is perhaps best captured in the description of one of the most seminal transcendental categories of "*yi* 易 (Change)" in the "Xici" chapter of the Book of Changes (*Yi Jing*, dated to the 3rd c. BCE). In the text, the *yi* (Change), rendered as a book (hence *theoria*) and a *dao* (here, the way as both *techné* and *praxis*) is said to be a process of "transforming (*bian*) just as it is due to be so, coming out and going in by (the means/virtue of) *du*…"[26] the text highlight the imperative of "transforming" the law of Change into a book or a practice and despite the challenges: parallel to the idea of transforming (*bian*), the means of *du* (i.e. the material and arithmetic transformation of reality) is analogical to the techniques of writing and translating "theory" into practice themselves. Furthermore, the measuring technique of *du* (or rendering into "degree" of being) is driven by interests akin to those of modern calculus—the arithmetical attention to continuous change and infinitesimal and, oftentimes, a passion for "surreal" numerological (or *shu*) systems—and the modern obsession with statistical precision and computing. Paired with the notion of (real) number (*shu*), the synonym compounds *dushu*, suggesting the technicality for quantifying measurement, could mean either an idealized state for ritual implementation (such as in "Yue ji" [record of music] chapter of the *Li ji*) or, quite oppositely, the "pettiest" end of measuring practice in political philosophy (such as in the *Zhuangzi*).

Parallel to the *du*, the idea/act of *liang* (used as a noun or transitive verb) may refer to both the objective quantification of entities (measures of volume) and the states of being, although the latter meaning seems to be more pronounced. As means of expressing "capacity," the noun of *liang* can suggest any container (typically *without* carved measures): to have a *liang* is simply to possess *space*. The possession of the techniques of casting the ritualistic *liang*-measurement (*liangqi*) *hence* the ability to create meaningful, empowered, and containable ritual *space* are endowed with rich metaphorical and analogical meanings; the inscribed bronze vessels of early *liangqi* reveal the origin of some of the most essential concepts and religious beliefs that shaped ancient Chinese history.

This conspicuous difference between a realistic *du* and more phenomenalist *liang* reveals the tension between different ways of qualification-quantification:

[25] The length of the "foot" (*chi*) in the archaeologically and historically known measurement systems of ancient China was highly variable. For archaeological specimens of pre-Qin measures, see Qiu et al (1984) and Herrmann (2009).

[26] Adapted from Gentz' translation as of the same passage as "changing just as they are about to change, coming out and going in with measure…" (Gentz, 2021, 35).

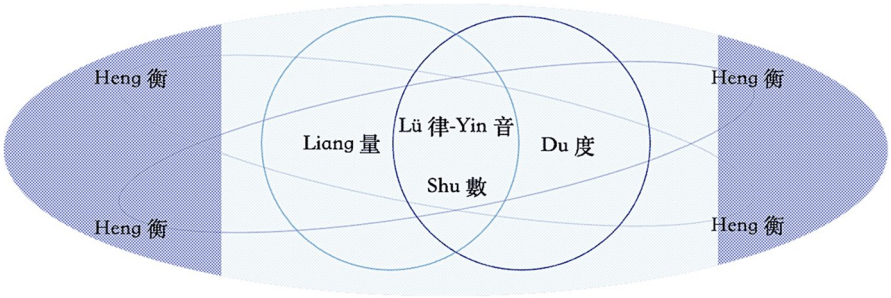

Fig. 1 Conceptual diagram for the "tetralemma" of measuring system of the inter-active *Yin-lü-shu* and *Du-Liang-Heng*, with the *Yin* ("Notes")-*lü* ("Pitch")-*shu* for the domains of poiesis, praxis etc., (as contesting space of emergence), the meditative/procreative *Liang* ("Volume") representing techno-poiesis, the restrictive *Du* ("Length/Degree") for techno-praxis, and Heng ("Weight/Balance") as mechanistic strategy, encompassing the overall scheme without being actually engaging

the *du* is the form of presence (in which all experiences occur) that remains (hence duplicable), whereas the *liang* is the form of presence that cannot remain present. Familiar and inescapable, the *liang* as a kind of measure has significance for us precisely because it is only given to us as experienced. We may see such nuance in the first group of professional translators of technical skills during the Tang dynasty (618–907 CE), *liang*—among other measuring concept—was chosen by Indian astronomers to translate the impressionistic visual diameters of the sun, the moon, and the intersection of the ecliptic and the moon's orbit (*ri-liang*, *yue-liang*, and *e-xiu*[*asura]-liang*) of Brahmanical works, such as the *Jiuzhi li* (*Navagrāha siddhanta*).

