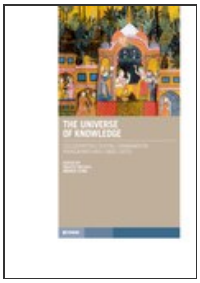
FORUM EDITRICE UNIVERSITARIA UDINESE



Andrea Cuna e Gabriele Angeli

Developing a Pilot Faceted Indexing Matrix to Provide Exploratory Subject Access to the Luigi Pio Tessitori Photographic Collection

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Keywords: Exploratory and faceted search, Facet analysis, Faceted interfaces, Faceted subject indexing, Visual subject analysis.

Contenuto in: The Universe of Knowledge. Celebrating Shiyali Ramamrita Ranganathan (1892-1972)
Curatori: Fausto Freschi e Andrea Cuna
Editore: Forum
Luogo di pubblicazione: Udine
Anno di pubblicazione: 2024
Collana: Tracce. Itinerari di ricerca/Area umanistica e della formazione
ISBN: 978-88-3283-428-4
ISBN: 978-88-3283-486-4 (versione digitale/pdf)
Pagine: 123-158
DOI: 10.4424/978-88-3283-486-4-05

Per citare: Andrea Cuna e Gabriele Angeli, «Developing a Pilot Faceted Indexing Matrix to Provide Exploratory Subject Access to the Luigi Pio Tessitori Photographic Collection», in Fausto Freschi e Andrea Cuna (a cura di), *The Universe of Knowledge. Celebrating Shiyali Ramamrita Ranganathan (1892-1972)*, Udine, Forum, 2024, pp. 123-158
Url: https://forumeditrice.it/percorsi/lingua-e-letteratura/tracce/the-universe-of-knowledge/developing-a-pilot-faceted-indexing-matrix-to

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1. Introduction and Background

European LAMs (libraries, archives and museums) have collected a vast and valuable corpus of photographs from all over Europe and beyond. To give just an idea of the size of the corpus, a survey conducted by the ECPA (European Commission on Preservation and Access) between December 1998 and February 2000 revealed that the 140 LAMs that responded to the survey held a total

of nearly 120 million photographs, half of which were over 50 years old (Klijn & de Lusenet 2000: iii). It is quite an impressive figure. However, it is only an approximation, since it does not include the photographs held by many European private LAMs. The historic photographs held by European LAMs are of tremendous interest to a great many people, such as researchers, students, writers, artists, media enterprises, and just curious people. Digitizing and bringing them online so that they can be discovered and accessed by anyone with Internet access anytime and anywhere in the world is a challenge that requires significant investments in time, money and human resources, as well as close public-private partnership and cooperation (Comité des Sages 2011: 4, 8). The LPT (Luigi Pio Tessitori) Archive, best known as the Archivio Peano, is a private archive that houses, among other information resources, the historic black-and-white photographic negatives (mostly glass plates) taken by the Italian Indologist Luigi Pio Tessitori (1887-1919) during his stay in India from 1914 to 1919. The photographic negatives cover a wide range of subjects, such as portraits, royal palaces, ancient sculptures, and scenes of traditional festivals and daily life, which are revealing of Tessitori's personal relationships with local people and places as well as archaeological and anthropological interests (Freschi 1999). The SILPT (Società Indologica "Luigi Pio Tessitori") is planning to make them publicly available through an online catalog on the Society's website as part of the LPT Project (SILPT 2009). While the SILPT recognizes that this would be a major step forward to prevent handling of these extremely fragile materials and to unlock their information potential to the wider community beyond scholars, it is also aware that providing enhanced subject access to them in a way appropriate to a wide range of users is not an easy task. Without extensive metadata, description, and a suitable search and browse interface, users would be flooded with a mass of information with no context or explanation. In focusing on this specific problem, this paper discusses the development of a pilot matrix for faceted subject indexing of the photographic collection. The developed matrix adapts and expands Shatford's (1986) matrix for analyzing and categorizing the subjects of representational (figurative) pictures by incorporating and implementing the principles of facet analysis developed by Shiyali R. Ranganathan and furthered by the UK CRG (Classification Research Group). The purpose of developing the matrix is twofold: first, to walk the indexer through the subject indexing process to assure that it is conducted systematically and methodically; and second, to help the information architect design and build multiple faceted interface structures – from flat to hierarchical – that would support users' exploration and navigation tasks based on the subject facets identified in the photographs by the indexer.

2. The Users' Quest for Integrated Subject Access

Many studies (e.g., Beaudoin 2007; Calhoun 2006: 31, 33; Calhoun & al. 2009: 43; Cochrane 1983; Golub & al. 2022; Schaffner 2009: 6-8) show that LAM users expect online catalogs to provide integrated subject searching and browsing capabilities across all collections and media types, yet they are seldom available. Historically, providing integrated online subject access has been one of the biggest challenges faced by LAMs, and the scale of the challenge has been multiplied by several orders of magnitude by the sheer volume and heterogeneity of born-digital and digitized content that they make available on their catalogs. In original cataloging, determining and representing the subject matter of a text-based work to create subject access points can be difficult, labor-intensive, and expensive. With visual works such as photographs, the process can be even more demanding. Unlike text-based works, visual works do not express in words what they are about; neither the titles nor the names that may have been given to them always provide truly reliable insights into their subject content.

To date, two general methods have been used to deal with the problem of providing subject access to visual content: the concept-based method and the content-based method. The first one depends on controlled vocabulary terms assigned by information professionals and/or free-text terms (tags) generated by users. The other relies on algorithms to identify low-level features such as color, shape, texture, and spatial configuration (Alzu'bi & al. 2015; Hamed & al. 2021; Jörgensen 2017). Both methods have their own strengths and weaknesses. The concept-based method has the advantage of providing a higher-level analysis of visual subject content, but is expensive, time-consuming, and prone to intra- and inter-indexer inconsistency. By contrast, the content-based method is relatively inexpensive and faster, but typically provides a lower-level analysis of visual subject content (Chen & Rasmussen 1999: 291). Because of their intrinsic strengths and weaknesses, the two methods should not be seen as mutually exclusive but as complementary (Enser 2008: 538; Neugebauer 2010: 102), meaning that LAMs should take full advantage of both, taking into account the nature of their visual collections, the intended users, and the available human, financial and technological resources.

This paper, however, focuses only on the concept-based method. Some clarifications are in order in this regard. Although "[t]here are instances where a message expressed in one medium cannot adequately be transposed to another" (Svenonius 1994: 600; see also Allmendinger 1987; Pearce-Moses 1994: 251-252), this is not the case with the LPT photographic collection because all the individual items that make it up are photographs of documentary and aesthetic value whose subjects can be named and indexed with a fair degree of confidence and certainty. Moreover, "[m]odeling indexing activities for a computer requires

the kind of sound theoretical foundation in indexing that only professional indexers and information professionals can provide" (Neugebauer 2010: 102). Additional clarifications include what is being cataloged and indexed, and the metadata standards used for subject cataloging of the collection. Even if for practical reasons (reverse polarity) subject indexing is mostly conducted based on the digital surrogates (positives) of the photographic negatives, what is being cataloged and indexed is the individual original glass plate and film negatives, not their digital surrogates. As for the metadata standards used, they include *AAT* (2021), *CCO* (2006), *LCSAH* (n.d.), *MARC 21* (2023), *TGM I* (2017), and *TGN* (2017).

