

ThePrimate® - HPW and NNs Ecosystem based on DDC⁺ classification oriented to singularities' peculiarities

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Abstract. ThePrimate® is an HPW [High Power Web] platform which allows dynamic classification of digital resources from european databases - including those coming from Europeana - the easy retrieval of data, reuse of items and methods based on enhanced tools, a deeper layer of attached information. The platform is strictly connected to Filamento®, an original IoT [Internet of Things] framework, determining a lattice of precisely identifiable talking objects in the real environment, related as digital items in a Network of networks (NNs). The structure of graph is founded on the keys of “affinity” and “proximity”, it is modifiable according to singular needs and reusable to many different issues. The circulation of resources among the users is reinforced by an original economic paradigm based on a virtual currency, determining self-sustaining.

Keywords: CREDIT, Culture, DDC, Dewey, Education, Europeana, Filamento, Heritage, Heureka, Knowledge, Learning, Network, ThePrimate, UDC

1. Introduction

ThePrimate® is a 3.0 networking project of international CH [Cultural Heritage]. Started in 2009, it is based on a distributed technology and mobile AIDC [Automatic Identifying and Data Capture]. The project has been shared with CRUI Foundation [Conference of Italian University Rectors]. Cataloging the Cultural Heritage (CH) was stimulated by an agreement¹ with a government department - Central Institute for Unified Catalogue [ICCU, Italy], who identified ThePrimate® as an agent for universal cataloging and a player to send data to Europeana. Now, the augmented goal

¹ Agreement: MIBAC_ICCU-CRUI-Xoolab - “For the development of initiatives aimed to disseminate guidelines and best practices in the application of digital technologies for more extensive use of CH” - December 4, (2009)

is to create a cultural *Network of networks* [NNs], circulating a huge amount of CH resources and related *real* services, through a multi-purpose facility.

2. General scheme for cataloging and interoperability

The outline of ThePrimate® project is a cataloging system using the bibliographic and interoperability standards, fully integrated through OAI-PMH [Protocol for Metadata Harvesting], Semantic Elements, Dublin Core Metadata, DOI system. However, it introduces special enhancements which make the catalog considerably more structured and adaptive. The packages of cultural items are aggregated in a user-tailored graph, combining resources by intrinsic properties and “*peculiarities*” identification, referring items to logical class of similarity called “*Peculiar Minds*” (PMs). PMs partition meets the following criteria: **(a)** PMs work by items-cluster *proximity* and *affinity* to the user peculiarity; **(b)** PMs are dynamic, they do not refer to immovable classification, but their classes can change; **(c)** despite their dynamic properties, PMs have a primitive dependence from the DDC [Dewey Decimal Classification], in order to infer an initial degree of order; **(d)** every new PM *implements/gets*, inferential issues *to/from* the global system; thus, each node of the graph *brings/infers* changes to the entire ecosystem, increasing the primeval ontologies; **(e)** PMs rules are “folksonomic”, *peculiarities* assume new traits and rules by users usage; **(f)** singular PMs are comparable each one to others: if the organization <A1> determines its own order of CH, using a custom DDC criterion [DDC⁺ (better described at 3.1.1)], saving it with name “A1-Library”, and the organization “A2” does the same with its own *peculiarities*, creating “A2-Library”, the consequence is that the whole catalog outlines as a *multiplexed* graph, in a *n-dimensions* matrix, based on the number of *peculiar* versions. Every user/organization could compare the emerging differences obtaining a *delta* from complexity. The whole relationship network model is a linear finite difference equation with constant coefficients' matrix **(1)**

$$y^{(n)} + a_1 \cdot y^{(n-1)} + a_2 \cdot y^{(n-2)} + \dots + a_{n-1} \cdot y' + a_n \cdot y = f(x) \quad (1)$$

The whole ecosystem turns out to be a series (a not bounded summation) of different morphologies, created by different players-cataloguers, in a networked state of connexion.