Lastly, the strategizing and "non-action" leverage of weighing, or *heng* ("beam" or "balance")—both a measure and its act—lies not so much in the ambiguous space between ontic and ontological measurements but more so as a balancing (*heng*) force between (above and detached from) the two states (for its "non-action" philosophical dimension, see Zhou, 2021, 26). Besides being a highly technical classifier in calendrical science and cosmognomy for the celestial circles centering on the pole (whose system is presented in the Gnomon of *Zhoubi suanjing*, Harper & Kalinowski, 2017, 155–156), it appears most frequently in literature as a verb and/or participle when evoked as a reference to a concrete technique (of weighing in balance/steelyard), a real measuring device, as well as its implication of "double-sidedness" (or fair arguments). For instance, the first century CE Assay of Arguments (*Lunheng*) by Wang Chong is well known for its arguments of both the esoteric knowledge of astrology and strong criticism against heterological ideas and practices. Reflecting the balancing metaphor as well as the steadfastness and reliability of a *hengqi* (*heng* measuring vessel), in early texts record the founding minister of the Shang Yi Yin, as "Ē Heng" ("the one who [knows how to] *heng*, i.e., lever" suggestive of Yi's special paradoxical attributes including his pious rebelliousness, effeminate virility, noble nature from humble origin etc. in the early texts); the alternative name even became a name for a prestigious office (e.g., *Shuowen jiezi*, 8A.5b). The unique metaphorically and even metaphorologically (the tracking of subterranean changes underneath

conceptuality) strategizing and "non-action" function of *heng* and relevant measuring techniques/tools in early Chinese political, military, and moral psychology such as *quan* ("leverage," as in *quanheng*) or the *ji* ([crossbow] "trigger" or trigger mechanism)—in contrast to the double (ontic/ontological, onto-poietic/practical)-function of the mathematically based proportional tool *biao* (gnomon) that belongs to the overlapped area in the diagram—is exposed by a series of study by Zhou (2019, 119–127; 2021, 2022, 563). Together, they expose the intricate and necessary task of defining, restoring, and refining the often entangled domains of measurement and tool ideas (or metaphors) that sprang out as (in tetralemma, "being, non-being, both, or neither") the poetic-musical-lyrical, the practical and "technological," both (as the overlapping curves on the Venn diagram show) or neither forms (for the Zhou, 2019, 139–142).

Perhaps it is not so "improper" that we end the discussion with a passage ("measured words") from the early Daoist bamboo manuscript of the Warring States period (475–221 BC), rescued in a tomb dated to around 300 BCE in ancient Chu (Hubei province), known as "Fanwu Liuxing" (all things flow in(to) form/forms in flux), which may illustrate how measuring concepts are used in early philosophical writing on the ontological states:

> The mass of humankind flows in the form of "human" (*ren*), by what do they come into life? To flow in the form of body, for what do they weaken and die? There is being and becoming, not knowing the conditioning of the "left" and "right," Heaven-and-earth establish(es) the end and the beginning. Heaven sends down five types of measuring (*wu-du*) for humankind—how do I horizontalize (*heng*) and verticalize? Five types of *qi* emerge together, how should I identify their similarities and differences? Humans speak five different types of *yan* [ways of forming ideas], who can provide fair judgements for them? Scholar-knights of the Nine Continents create plans, who can mark boundaries for them?[27]

The parallelism found in the groups of *wu-du* (measurement in five) represents an archaic fivefold (or five-phased, *wuxing*) phenomenon representing the primordial measuring pattern of the Heavenly *Dao* (the fivefold sound, the fivefold cosmic humor of *qi* etc.). At the same time, the "lowering of five-*du*" can also be read in sound techniques as "moving the pitch of the tone downward for five du/degrees."[28] The *heng* (here "horizontalizing"), paired with *zong* (verticalizing), represent two main ways of crafting work (cutting and shaping) as well as two ways of habitual thinking in which the author(s) find themselves enmeshed. Put in front of the groups of five *du*-measurement that captures "all things," from kinesthetic to conscious awareness, the passages essentially summarize the theme of the whole text: if measures are created (from habitual ways of thinking), why do we measure at all?

[27] Transcription and translation largely based on Cao, 2017, 89 with some revisions in translation. For the two versions of the text, see Ma, 2001.

[28] The act of *heng* 衡 evokes the notion of "five horizontals (*heng*) 横" in early hemerology (see Harper, 2012).