3. Faceted Subject Indexing of the LPT Photographic Collection: Theoretical Framework

3.1. What is the Subject of a Photograph?

It can be said that every photograph is on a subject or subjects. But what is the *subject* (or *subject matter*) of a photograph? The answer is usually taken for granted: it is what is depicted in or by a photograph. This definition, however, is too general or vague to be helpful, leaving considerable opportunity for misinterpretation or misunderstanding on the part of the indexer. Complicating the matter further is the fact that subject is a multifaceted concept, meaning different things to different people. To date, there is no consensus definition of the concept among library and information science (LIS) professionals; competing epistemological stances have resulted in multiple and often conflicting definitions, which map differently across domains (Hjørland 1992; 1997), making subject searching and browsing more challenging for end users. Determining the subject of photographs is even more difficult because of the overlapping factual, emotional and cultural meanings that viewers read into them.

3.1.1. Subject in Panofsky's Method of Visual Subject Analysis

In his influential book *Studies in Iconology*, Panofsky (1939: 3-17) identifies three interconnected layers of subject matter or meaning in a representational work of art:

1. *Primary* or *natural subject matter*, divided into *factual* and *expressional*;
2. *Secondary* or *conventional subject matter*; and
3. *Intrinsic meaning* or *content*.

To illustrate how these three layers of meaning work together on a continuum going from appearances (sensory impressions) to understanding, he does not begin with an example from the visual arts, but from everyday life, that of an

acquaintance greeting him on the street by lifting his hat[1]. This choice is far from arbitrary or incidental. Implicit in the example is the assumption that participation of the self (the "I"-perspective of the perceiving subject) plays an active, significant role in deriving and constructing meaning from sensory experience. To paraphrase the example, when an acquaintance greets us on the street by removing his hat, what we see from a purely formal point of view is nothing more than a change in the configuration of certain lines, colors and shapes within our field of vision as a result of the movement of our eyes. As soon as we spontaneously identify this configuration as an object (gentleman) and the change in detail as an event (hat-lifting), we have already crossed the limits of perception of pure forms alone and stepped into another dimension of subject matter or meaning. This dimension of meaning, which may be called factual, is grasped by associating certain visual forms with certain objects and by identifying the change in their pattern of relations with certain actions or events, all of which are part of our stock of practical experience. Our encounter with these objects and events does not leave us indifferent but arouses spontaneous affective/emotional responses within ourselves. Indeed, from the way in which the gentleman performs the act of greeting, we can sense his mood and feelings towards us. This other dimension of meaning, which may be called expressional, differs from the factual one in that it requires empathy, that is, the ability to understand and share the feelings of another person (another "I"), rather than mere identification. To grasp it, we need a certain sensitivity towards objects and events that are still part of our practical experience. By contrast, to recognize that the lifting of the hat is a form of polite salutation (a "sign") that modern Western societies have inherited and adapted from the code of Medieval chivalry, we need to be familiar with the habits, customs and cultural conventions of those societies. This layer of meaning, which may be called secondary or conventional, differs from the primary or natural one in that it is intelligible rather than sensible and transmitted consciously rather than unconsciously by the practical act from which it results. Delving deeper into the meaning of our acquaintance's act of lifting the hat, that is, going beyond appearances and expression, we may be able to gain insights into the many factors that have contributed to the making of his overall personality and way of viewing the world (*Weltanschauung*). Although all these factors are virtually embedded in the act of greeting, they show themselves only indi-

[1] According to Hart (1993), Panofsky's example and tripartite schema of interpretation are heavily indebted to K. Mannheim. Elsner & Lorenz (2012: 488), however, rightly point out that when Panofsky revised his schema in the 1939 introduction to *Studies in Iconology*, he did not cite Mannheim but E. Cassirer's concept and system of symbolic forms.

rectly ("symptomatically")[2]. Consequently, to construct an "ideal" portrait of our gentleman, we need to connect his act with other similar observable objects and events and to interpret them in light of a much broader context, such as his social, national, and cultural environment. Unlike the other two layers of meaning, this last layer, which may be called intrinsic meaning or content, is not derived from our phenomenal analysis but from our *synthetic intuition*. This may be defined as a functional, unifying faculty of the mind that provides objects and events with a certain structure and organization and puts them in relation with a multiplicity of other objects and events by coordinating the particular with the general.

Moving from the realm of everyday life to the realm of works of art, we will find that the same layers of subject matter are at work, even though the focus of our analysis and interpretation is no longer concerned with another "I" but a cultural work or object (a "monument")[3]. Accordingly, recognizing the primary or natural subject matter (*pre-iconographical description*) in a work of art involves a mere enumeration or inventory of artistic motifs, derived through a pseudo-formal analysis of what we see in a work of art at the most basic level (visual configurations or gestalts)[4]. For example, a certain configuration of lines, colors and shapes may represent 13 men sitting at a dinner table expressing individual reactions, feelings and emotions as they share a meal and converse with each other. By contrast, identifying the secondary or conventional subject matter (*iconographical analysis*) requires the ability to establish connections between artistic motifs or their combinations (compositions) and themes or concepts expressed in images, stories and allegories using our existing knowledge, or new knowledge, from a variety of literary sources. For example, recognizing that 13 men sitting at a table, sharing a meal and conversing with each other represent the theme of *The Last Supper* rather than an occasional dinner party between old friends. Lastly, identifying the intrinsic meaning or content (*iconographical synthesis*, or *iconological interpretation* in Panofsky 1955: 40) involves "ascertaining those underlying principles which reveal the basic attitudes of a nation, a period, a class, a religious or philosophical persuasion – unconsciously qualified by one personality and

[2] Panofsky seems to be going back to the tradition of Greek medicine, according to which physiological symptoms are signs (*semeia*) that stand for something other than themselves. In a similar vein, Peirce (1905: 485, note 2, emphasis in original) states that "it is the belief men *betray* and not that which they *parade* which has to be studied".

[3] For the difference between document and monument, see Panofsky (1955: 1-25) and Le Goff (1978: 38-48).

[4] Panofsky (1939: 6) emphasizes that "'[f]ormal analysis' in Wöllflin's sense is largely an analysis of motifs and combination of motifs (compositions); for a formal analysis in the strict sense of the word would even have to avoid such expressions as 'man,' 'horse,' or 'column,' let alone such evaluations as 'the ugly triangle between the legs of Michelangelo's David' or 'the admirable clarification of the joints in a human body'".

Table 1. Panofsky's matrix of visual subject analysis (adapted from Panofsky 1939: 14-15).

Focus of Interpretation	*Layer of Interpretation*	*Equipment for Interpretation*	*Corrective Principle of Interpretation*	
1. Primary or natural subject matter a) Factual b) Expressional	Pre-iconographical description (and pseudo-formal analysis)	Practical experience (familiarity with objects and events)	History of style (manner in which, under varying historical conditions, objects and events have been expressed by forms)	
2. Secondary or conventional subject matter	Iconographical analysis	Knowledge of literary sources (familiarity with specific themes and concepts)	History of types (manner in which, under varying historical conditions, specific themes or concepts have been expressed by objects and events)	*History of tradition*
3. Intrinsic meaning or content	Iconographical interpretation	Synthetic intuition (familiarity with the essential tendencies of the human mind)	History of cultural symptoms or symbols (manner in which, under varying historical conditions, essential tendencies of the human mind have been expressed by specific themes or concepts)	

condensed into one work" (Panofsky 1939: 7). For example, Leonardo's fresco *The Last Supper* (ca. 1495-1497) in the Dominican church of Santa Maria delle Grazie in Milan is revealing not only of Leonardo's personality as an artist, scientist and intellectual but also of the culture of the Italian High Renaissance.