3. CREDIT: the five pillars of Knowledge

ThePrimate® multi-purpose facility is a service project called *CREDIT* [acr. *Classification, Referencing, Educating, Disclosure, Transferring*], based on five pillars:

- a. *Classification*: ThePrimate® Digital Library uses an extended Dewey classification, called **DDC⁺** [augmented DDC]. This criterion is linked to HEUREKA® Prototype²;
- b. *Referencing*: Filamento® and UDC⁺ [augmented Universal Digital Code] determine a physical lattice of referenced talking objects of the CH;
- c. *Educating*: ThePrimate® e.Passport⁺ [vocational e.learning platform³] is a Higher Education courseware, aiming to ally the best european HEIs, ACADs, PRIs and Bs;
- d. *Disclosing*: CircÓs OpenJournalism harvests scientific papers with peer-reviews;
- e. *Transferring*: ThePrimate® k.Edge Store ensures the large-flow of digital cultural items, due to a virtual currency and gamification-criteria.

3.1 Classification in a Digital Library with DDC⁺

The method for resources and items classification is built on two layers. At the first, the digital files are classified by Dewey Decimal rules⁴ in multilingual [>10]. CH items are stored into ThePrimate® merging the *primitive* classes inferred by DDC with original ontologies and *subjective peculiar* keys. Thus, the static of DDC curves in a dynamic series of new possibilities, tending the catalogue to be congenial by *affinity coefficient* to each entity is using it. Items can be stored in more than one category, resulting an archive with discrete structure. Clusters [called *Peculiar Minds*] can be dismembered according to the wishes of the users; clusters of digital resources will be variously associated and linked in different sequences and grids. ThePrimate® graph grows with an extremely adaptive rate, establishing an ecosystem of different varieties, gathered from similar instances collected from different users; this expands and enhances the canons of DDC in the augmented **DDC⁺**. It is possible to select a *comparative* use (the “*delta-option*” is the real time comparison between similar archives created by different organizations). The library provides also ranking functions, review board, DRM system, and it servers all the other CREDITS environments.

2 HEUREKA, 2012: *enHancing the EUropean REuse of Knowledge Arts*. Consortium consists of 23.

3 ThePrimate® e.Passport⁺, 2012: *European Educational and Entrepreneurial Powerful AllianceS Supporting Tourism+Travel* - Consortium consists of 15 + associates partners.

4 *A History of the DDC System and its Creator M. Dewey* - Un. British Columbia's School of Library, Archival Information Studies. *Latest versions* [OCLC] - <http://www.oclc.org/dewey/versions/default.htm>

3.2 Referencing with Filamento® and UDC⁺

Filamento® is an original engine, currently under patent on behalf of the inventors of ThePrimate®. It is devoted to join the CH recorded to the web with a logic lattice of physical correspondents in the real world, self-transmitting position and properties through the Internet, so defining a “*talking-objects*” grid. The UDC+ system is composed of two layers: (i) the former is an intelligent machine and semantic-reasoning engine, processing object signals and assertions incoming from ThePrimate® users. It infers *folksonomic* rules, automatically cataloging new properties and logic ontologies, re-implementing into the cycle-flow of the network; (ii) the latter is a *distributed robot* who physically references every real object of the CH, precisely inferring to each item a dynamic code about position and intrinsic properties. It gives to cultural objects a “*subjectivity*”. It implements related information coming from humans and their organizations, in a social way: Filamento® is able to rely on a *fractal* lattice, consistent of *significant* information coming from objects [about themselves (etiology and physical properties and changes)], as well as reports sent by users from the real place where they are enjoying CH. According to Filamento® technology, CH can be always rendered as *immaterial*, through the virtual collection of digital information, *fractalized* from the real, and interpolated by Filamento® reasoner - whatever the item state is [tangible, static, dynamic, poly-dimensional]. CH can be provided with a potentially perpetual code, which will return unambiguous identification of quantity and *quality*⁵, according to the rules of *accessibility*, *accuracy*, *comparability*, *completeness*, *consistency*, *relevance*, *timeliness*. In terms of user interaction, Filamento® is represented as an expert *subject-engine*, talking in similar-natural language, able to render user requests, providing adequate responses, services, functions - in some cases in a *conversational mode*⁶. In terms of logics, Filamento® processes the incoming items with adaptive criteria, coupling them, interpreting the increase of properties, employing a “*genetic learning*”⁷ and deploying CH into **DDC+** Library. The *magnitude* around which the system is based is the “*Catalog-gist*” of ThePrimate®: without it, the graph would be scattered into myriads of non-connected nor significative information. Filamento® holds together the network of *talking objects*, combining 3 logic-subjectivities: **(A)** the set of physical resources of the CH, present at a given moment in the real