5 Conclusion

The most recent dual-conception of technology by Amzallag sheds light on the important "forgotten" dimensions of technology, the so-called technopoietic. Among other implications, the distinction of technopoiesis and technopraxis seeks to highlight explicitly the decline of *poiesis*, of the art of *making*, of the desire to create in the enclosed systems by modern and postmodern technology and society that prioritize almost exclusively the produced finality or design end of a technological process (Wenaus, 2021).[29] Techno-poiesis accounts for the potentiality, creativity, and poetics that are characteristic of the early phase of development of a new technique. As a technique matures and ages, these qualities tend to fade into the taken-for-granted, implied background in a teleologically oriented framework (Amzallag, 2021, 789). Methodologically, the emphasis on the poietical dimension of technology creates a friendly environment where both ancient and modern historians may speak of the singular survival and self-recycling (or even ever-presence) of the "technopoietic" dimension of a given technique or technology—somewhat parallel to the noteworhy observation of copper metallurgy throughout the Bronze Age, where the "infinite" recycling (re-connecting) ability of the metal of old artifacts, through their remelting in a furnace (process of emergence), accompanies the development of the copper industry of production and trade. In restoring the "lost" poietic dimension across time and space, the dual conception calls for an alternative method that combines the examination of localities with the reconstitution of the categories of technology and techniques in new, dimensional, or spatial forms, such as the "timescapes," "metroscape" and various sense-scapes mentioned above. Beyond providing an analytic response to the growing interests in grand statements about macro-level, "transnational" or universal forms and orders, our hope is to provide a less austere set of theoretical vocabulary to refine the relatively new concepts.

Problems arise when we apply it to a given context, especially since our evaluation of the phases, practicality, and meaning or importance of a technique or its end-product is contingent more on the common sense of the modern era, instead of their historical understanding. Therefore, as much as the poietical dimension needs to be recalled—especially today, given the critique of the result-driven hegemony in science (Stengers, 2010, 2011)—a definition of *technopoiesis* (based on what is rejected by technopraxis) serves to stipulate not only what it is but also what it is *not*. In other words, it assists with the construction of a linear, dualistic model of human beings either standing on the new, exciting threshold of emergent technologies or falling into the "end" (both sequentially and causally) of a creative process. In this way, it tends to share the mainstream human sciences' overriding view with the process of production being a continuity that is created and preserved in

[29] In line with Amzallag's distinction, Wenaus defines poiesis as "[poeisis is] in the broad sense of creating a new idea or thought that transcends prescribed combinatorialism and offers wholly novel concepts. By delimiting the unpredictable emergence of novel potencies and unruly potentialities, both useful and useless, combinatorial prescribes limits to poietic alternatives and, ultimately, reduces the human to the quantifiable" (Wenaus, 2021, 2).

and through continual interaction with the biological, cultural, and societal factors, rather than a process of becoming that "must not be viewed as a goal or an end in itself, nor must it be confused with an infinite perpetuation of itself" (Deleuze & Guattari, 1983, 5). Without further illustration, in a practical attempt to harmonize the two views, the dual conception of technology could become essentially conservative and deterministic, contrary to what it promised in the first place: innovation and creation are primary processes for and *only for* the emergent phase of technology and technique; as some point as they *must* enter the mature phase, the orientation toward novelty is replaced by the pursuit of the purposes of (re)production and preservation. While such prediction is made in the Aristotelian (and less explicitly, the Heideggerian) model, it tends to conceal the fact that, even in early phases of technical development, variations in terms of the cultural, philosophical, aesthetic, socio-individual, and other reasons are aligned in one way or another with a specified, yet changeable self-positioning, immediacy, and *purposefulness* of even the most fundamental techniques (and "technical" ways of thinking). Parallel to the view that technopoiesis is a transient, largely non-material, "juvenile" and impractical stage of development, we argue that, while a specific issue or end-product has historicity and varied nuances, the key aspect that characterizes technology in its different modes of existence is the persistent, often clustering elements of purposefulness, preparedness, and sense of "positional" strategizing (*shi*, often related to as efficacy and essentialized as a specific "mode of thinking"). Together, they enable the wisdom of *poiêtikê technê* and its productive self-renewal. Specifically, the article experiments with new "properties"—namely, purposefulness, preparedness, "interactive emergence," and "poietic clusters" that are intended to nourish Amzallag's notion and our transforming understanding of technology (itself affected by the modifications in thinking about measures [products] and measuring [processes]), inviting exciting studies on the refined front of technopoiesis in ancient and modern times.

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