On the one hand, Panofsky acknowledges that the analysis and interpretation of the subject matter or meaning of a work of art has an unavoidable subjective dimension, since it presupposes a *lived experience* of the work of art – one that is pre-reflective, pre-theoretical, pre-conceptual, and pre-linguistic. On the other hand, he is deeply concerned about how to compensate for any subjectivity clinging to nothing but itself (epistemological egocentrism). To address this problem, he couples each layer of his matrix with corrective principles building one upon the other to help the interpreter seamlessly navigate through the objectification process. These correctives include: (1) history of *style* (the manner in which, under different historical conditions, objects and events have been expressed by forms) during pre-iconographical description; (2) history of *types* (the manner in which, under different historical conditions, themes or concepts have been expressed by objects and events) during iconographical analysis; and (3) history of *cultural symbols* in Cassirer's sense (the manner in which, under different historical conditions, general and essential tendencies of the human mind have been expressed by specific themes and concepts) during iconographical synthesis. Table 1 summarizes the essential components of Panofsky's matrix, while the table

in Appendix 2 shows an example of application of his method to a photograph from the LPT collection.

Although Panofsky developed his method primarily in relation to works of art of the Renaissance, his approach has subsequently been adapted and extended by others to non-art images as well. In the field of LIS, Shatford (1986) in particular has been instrumental in generalizing it to all representational pictures, but in a somewhat simplified and more pragmatic manner, one considered better suited for analyzing, determining and representing subject matter for browsing and retrieval of visual content (Enser 2008: 533)[5].

3.1.2. Subject in Shatford's Method of Visual Subject Analysis

Taking Panofsky's three-layered matrix as a starting point, Shatford (1986: 45, emphasis in original) categorizes the subject matter of representational pictures as simultaneously Generic Of, Specific Of and About, namely

> [a]t the pre-iconographic level, the *Of* aspect is generic description of objects and events; at the iconographic level, it is a specific, or proper, appellation of those objects and events. *Of* words describe people, places, objects, conditions, and actions that have a physical manifestation. The *About* aspect is, at the pre-iconographic level, a description of the mood of the picture; at the iconographic level the *About* aspect is an identification of mythical beings that have no unique and verifiable concrete reality, of symbolic meanings and abstract concepts that are communicated by images in the picture. *About* words include those describing emotions (love, sorrow) and concepts (truth, honor).

To illustrate her argument, she (44, 47, 50) gives the example of Sir Joshua Reynolds's *Sarah (Kemble) Siddons as the Tragic Muse* (1783-1784, The Huntington Library, Art Museum, and Botanical Gardens, San Marino, CA, Object no. 21.2). She explains that at the pre-iconographical level, the painting is Of a woman (Generic Of); at the iconographical level, it is Of the woman depicted in the painting, Mrs. Siddons (Specific Of), and About Melpomene, the Greek Muse of Tragedy (Specific About). She (48) then goes on to show how the Generic Of, Specific Of and About aspects of pictures can be combined with a

[5] This generalization has not been unchallenged. According to Christensen (2017: 1784), "Panofsky's model might be replaced by more relevant theories, for example, image semiotics in the structuralistic vein". While this paper acknowledges that Panofsky's method is not a "one-size-fits-all" approach for subject analysis of images, it argues that in many cases it can be a powerful and effective tool to provide subject access to representational pictures, provided that it is properly interpreted and applied. Sadly, all too often reasons of time, cost and effort have led to a quick-and-dirty application of the method, resulting in poor or unsatisfactory subject indexing.

Table 2. Faceted categorization of subject aspects of pictures according to Shatford's matrix (adapted from Shatford 1986: 49, Figure 1).

Ranganathan's Fundamental Category	*Facet*	*Specific Of*	*Generic Of*	*About*
Personality/ Matter	Who?	Individually named persons, animals, things…	Kinds of persons, animals, things	Mythical beings (Generic/ Specific), abstractions manifested or symbolized by objects or beings
Energy	What?	Individually named events	Actions, conditions	Emotions, abstractions manifested by actions, events
Space	Where?	Individually named geographic location	Kind of place (geographic or architectural)	Places symbolized (Generic/Specific), abstractions manifested by locale
Time	When?	Linear time: dates or periods	Cyclical time: seasons, time of day	Emotions or abstractions symbolized by or manifested by time

Table 3. Categorization of the subject aspects of Reynolds's portrait according to Shatford's matrix.

Ranganathan's Fundamental Category	*Facet*	*Specific Of*	*Generic Of*	*About*
Personality/ Matter	Who	Siddons, Sarah (1755-1831) • actor (performing artists)	women • man	Melpomene • Pity • Terror
Energy	What	looking • sitting • standing		acting • tragedy (general genre)
Space	Where		interior spaces (spaces by location)	
Time	When			

faceted approach to subject analysis, starting from four broad questions, which she calls "facets", mapping onto Ranganathan's fundamental categories, namely Who ≈ Personality and Matter, What = Energy, Where = Space, and When = Time, as summarized in Table 2.

For example, in keeping with Reynolds's portrait, its subject aspects may be categorized according to the above matrix as shown in Table 3.

Shatford's matrix provides a valuable starting point to help identify the Of and About aspects of representational pictures, but it has not been developed to

the point at which it can be said to be an operational tool for rigorous facet analysis and classification of pictorial subjects (cf. Stewart 2013: 75)[6]. Her matrix is essentially a two-axis analytical tool, with the vertical axis guiding the analysis of visual subject content at the most general and abstract level (categorical analysis), and the horizontal axis guiding the description and identification of binary objective (Generic and Specific Of) and subjective/interpretative (Generic and Specific About) aspects of visual subject content. There are two major problems with her tool, which results in oversimplification and ambiguity. One is the meaning of the term facet. The other is the manner in which the Generic Of, Specific Of and About aspects (or "subfacets") are applied during facet analysis.

It is a fact that "[t]he understanding of what a facet is varies considerably from one context to another, and the language that is used to describe facets shows very little consistency or consensus on use" (Broughton 2023: 411). However, in *Prolegomena to Library Classification*, Ranganathan (1967: 88, emphasis added) – arguably the father of facet analysis – states that facet is "[a] *generic* term used to *denote* any component – be it a basic subject or an isolate – of a Compound Subject". It is not entirely clear whether in the citation the adjective "generic" is used in a classificatory sense or the associated verb "denote" means the term's ability to restrict the class of concepts to which the term refers – although it seems highly likely. A more illuminating definition of facet can be found in Postulate 1 of *Elements of Library Classification*. Here Ranganathan (1960: 67, emphasis in original) postulates that

> *[e]ach facet of any subject [in the universe of knowledge] can be deemed to be a manifestation of one and only one of the Five Fundamental Categories – Personality, Matter, Energy, Space and Time [PMEST]. We may call a facet a general manifestation… of the fundamental category concerned.*

A few pages earlier (56) he explains that the reason for introducing the term facet in his *Colon Classification* was a matter of "style", that is, he found that the term facet was "more elegant" than his previous term "Train of characteristics". Style apart, the operational significance of this change cannot be overlooked. This fact becomes all the more obvious if one considers the example of facet analysis that immediately follows his explanation. In the example (57-62), the subject Tuberculosis of the lungs, which falls within the basic subject or main class Medicine, consists of two components: Tuberculosis and Lungs. The

[6] Shatford (1986: 48, emphasis added) expressly states that she "is not attempting to develop an actual classification scheme for pictures, but only to identify and *classify* the kind of subjects a picture may have".