5 DAMA *Notions of Data Quality Management - CMS Sommersemester* (30.4.2010 ff) - B. Thalheim, Computer Science Institute, Kiel University, Germany - 2010 - also cfr. [1, 2]

6 Dana Quade, Vol. 39, No. 3, pp. 343, 345 - cfr. [3]

7 *Evolutionary algorithms* - cfr. [5, 6, 8, 9, 10, 12, 13, 14, 15, 16]

environment; **(B)** the rendered resources, by fractalization and interpolation, cataloged into ThePrimate®; **(C)** the unique lattice infrastructure realized by its intelligence, which assigns to each real element in **(A)**, linked to its digital corresponding in **(B)**, a unique identifier called **UDC⁺**. This is dynamic, and brings in its map the information to recognize, identify, *storify*, and 4-dimensionally situate each item. The networked hardware transmits the own signal of every standing object, endowed with position changing. So that Filamento® is able to constantly produce an alive map of CH environment, for every given time. The signal⁸ transmitted is not to be barely considered as physical, because the **UDC⁺** is a carrier of several structured information: a shell supports self-diagnosis of conditions [temperature, pressure, density, color, vibratory compaction, frequency, comparative forces], etiological information [reasons for occurring changes], *sociality* coefficients. The other pillars of CREDITS constantly use Filamento® lattice of **UDCs⁺**.

3.3 Educating with ThePrimate® e.Passport⁺ courseware

The social value of CH is achieved by its movement, and it is close to the coefficient of re-use of items. To increment it, we determined a large pools of practical, social interests. Including a huge mass of digitized resources of CH into an educational framework, available to universities and research centers, and linked to **DDC⁺** and Filamento® lattice, we moved in this growing way. To create ThePrimate® e.Passport⁺, it was necessary to develop a receptive fabric, finally creating stable stakeholders of the *raw material* of CH. We identified policies for cooperation between Universities and Business entities, in an unique ecosystem [**UBC⁺**, augmented University-Business Coop], focusing on **8 main topics**: (i) Cooperation in R&D, (ii) Mobility of Academics towards industries, (iii) Mobility of students toward innovative Higher Education Institutes, (iv) Economic Evaluation of Education and R&D results [CH value-chain, from the early stage of education through experimental phases], (v) Curricula Development and Spread through pan-European pole of innovative training, (vi) Pushing-up the *life-long-learning*, (vii) Vocational Education, (viii) Technologic Network of networks setting. The model we used helped to establish a framework which consistently allows different subjects with different interests to interoperate, in an ecosystem that grows according to the dynamics of *triple helix*⁹. This model overcomes the gap between educational-training and industrial application. The parties in the model are: **(I)** Institutions of Higher Education and Academics [**HEIs**,

⁸ Filamento® can use a combined technology for: (i) deep coding items, through the application of artificial DNA tending to infinity number of unique codes; (ii) ultrasonic sensor transponder for complex active sensing.

⁹ The model of the Triple Helix, resulting by the final convergence of three worlds, could be represented by three factors: the *actors*, the *institutions* and the *rules and regulations*. cfr. [9, 10]

ACADs], (II) Research entities, both public and private [**PRIs**], (III) Industries who applies sciences through post-graduates employment and projecting into Business domains [**Bs**]. We enhanced the original criterion of *triple helix* considering the particular *receptor-ligand*¹⁰ state which is intrinsic for (**B**) and (**C**) [**PRIs** and **Bs**] subjects. In fact, they could be considered two sides of a single synthesis, since the industrial departments searching for new specialists constantly draw from the layer of Higher Education. Thus, they serve as a bridge for the access of Higher Trainees coming from **HEIs**, **ACADs** and **PRIs**, in the **Bs** world. Keeping separate their *helixes* reduces the model's growth. Last, the technological driver can constitute by itself a *subjectivity* for the "*triple helix*". Hence, the most efficient way to induce **HEIs**, **ACADs** and **PRIs** to interchange activities and needs with **Bs**, includes a technological platform as an essential entity - not considering it as a mere backbone: ThePrimate® e.Passport+ works in this way, according to *Everyware*^{11,12} criterion [*ubiquitous computing*], allowing the subjects to create curricular trainings, by using a "puzzle style" with a dynamic "LEGO®" effect, drawing/implementing resources from/into the **DDC+** Libraries of digitized CH for a new pedagogical, **UBC+** oriented aim.

3.4 Disclosure of knowledge through **CircÓs OpenJournalism e.Print repository and "Great Debates"**

Paraphrasing the title of a recent study¹³, it is possible to define the concept of Culture "*questionable*". Circulation of CH is reinforced by strong social mechanisms, such as the sharing of ideas and criticism, thus to ensure a speculative analysis, as well as to feed a quali-quantitative corpus of *citations*. The dozens of repositories that collect publications and documents of cultural analysis don't cover a social-model of open journalism devoted to CH: yet, there wasn't a CH social platform available to public, broader than specific circuit of peculiar niches. Since it was necessary to involve great participation in order to procure folksonomic issues, we founded a model for a broadly participatory journalism for CH and Science. We determined a complex pattern in an open-source platform with self-archive criteria, and we called it "*CircÓs Openjournalism*", intrinsically connected to the **DDC** Library, Filamento® lattice and

10 Studies about networks properties have particularly concentrated on bio and social networks' common criteria: *small-world*, *power-law* distributions, network *transitivity* - *receptor-ligand* kinetics included.

11 A sample of pervasive ubiquitous computing: see the Project *Oxygen*, MIT, <http://oxygen.lcs.mit.edu/>

12 An European sample of design of ubiquitous computing application: view SLCA [cfr. 20].

13 cfr. [21] Claidiere, N., André, J. B., 2011

e.Passport+ courseware. It is based on a multilayer logic: **(a)** the first is for user identification, producing the value (**_ID**) among six subjectivities: 1-Students, 2-Pro-users, 3-Campus, 4-Companies, 5-Journalists+Peers, 6-Directors; **(b)** the second is for contents processing: at its end, it expects to intersect with a parametric matrix allocating uses-licenses and DRM. The value (**_R**) is assigned; **(c)** in the third layer, the *rating* procedures starts, evaluating through a factorial algorithm of 3 progressive rates: (1) *community rate (rate 1)* → (2) *journalists and "peers" rate (rate 2)* → (3) *directors rate (rate 3)*, each one of them choosing among a triple evaluation factor; thus resulting that every submitted contribute gets a **3! rate [v1 → v2 → v3]** respectively coming from *community, peers and journalists, directors*. The evaluation algorithm prevents the contribution to transit unfiltered from one layer to another: it can infer the spin $\{(a \Rightarrow b) \Leftarrow (c)\}$, or thereafter $\{(a \Leftarrow b) \Rightarrow (c)\}$, turning back the rating sequence and overturning the projection. It prevents the dominance of the typical *popularity rate*, that we actually considered misleading. The CircÓs' contribute, after passing **(c)**, is compared with the array of systemic ontologies, giving the result of (**_P**) (= *social weight of item*) **(3)**. Finally, it is sent to DDC+, learning curricula, experimental re-uses. It is approximately*:

$$4_{\langle \text{typ} \rangle} \cdot (\Phi^5) \cdot (\Theta^8) \cdot (\mathbf{B}^4) / 2_{\langle \text{form} \rangle} = \mathbf{P}_{\langle \text{item} \rangle} \quad (3)$$

with: $\langle \text{typ} \rangle$ = *objective required*; Φ = vectorial ontology for *permission or privilege*; Θ = vectorial ontology for *contribute's physical type*; \mathbf{B} = vectorial ontology for *user functionality*; $\langle \text{form} \rangle$ = *significance*; $\mathbf{P}_{\langle \text{item} \rangle}$ = (**_P**) ~ *social weight of item* — *[Jargon simplified]

3.5 ThePrimate® k.Edge - Transferring the value of CH items through (virtual) economic systems

We considered the need to use an exchanging system for CH, through a cumulative method based on virtual currency. ThePrimate® k.Edge provides users with a personal *plafond*, referred to units of wealth, for a concrete economic evaluation rating of CH assets. At his first entry into ThePrimate®, each user receives a *score* called "*Karyotipós*". It is quantitatively defined by λ [*Lambda*], having a dynamic and unstable oscillatory behavior, following the lifespan of each user, depending on his degree of activity in the ecosystem. *Karyotipós* corresponds to the currency called "**EUKEY**" [uKs]. In the beginning, the λ *Karyotipós* of new members is set to **500** uKs [$\lambda=500$]. Each resident producing value in the ecosystem - just entering resources, manufacturing models, swapping assets, creating clusters, defining classes and creating best-practices - distributes elements of enrichment; to be capitalized, his λ must be divided in **2 parts**:

- a) the first part is called σ [*sigma*], corresponding to the *personal enrichment* the user collects for himself, by individual activities he is able to produce;

b) the portion Θ [theta] is sent to the global environment wealth, as a fee.

So, every subject adds to its λ *Karyotipós* a new score consistent in σ_n [sigma], and he sends the values Θ_n [theta] to the ecosystem, due to his activities. The percentage calculation of Θ is inversely proportional to the total value of individual λ : increasing λ , it decreases Θ [theta] fee-rate. This reversal proportion solicits the user interest to increase activity, in order to contribute with lower odds. This concept is justified by evidence that, for every personal enrichment, a contribute to the global ecosystem has necessarily been sent “in nature”. It results that “participatory is a vital richness”, and it can be shown that both global and individual enrichment functions are asymptotic, stable and positive. Given \hat{A} as an Hermitian operator¹⁴, we have that:

$$\langle \sigma_n | \hat{A} | \Theta \rangle = \int dV \sigma_n^* (\hat{A}\Theta) \quad (4)$$

The ecosystem ever increases, while the global wealth [Σ (*Sigma Capital*)] can never decrease if all λ (s) are growing. The global Σ corresponds to asymptotic stable function everywhere positive. To prevent individual apathy, acting is stimulated by a 2nd factor, influencing λ *Karyotipós*' growth; it is τ [tau], a constant with periodical increasing, due to the passage of *unproductive time*. It has the opposite sign against (3); τ [tau] is an *opponent-value* to the *Karyotipós*, and it continuously tends to decrease it. Such systemic functions enable the convergence of *singularities*' interests toward a community advantage, boosting the CH usage; this results in a game that rewards the permutation of the opponent carriers of peculiar interests in the same direction of “helix-growth”, optimizing the natural selection of positive behaviors through the application of genetic criteria.

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¹⁴ Given the vectorial domains of σ and Θ , \hat{A} operates on $| \Theta \rangle$ and turns it into $\hat{A} | \Theta \rangle$

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