first component is related to the Problem characteristic, the second one to the Organ characteristic. To put it in another way, the subject Tuberculosis of the lungs has two facets: the Organ facet and the Problem facet. Lungs and Tuberculosis are in turn foci (terms) of the first and second facet, respectively. At the most abstract level of categorical analysis, we find that "[t]he Organ facet of Medicine is a general manifestation of the Fundamental Category 'Personality'" (67), while "[t]he Problem facet of Medicine is a general manifestation of the Fundamental Category 'Energy'" (67). Transposed from the ideal (conceptual) to the verbal (terminological) plane, the PMEST formula thus becomes a device – a sort of preliminary scheme – designed to guide the sorting of terms into a set of basic categories of high generality and applicability. Seen in the context of these fundamental categories, facets are criteria by means of which it is possible to further organize concept terms into homogeneous and mutually exclusive subgroups based on some common characteristic. At the same time, facets are the result of an incremental process of division and organization. The main difficulty involved in the process is deciding on which characteristic or principle of division should be applied. Ranganathan (1967: 146, emphasis added) expressly addresses this difficulty in the Canon of Relevance of his *Prolegomena*, where he states that "[a] characteristic used as the basis for the classification of a universe [of knowledge] should be relevant to the *purpose* of the classification." However, because purpose varies considerably depending on several factors, such as knowledge domain and intended users, he (147, emphasis in original) prudently adds that

> [n]o *a priori* rules for hitting upon the most helpful set of characteristics have been found as yet. Generally it depends on genius [read "insight"]; but, other things being equal, persons with knowledge and experience are likely to develop the flair to reject the less helpful characteristics.

In taking over the challenge of advancing the facet analytical method, the members of the UK CRG – especially Brian C. Vickery – found that Ranganathan's PMEST formula was too limited for use in special domains and suggested to extend it to 13 categories. Table 4 shows how the UK CRG's standard categories map onto Ranganathan's fundamental categories, but it is important to emphasize that the former "are not fundamental in the same sense as PMEST" (Broughton 2023: 416-417). Ranganathan's Personality category is specified in the context of hierarchical relationships (generic and partitive) associated with a Thing [Entity], including its properties; the Energy category is divided into Process (an action that happens by itself) and Operation (an action performed by an external agent); Patient, Product, By-product and Agent are newly developed categories that provide context for the Operation category.

Table 4. Mapping between Ranganathan's fundamental categories and the UK CRG's standard categories (adapted from Broughton 2006a: 109, Table 12.1).

	Ranganathan's Fundamental Categories	*UK CRG's Standard Categories*
P	Personality	Thing [Entity] Kind Part Property
M	Matter	Material
E	Energy	Process Operation Patient Product By-product Agent
S	Space	Space
T	Time	Time

The UK CRG's categories have proven to be flexible enough to accommodate a vast array of subjects, especially those of the science and technology domains, but much less those of the humanities and social sciences (Broughton 2006a: 109; Svenonius 1997: 12-16). This is not an unsurmountable problem, though, but one that may be addressed, often successfully, by creating new categories or relabeling the existing categories (Broughton 2006a: 109). The next section will show how this can be done for the subjects covered by the LPT photographic collection by making Shatford's matrix more consistent with the general principles of the facet analytical method.

3.1.3. Adapting and Supplementing Shatford's Matrix to Make it More Consistent with the Facet Analytical Method

Shatford's WWWW (Who, What, Where and When) facet-based matrix has established itself as one of the most influential conceptual tools for analyzing and categorizing the kinds of subjects a representational picture may have. However, testing of the matrix on a sample of photographs from the LPT collection revealed several categorization and classification problems, which prompted a series of major changes to make it fitted for operational use. It must be emphasized that most of these problems are cascading in nature and stem chiefly from a loose understanding of the notion of facet, as well as an unorthodox (from the perspective of most UK facet analysts at least) application of the facet analytical method, so typical of the North American knowledge organization and information architecture communities (La Barre 2010). Facet analysis

of the subject terms relating to the photograph reproduced in Appendix 1 will serve to demonstrate the point, as well as show, step by step, how the matrix has been revised after testing.

Facet analysis applied to the construction of a faceted classification type structure is typically conducted in a sequence of steps, with somewhat subjective decisions being made at each step. The first step involves the analysis and sorting of the concept terms that make up a given subject vocabulary into broad basic categories from the bottom up (Broughton 2006b: 51). As with Ranganathan's categories and the UK CRG's categories (Table 4), the four facets on the vertical axis of Shatford's matrix (Table 2) can be considered a sort of question-based preliminary scheme intended to guide the sorting of concept terms into a set of basic categories of high generality and applicability. This approach is not entirely new. It can already be found, for instance, in the ISO (1985: 2) 5963 standard, which clearly incorporates some of the UK CRG's categories into the suggested checklist of general factors. Although not exhaustive, this checklist provides useful general guidance on how to identify subject concepts, "even when the items in the collection are artifacts or communications in media other than those which the word 'documents' usually conveys" (Dykstra 1989: 173-174), as is the case with the LPT collection.

The first problem one encounters in conducting a facet analysis of the concept terms provided in Appendix 2[7] according to Shatford's matrix is the presence of mixed characteristics in the Who facet (encompassing persons, animals and things) as a result of the conflation of the Personality and Matter categories[8]. This conflation not only violates Ranganathan's (1967) Canons of Differentiation (145), Concomitance (153) and Exclusiveness (160) and the UK CRG's Principles of Homogeneity and Mutual Exclusivity (see Vickery 1960: 12) but also the rules of English grammar, since the interrogative pronoun "who" can only refer to people, while the interrogative pronoun "what" can only refer to things. Quite obviously in this context, people fall within the Personality category, while things fall within the Matter category. To complicate matters even further, on the horizontal axis of her matrix Shatford introduces three additional analytical subfacets (Generic Of, Specific Of and About) for each of Ranganathan's categories. While these subfacets make sense and are useful when conducting a visual sub-

[7] The concept terms are the result of in-depth subject analysis, which has been done for illustrative purposes only. In practice, the required depth of subject analysis depends on several factors, including the nature of the visual collection, the intended users, the available human and financial resources, and local institutional policies.

[8] Ranganathan (1967: 401) states that "'Personality' presents the greatest difficulty. It is too elusive. It is ineffable". Yet, he (401) continues, "any entity which is not a manifestation of 'Time', or 'Space', or 'Energy', or 'Matter', should be a manifestation of 'Personality'".

Table 5. Sorting of Generic Of terms from the table in Appendix 2 based on Shatford's matrix.

Facet	*Generic Of Terms*
Who	armchairs • artifacts • bas-reliefs (fragments) • bookcases • books • boots • chairs • desk organizers • desks • documents • étagères • interior spaces • lamps • mats • men • middle-aged men • mustached men • neckties • notebooks • occasional tables • offices • open desk organizers • papers • pens • photographs • portraits • reliefs • revolving bookcases • scrolls • shields • shirts • suits • swords • table lamps • tables
What	looking • sitting
Where	interior spaces • offices
When	daytime • winter

Table 6. Mapping between Ranganathan's fundamental categories and Shatford's facets (first round of revision).

Ranganathan's Fundamental Category	*Shatford's Facet*	*Shatford's Generic Of Terms*
Personality	Who	men • middle-aged men • mustached men
Matter	M-What	armchairs • artifacts • bas-reliefs (fragments) • bookcases • books • boots • chairs • desk organizers • desks • documents • étagères • lamps • mats • neckties • notebooks • occasional tables • open desk organizers • papers • pens • photographs • portraits • revolving bookcases • reliefs • scrolls • shields • shirts • suits • swords • table lamps • tables
Energy	E-What	looking • sitting
Space	Where	interior spaces • offices
Time	When	daytime • winter

ject analysis according to Panofsky's three-layered method (see section 3.1.1 and Appendix 3), they become tenuous if not meaningless – even on a very broad level – when constructing a rigorous fully faceted structure, since they are not derived from the application of any logical, orderly and systematic principle of division, which is the hallmark of the facet analytical method (Mills 2004: 550). To illustrate, according to the matrix criteria, all the concept terms in Table 5 fall within the Generic Of subfacet simply because they represent generic objective kinds (of persons, things, and activities) rather than identifiable (individually named) instances of objective kinds.

On the one hand, the separation of the Personality and Matter categories is a necessary requirement to align Shatford's matrix with the principles of facet

Table 7. Mapping between Shatford's facets and the UK CRG's standard categories (second round of revision).

Shatford's Facet	*UK CRG's Basic Facet*	*Shatford's Generic Of Terms*
Who	People	men • middle-aged men • mustached men
M-What	Thing	armchairs • artifacts • bas-reliefs (fragments) • bookcases • books • boots • chairs • desk organizers • desks • documents • étagères • lamps • mats • neckties • notebooks • occasional tables • open desk organizers • papers • pens • photographs • portraits • reliefs • revolving bookcases • scrolls • shields • shirts • suits • swords • table lamps • tables
E-What	Process	looking • sitting
Where	Space	interior spaces • offices
When	Time	daytime • winter

classification and the rules of English grammar. On the other hand, it brings with it another problem, which is the duplication of the What facet. This problem, however, can be overcome by disambiguating the facet in question as follows: M-What (for the Matter category) and E-What (for the Energy category), where the first one is intended to subsume all kinds of things, and the second one all kinds of active and passive operations, processes, activities or actions. Bearing this in mind, the matrix may be initially modified as shown in Table 6.

The broad groupings shown in the table above may be further divided according to the principles of division embodied in the UK CRG 13-category scheme (see Broughton 2006a: 108). Here, however, a difficulty arises. All the concept terms in Table 6 match the scheme's categories except "men", "middle-aged men", and "mustached men". One might be tempted to force them to fit into the Agent category, but this would lead to confusion and inconsistency, since this category refers to the means by which an operation, process, activity or action is conducted, which can be a person or a piece of equipment (Broughton 2006a: 109). Consequently, there is no other way to satisfactorily accommodate these terms except creating a new category. In general, this choice is always possible and permissible insofar as the terms share a common characteristic (Broughton 2006a: 110), which happens to be the case here (all the terms refer to kinds of people). Table 7 shows the outcome of this first logical division.

Having aligned the vocabulary of terms with the UK CRG' categories (basic facets), it is now possible to proceed with the second step of facet analysis, that is, the division of each basic facet into homogeneous and mutually exclusive subfacets (or subclasses). More specifically, this step consists in taking each of the terms that make up the vocabulary of the basic facets and defining it *per*

Table 8. Mapping between Shatford's facets and the UK CRG's standard categories (third round of revision).

Shatford's Facet	*UK CRG's Basic Facet*	*Shatford's Generic Of Terms*	*Shatford's Specific Of Terms*
Who	People	men	middle-aged men • mustached men
M-What	Thing	furnishing & equipment	armchairs • bookcases • boots • chairs • desk organizers • desks • étagères • lamps • mats • neckties • occasional tables • open desk organizers • pens • revolving bookcases • shirts • suits • table lamps • tables
		documents & manuscripts	books • documents (paper, records) • notebooks • photographs • portraits • scrolls (information artifacts)
		objects & works of art	bas-reliefs (fragments) • reliefs • shields • swords
E-What	Process	activities	looking • sitting
Where	Space	places	interior spaces • offices
When	Time	time	1919

genus proximum et differentiam specificam (Vickery 1959: 858; 1960: 12) in order to qualify what kind of subject concept it is (Cuna & Angeli 2021: 514). Table 8 shows the outcome of this subdivision.

Shatford rightly points out that what a picture is Of and About may be described in many ways, from the broadly generic to the highly specific. For example, if a picture is Of a person, event, or place, such subject may be described generically as a class or specifically as a manifestation or instance of the class. The latter type of relationship is not one of logical division – by which genera are divided into species – but one in which the narrower term is one specific individual instance of the class represented by a proper name (Aitchison & al. 2000: 56). Class-of-one terms like the ones in Table 9 are often excluded from the main body of the thesaurus and held in a separate file (Aitchison & al. 2000: 56).

The Who concept terms shown in Tables 8 and 9 are by no means exhaustive of the terms applicable to the man portrayed in the photograph under consideration. Additional terms include "archeologists", "ethnohistorians", "Indologists", and "linguists" (relating to the professional activities in which he was engaged). While, according to Shatford's criteria, these terms should straightforwardly be categorized under the Generic Of subfacet without further analysis, rigorous facet analysis shows that they share a common characteristic, that is, they all refer to kinds of people who have done advanced study and acquired expertise in a special field. Hence, they may be placed under the class "scholars", as shown in Table 10.

Table 9. Instance relationships in the Who and Where facets.

Shatford's Facet	*Shatford's Generic Of Terms*	*Shatford's Specific Of Terms*
Who	men	Luigi Pio Tessitori
Where	places	Bikaner • India • Rajasthan

Table 10. Different Generic and Specific Of terms in the Who facet.

Shatford's Facet	*UK CRG's Basic Facet*	*Shatford's Generic Of Terms*	*Shatford's Specific Of Terms*	*Instance*
Who	People	men	middle-aged men • mustached men	Luigi Pio Tessitori
		scholars	archeologists • ethnohistorians • Indologists • linguists	

Table 11. Different Generic and Specific About terms in the E-What facet.

Shatford's Facet	*UK CRG's Basic Facet*	*Shatford's Generic About Terms*	*Shatford's Specific About Terms*
E-What	Process	activities	archeology • ethnohistory • Indology • linguistics • studying

It goes without saying that most of the considerations made for the Generic and Specific Of subfacets hold true also for the About subfacets (see Table 11), though the latter are a little more complicated due to the complex interplay between intrinsic visual content and related contexts (archival, historical, ideological, social, psychological, cultural, etc.), and would deserve a separate, detailed discussion, which cannot be undertaken here.

By now it should be clear that in designing and constructing a classification structure according to the facet analytical method, the notions of Generic and Specific come to assume a meaning quite different from that attached to them by Shatford in her matrix. The crucial point is that visual subject analysis and facet analysis are two distinct types of analysis. Determining what a picture is Of and About at each of Panofsky's layers of meaning is a step that should be completed before facet analysis begins, otherwise one immediately runs into serious classificatory problems. During facet analysis of pictorial subjects, it no longer matters whether they are Of or About something, what matters is in which facet they should be placed. And this decision is guided by one fundamental principle only:

logical division. One of the strengths of rigorous logical division is that it allows one to go beyond the simplistic generic-to-specific continuum, revealing important semantic relationships that would otherwise remain hidden from users' view. Although it has long been recognized that subject relationships and cross-referencing play an important role in assisting users of LAM catalogs to effectively accomplish their search and browse tasks (see, e.g., ALCTS/CCS 1997), they have not been exploited to any great extent or with much success to date when it comes to support serendipity, unexpected discovery and learning – a cursory glance at current online LAM catalogs reveals a nearly exclusive focus on supporting lookup tasks. In the following sections, it is argued that substantial changes to current indexing practice of pictorial collections would be necessary to boost the potential of subject facets in LAM catalogs in order to support this goal.

3.2. Faceted Subject Indexing of the LPT Photographic Collection: a Circular Interpretive Process

For the purposes of this paper, subject indexing is broadly defined as the process concerned with determining and representing the subject matter of a photograph to provide intellectual access to it. Subject indexing is the most critical part of cataloging, yet there is little understanding of the cognitive processes behind it (Joudrey 2005: iv; Mai 2000: 1; Rondeau 2012: ii). This is especially true for visual works such as photographs, whether they are original works or their visual surrogates. Much of the literature on subject indexing has focused on putting forward rules of general applicability on how to conduct the task in an objective and neutral manner (Dahlgren 2022: 6-7; Mai 2000: vii-viii; Winget 2009: 959). Driven by the lure of quasi-absolute objectivity and intra- and inter-indexing consistency, this positivist-oriented literature has tended to put a premium on the objective aspects of subject content at the expense of the subjective/interpretative aspects, resulting in limited subject representation on the part of indexers and, consequently, limited subject access on the part of end users (Schaffner 2009: 6; Stewart 2010: 300; Stewart 2015: 16). In contrast to this positivist-oriented literature, this paper takes the view that subject indexing is fundamentally an interpretive process that stands midway between science and art (cf. Hass Weinberg 2017: 1985). It is partly science because it involves observation, analytic examination, logic, and evidence. It is partly art because it requires imagination[9], intuition and expression. As Hass Weinberg (2017: 1985) aptly puts it,

[9] Meaning the ability to organize discrete pieces of knowledge and evidence into a larger schema of understanding and possibilities, avoiding arbitrary or fanciful assumptions.

> [a]n indexer must be something of a prophet – envisioning the concepts likely to be sought by users of a document, expressing those concepts in terms likely to be sought by users, and providing cross-references from synonyms and alternative spellings as well as links to related terms to assist users in finding all the information that is relevant to their topic of interest.

In practice, "'[t]he user' of an online catalog is a mythical character" (Olson & Boll 2001: 276), and the indexer is no seer or mind reader (Mai 2000: 261-262; Pugh 1982). The indexer's attempt to achieve intersubjectivity can only be as good as the concepts and index terms they choose to represent the subject content of the item being indexed based on their knowledge, experience and judgment, under the constraints of some indexing language and institutional policies (Mai 2000: 274). Like all human processes, subject indexing is not foolproof. It is subject to human nature – with its complex mix of intellectual, emotional, spiritual and psychological aspects – as well as bias and oversight. Thinking about alternatives on how to narrow the semantic gap between indexers and users (see, e.g., Dahlgren 2022: 2, 17; Furnas & al. 1987; Pearce-Moses 1994: 254-255; Rafferty 2019: 6-7), there may be no other way except providing multiple modes of visual and textual subject access through different faceted interface structures incorporating convenient search and browse mechanisms and pathways, both for domain-expert and domain-novice users.

In the relevant literature, subject indexing is typically described and represented as a linear multistep process flowing one way, from determining subject matter to transposing it to an indexing language (Mai 2001: 594). But the process should be better understood as a circular process, one that moves backwards and forwards in multiple loops until a stop criterion is reached. Subject indexing should also be understood as iterative in the sense that it should be revised regularly to ensure that it is constantly aligned with changing users' needs and demands. In this regard, analysis of search and browse logs and user feedback play a key role because they can help identify areas for improvement that may not be immediately apparent.

Faceted subject indexing of the LPT photographic collection is thought of as a circular process involving two elements, three steps, and six substeps, as listed below and diagrammed in Figure 1.

- *Elements:* an agent and an object. Agent: an indexer of visual resources who is also familiar with facet analysis and classification. Object: a photograph (negative or positive). The series of actions performed by the agent on the object is what constitutes the faceted indexing process.
- *Steps:* (1) visual subject analysis, (2) representation, and (3) facet analysis.
- *Substeps:* (1.1) pseudo-formal analysis, (1.2) subject analysis, (2.1) subject display, (2.2) subject indexing, (3.1) categorization, and (3.2) classification.

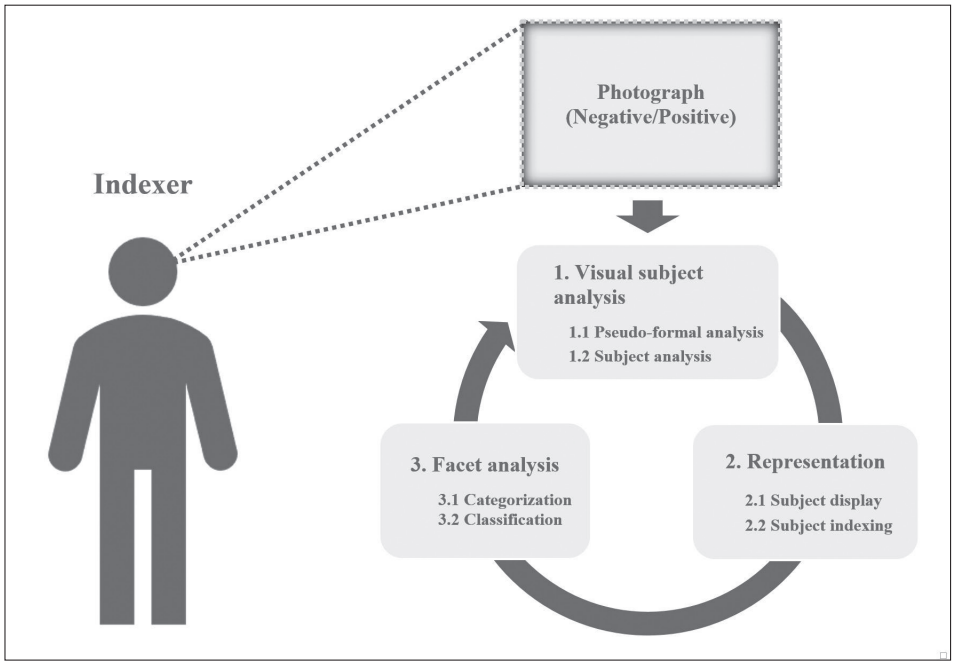

Figure 1. The LPT faceted subject indexing cycle.

As a preliminary step before the indexing process actually begins, the indexer will conduct a thorough examination of the original negative under consideration, including its housing, paying attention to any textual clues – both on the negative itself and in the accompanying documentation – that may help them establish the photograph's subject content, meaning, and archival context (see Benson 2010; Schwartz 1995: 46; 2004: 110; Turner 1998: 36; Zinkham 2006: 65-68), and whether the item is a stand-alone photograph or is part of a logically connected series.

Step 1 (visual subject analysis): it involves an analysis of the photograph's basic formal elements and subject matter.

- Substep 1.1 (pseudo-formal analysis): the indexer will identify and analyze the photograph's basic visual configurations or gestalts (clusters of forms defined by size, shape, orientation, texture, contrast, etc.), paying attention to how they relate to one another, as well as how they relate to the whole (composition). The indexer will make no attempt to describe in words the photograph's formal features (pure visual elements such as lines, colors, shapes) for indexing and retrieval purposes as this would be a futile effort. This task can be best accomplished by using the content-based method.

- Substep 1.2 (subject analysis): the indexer will conduct an in-depth analysis of the photograph's subject matter according to Panofsky's first two layers of meaning (see section 3.1.1), striving to capture the full range of possible subject aspects. Panofsky's third layer of meaning is out of scope for this stage of the LPT project, but it may be considered in future developments. At some point, the indexer will make some assumptions about what the photograph is Of and About, which they will check for accuracy against information and evidence from other sources, both visual and textual.

Step 2 (representation): this step is not a mere transposition from one medium to another, but a (re)construction of meaning based on the indexer's knowledge, judgment, understanding, and imagination. The indexer will decide on which subject concepts coined and carried in mind during the previous substep are worth recording as being relevant to the users who are likely to use the online catalog – bearing in mind that specificity and exhaustivity affect both precision and recall – and then represent them both in natural and controlled language. Representing subject concepts both in natural and controlled language may seem redundant, but it is not. In fact, the two types of representation serve two different purposes, namely display and indexing (see *CCO* 2006: 24-25; *CDWA* 2022: "16.3.1. Specific Subject Type").

- Substep 2.1 (subject display): the indexer will provide a representation of the photograph's subject matter in natural language that is easily read and understood by users and that can convey nuance and uncertainty. This data will be recorded in MARC 21 field 500 General Note and in MARC 21 field 520 Summary, Etc. (both fields are full-text searchable).
- Substep 2.2 (subject indexing): the indexer will provide a representation of the photograph's subject matter in controlled language. The controlled vocabularies of choice will be *AAT* (2021), *LCSAH* (n.d.), *TGM 1* (2017), and *TGN* (2017). If a concept term is not present in any of these controlled vocabularies, or is less than ideal, the indexer will select a term that most accurately represents the concept from other authoritative reference sources such as dictionaries, encyclopedias, glossaries, and domain-specific controlled vocabularies, treat it as a novel term, and add it to the local subject authority file (thesaurus). Controlled subject terms will be recorded in MARC 21 field 654 Subject Added Entry – Faceted Topical Terms. The indexer will also record the photograph's genre or form, that is, the specific subject representation type (e.g., "portraits"), in MARC 21 field 655 Index Term – Genre/Form.

Step 3 (facet analysis): it consists in sorting the subject terms identified in the previous substep into categories and facets according to the principles developed

Table 12. The LPT faceted subject indexing matrix.

Panofsky Component		
Layer of Interpretation	*Actions*	
Primary or Natural Subject Matter	• Identify and analyze the photograph's basic visual configurations, paying attention to how they relate to one another, as well as how they relate to the whole (composition). • Determine what they depict (what they are Of and About) at Panofsky's first layer of meaning. • Enter your thoughts into a Notepad file; it will help you not to lose track of them as you dive into the analysis.	
Secondary or Conventional Subject Matter	• Determine what the identified visual configurations depict at Panofsky's second layer of meaning. • Enter your thoughts into the Notepad file as you continue with the analysis.	
Intrinsic Meaning or Content	Not implemented	
***CCO/CDWA* Component**		
Level of Description	*Subject Display – Actions*	*Subject Indexing – Actions*
Subject Description	• Construct a formal statement in natural language describing the photograph's subject matter at Panofsky's first layer of meaning. • Enter the statement into MARC21 field 500 General Note (R), subfield $a (NR), under the heading Subject Description, as well as into MARC 21 field 520 Summary, Etc. (R), subfield $a Summary, etc. (NR), under the heading Subject Description.	• Choose the most specific AAT, LCSAH or TGM I terms that represent the Of and About concepts you have provided in natural language at Panofsky's first layer of meaning. • If a concept term is not represented in any of the controlled vocabularies of choice, or is less than ideal, select a term that most accurately represents the concept from other authoritative reference sources, treat it as a novel term, and add it to the local subject authority file. • Enter the individual index terms into MARC 21 field 654 Subject Added Entry – Faceted Topical Terms (R), subfield $a Focus term (R) and subfield $b Non-focus term (R), as appropriate, along with the corresponding facet hierarchy into subfield $c Facet/hierarchy designation (R) and the source of the term into subfield $2 Source of heading or term (NR).
Subject Identification	• Construct a formal statement in natural language describing the photograph's subject matter at Panofsky's second layer of meaning. • Enter the statement into MARC 21 field 500 General Note (R), subfield $a (NR),	• Choose the most specific AAT, LCSAH, TGM I or TGN terms that represent the Of and About concepts you have provided in natural language at Panofsky's second layer of meaning. • If a concept term is not represented in any of the controlled vocabularies of choice, or is less than ideal, select a term that most accurately represents the concept from other authoritative

	under the heading Subject Identification, as well as into MARC 21 field 520 Summary, Etc. (R), subfield $a Summary, etc. (NR), under the heading Subject Identification.	reference sources, treat it as a novel term, and add it to the local subject authority file. • Enter the individual index terms into MARC 21 field 654 Subject Added Entry – Faceted Topical Terms (R), subfield $a Focus term (R) and subfield $b Non-focus term (R), as appropriate, along with the corresponding facet hierarchy into subfield $c Facet/ hierarchy designation (R), and the source of the index term into subfield $2 Source of heading or term (NR). • Enter the photograph's genre or form into MARC 21 field 655 Index Term – Genre/ Form (R), subfield $a Genre/form data or focus term (NR) and subfield $b Non-focus term (R), as appropriate, along with the corresponding facet hierarchy into subfield $c Facet/hierarchy designation (R), and the source of the index term into subfield $2 Source of term (NR).
Subject Interpretation	Not implemented	Not implemented

Ranganathan/UK CRG Component

Ranganathan's Fundamental Category		*UK CRG's Standard Category*	*Question*	*Facet*	*Subfacet*	*Actions*
P	Personality	Thing [Entity] Kind Part Property	**W**ho?	…	…	• Sort all concept terms into broad categories by answering the associated questions. • Divide the broad categories into mutually exclusive facets and subfacets by applying a single principle of division at a time. Remember that division must be exhaustive (the dividing members when taken together must be coextensive with the divided whole) and proximate (no intervening class should be omitted).
M	Matter	Material	**W**hat?	…	…	
E	Energy	Process Operation Patient Product By-product Agent	**W**hat?	…	…	
S	Space	Space	**W**here?	…	…	
T	Time	Time	**W**hen?	…	…	

Key: NR = Nonrepeatable; R = Repeatable

by Ranganathan and furthered by the UK CRG. Although in the LIS literature the terms categorization and classification are often used interchangeably due to some similarity (Broughton 2023: 412), they are in fact two markedly different ways of providing structure and semantics for the representation of concepts in an information environment (Jacob 2004: 527). Specifically, categorization is the everyday process by which individuals sort entities (beings, objects, events, etc.) into groups or categories based on some perceivable similarity and resemblance in an effort to make sense of the experienced environment, be it physical or digital. Categorization is important because it is flexible enough to provide convenient reference points for identifying new entities as well as relationships between known and new entities. Classification is much more a complex and sophisticated cognitive process than categorization. It consists in assigning an entity to one and only one class within a system of mutually and nonoverlapping classes in a systematic, orderly and consistent manner. While categorization allows one to draw nonbinding associations between entities, classification does not – an entity is either a member or a nonmember of a specific class (Jacob 2004: 527-528). Recognizing these differences is paramount because it affects the way in which concept terms are presented to end users in the information environment (Jacob 2004: 527).

- Substep 3.1 (categorization): the indexer will sort all subject terms into broad groups (categories) based on conceptual similarity.
- Substep 3.2 (classification): the indexer will arrange these broad groups into successively larger mutually exclusive groups, called facets (classes) and subfacets (subclasses or arrays), using just one characteristic of division at a time.

The purpose of this section was to outline and diagram the key elements and steps of the faceted subject indexing process for the LPT photographic collection, that is, how the process is supposed to flow. The next section will describe how the process is expected to be conducted by the indexer under the guidance of a project-specific matrix.

3.3. The LPT Faceted Subject Indexing Matrix

Section 3.1.3 has discussed the classificatory problems faced in attempting to apply Shatford's matrix for faceted subject indexing of the LPT photographic collection and proposed some major changes to make it more consistent with the facet analytical method. Those changes have led to the design of a pilot matrix, called LPT matrix, aimed at walking the indexer through the indexing process to assure that it is conducted systematically and methodically.

The matrix consists of three components, reflecting the three steps of the process flow outlined in the previous section: (1) the Panofsky component; (2) the *CCO/CDWA* component; and (3) the Ranganathan/UK CRG component. To conduct the process, the indexer will use an input mask that will guide them in entering the subject data correctly into the relevant MARC 21 fields of a relational database. This data will then be extracted (programmatically) and optimized (manually) by the information architect to generate multiple faceted interface structures – from flat to hierarchical – intended to support exploratory search.

4. Concluding Remarks and Future Work

Faceted search has become a popular approach in online LAM catalogs, but its implementation often lacks the semantic richness and formalisms necessary to organize subject facets into a cohesive and logical multidimensional structure that can truly support exploratory search behavior (Cuna & Angeli 2021: 514).

The dominant information access model of current-day faceted LAM catalogs remains the "query and response" model, in which users enter a query into a blank search box and receive a ranked list of potentially relevant results together with a set of facets – mere query filters rather than *true* facets – in return. While this model works well for analytical search strategies, where users already know what they are looking for, it is completely unsuited for exploratory search strategies, where users have an open-ended or ill-defined information need or problem (Marchionini 2006: 42; White 2016: 130; White & Roth 2009) or are simply driven by curiosity (Dörk & al. 2011).

What exploratory users need, first and foremost, to accomplish their strategies is not a blank search box, but a bird's-eye view of the whole information environment they are about to explore in advance of a query to help them establish a mental model of the information environment and orient themselves accordingly (Antelman & al. 2006: 130; Bates 2007: "The Proposed definition"; Bauder & Lange 2015; Golub 2016a; 2016b: 23; Julien & al. 2012; Shneiderman 1996: 337). As they explore and become familiar with the various dimensions of the information environment, they can learn domain terminology and clues that they can put into use in more sophisticated search strategies, such as combined browsing and keyword searching (Bates 1989).

Constructing such a structure is no simple undertaking because it requires the design of complex models capable of reflecting the dynamic information needs and information seeking behavior of a wide variety of domain-novice and domain-expert users. It also requires robust facet analysis and classification, which Shatford's matrix turned out to be unable to support. This finding has led

to the design and implementation of a project-specific pilot matrix. Although specific to the LPT Photographic Collection, the matrix and the accompanying commentary provide conceptual and practical guidance that can be used by other indexers and information architects involved in the creation of exploratory faceted subject access to collections of representational pictures. Future work will present the opportunities and challenges met in developing the prototype exploratory search interfaces for the LPT photographic collection and other types of visual collections.

Appendix 1

Luigi Pio Tessitori (?), *Io nel mio studio. Bikaner 18 febbraio, 1919 = I in my studio. Bikaner, February 18, 1919*. Digital positive from glass plate negative inv. no. AP/V/6/4. Udine, Società Indologica "Luigi Pio Tessitori" (© 2005 SILPT).

Appendix 2

Visual subject analysis and indexing of the photograph reproduced in Appendix 1

Visual Subject Analysis According to Panofsky's Method		
Layer of Interpretation		*Subject Terms (Vocabulary)*
Primary or Natural Subject Matter	Free Text	Interior view of an office. Foreground: empty. Middle ground: middle-aged mustached man, directed to right, facing and looking straight to front, sitting diagonally with crossed legs on a bentwood armchair, left arm leaning on a desk, left hand holding the head, right arm laid on the back of the armchair, wearing a linen suit, shirt, necktie and dusty leather boots; the desk covered with various items, including an open notebook with a pen on it, another open notebook with an unidentified artifact on it, and papers; the occasional table on the right side of the desk covered with a cloth and holding various items, including a bunch of rolled papers and a revolving bookcase filled with books and papers; next to it, a fragment of a bas-relief made of stone lying on the floor; the floor covered with a mat; the open desk organizer behind the desk carved in bas-relief and filled with papers and photographs. Background: aligned against the wall, a piece of furniture with a bas-relief, a pile of papers, books and a table lamp on it; next to it, two étagères filled with books and papers; above them, hanging on the wall, some scrolls and a metal shield with two crossed swords. The man looking self-confident. The general atmosphere of the interior conveying a sense of quiet and order. Happening during daytime, in winter.
	Concept Terms	armchairs • artifacts • bas-reliefs (fragments) • bookcases • books • boots • chairs • desk organizers • desks • documents • étagères • interior spaces • lamps • mats • men • middle-aged men • mustached men • neckties • notebooks • occasional tables • offices • open desk organizers • orderliness • papers • pens • photographs • portraits • quietness • reliefs • revolving bookcases • scrolls • self-confidence • shields • shirts • suits • swords • table lamps • tables
Secondary or Conventional Subject Matter	Free Text	Luigi Pio Tessitori in his studio in Bikaner, Rajasthan, February 18, 1919.
	Concept Terms	archeologists • archeology • Bikaner • ethnohistorians • India • Indologists • linguistics • linguists • Luigi Pio Tessitori • 1919 • Rajasthan • scholars • studying
Intrinsic Meaning or Content	Free Text	Not implemented
	Concept Terms	Not implemented

Subject Indexing According to *CCO/CDWA*

Level of Subject Description	*Subject Type*	*Index Terms*
Subject Description	Of	interior spaces (spaces by location) • men (male humans) • offices (work spaces)
	About	orderliness • quietness • self-confidence
Subject Identification	Of	archeologists • Bikaner (inhabited place) • ethnohistorians • Indologists • linguists • Tessitori, Luigi Pio (1887-1919) • scholars
	About	archeology • ethnohistory • Indology • linguistics • studying
Subject Interpretation	About	Not implemented

Note on concept terms: all countable and proper nouns are in the plural form; terms are arranged alphabetically.

Appendix 3

Faceted structure resulting from facet analysis of the concept terms provided in Appendix 2.

People
People
- <*by gender or sex*>
  - men
    - mustached men
- <*by age*>
  - middle-aged men
- <*people associated with education, research & communication*>
  - scholars
    - archeologists
    - ethnohistorians
    - Indologists
    - linguists

Thing
Arm & Armor
- <*arm & armament*>
  - daggers & swords
- <*armor*>
  - shields

Furnishings & Equipment
- <*clothing & costume*>
  - boots
  - neckties
  - shirts
  - suits
- <*equipment*>
  - pens
- <*furnishings*>
  - lamps
    - table lamps
  - mats
- <*furniture*>
  - bookcases
    - revolving bookcases
  - chairs
    - armchairs
  - desks
    - desk organizers
      - open desk organizers
  - étagères (shelves)
  - tables
    - occasional tables

Information Objects
- <*by form of production*>
  - <*handwritten*>
    - documents (papers, records)
    - notebooks
    - scrolls (information artifacts)
  - <*printed*>
    - books
  - <*visual*>
    - photographs
      - <*by genre*>
        - portraits

Objects & Works of Art
- <*arm & armament*>
  - daggers & swords
- <*armor*>
  - shields
- <*sculpture*>
  - reliefs
    - bas-reliefs (fragments)

Process

Activities
- <*active*>
  - archeology
  - ethnohistory
  - Indology
  - linguistics
  - looking
  - sitting
  - studying

Space

Places, Rooms & Spaces
- <*by geographic location*>
  - India
    - Rajasthan (state)
      - Bikaner (inhabited place)
- <*by location or context*>
  - interior spaces
    - offices

Time

Time & Seasons
- <*by date*>
  - 1919
- <*by season*>
  - winter
- <*by time of the day*>
  - daytime

Associated concepts
Associated concepts
- manliness
  - scholarly manliness
- orderliness
- quietness
- self-confidence

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