Icons and Icons: New Paradigms In Interface Design

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Abstract: The use of icons in the visual communication of computer languages has recently increased in quantity and complexity with the widespread proliferation of icons in mobile dispositives such as smart phones, ipads, etc. Icon designers and analysts, however, seem to underestimate the semiotic and rhetorical implications in the representation of icons, the subsumed syntax leading to easy or difficult dialogue in iconic communication, the need for an architectural representation of iconic contents. I shall analyse terminological phallacies and conceptual limitations of present interpretations in icons usability and provide a possible further interpretation on the basis of semiotic, linguistic, rhetorical assumptions and related syntax. In particular I shall propose a syntactic interpretation based on the relation between metaphors and metonymies in iconic representation needed to validate the results of comprehension tests.

Key words: metonymic and metaphoric icons, semiotic and rhetorical interface design, iconic syntactic structures.

Introduction

The pioneering analysis of interface design by Nadin has put forward a number of basic issues of the semiotic perspective as he declared that "design principles are semiotic by nature" (Nadin, 1988, p.270). We leave aside the debate on the distinction between 'concrete' and 'abstract' in philosophy and linguistics, and turn to Nadin who introduced the opposition of *concrete* versus *abstract* icons.The visual representation may vary from the 'concrete' (namely pictograhic) representation of computer objects/functionalities to the abstract representation of the same (Nadin, 1988, pp. 283-284). The representations, moreover, can be realized as iconic, indexical or symbolic signs following Peirce's triad (Nadin, 1988, pp. 270-271). In this perspective, an object can be represented iconically, if the representation is based on resemblance, likeness; indexically if the representation is causally influenced by the object and symbolically when representation is based on convention (Nadin, 1988, p.270).

Concrete versus abstract, iconic versus symbolic signs

A first terminological check questions the definitions of concrete versus abstract icons and the related quality of iconic representation, as we shall see later on.
The Neozelandese school has widened Nadin's analysis of visual communication in the computer language (Ferreira, 2004, Ferreira, Noble, Biddle, 2005) according to semiotic and rhetoric criteria.
On the one hand, they apply the peircian triadic articulation of signs in icons, indexes and symbols to the analyses of icons in computer interaction using the distinction between *iconic* and *symbolic icons*.
On the other hand, they propose the interpretation of visual representations in interface design by applying the typology of language metaphors as cognitive devices put forward in 1980 by Lakoff and Johnson (2007) to graphic interfaces (Barr, Khaled , Noble & Biddle, 2005).
Dormann (1994) recalls Nadin's interpretation and proposes a typology of mechanisms of construction of *compound icons* to be considered as the 'syntax'of the iconic language.

These and other analyses, however, do not allow for an explanation of why certain icons in computer and mobile interfaces are understood better than others by users (Ferreira, Noble, Biddle, 2006; Gatsou, Politis, Zevgolis 2012).

The common generalization of the results of intuitive tests as administered to diverse targets of users in different studies on the basis of the concrete/abstract and the iconic/symbolic opposition seems to confirm a better usability of 'concrete' icons against a loose usability of 'abstract' ones with the only debatable specification that concrete and iconic signs would be closer to the object/function they represent, in a sort of tautological loop. The degree of likeness of the icon to the represented object is called *articulatory distance* and implies the obvious consideration that the designer's intended meaning should coincide with the user's comprehension. What is not explained is the correspondence of an 'object' (?) with a 'function' and their translation into an iconic representation: in other words why should the icon of a printer stand for 'printing' or that of scissors fo 'cutting'.

In the above mentioned assumptions the assimilation of the notion of 'concrete' to that of 'iconic' icons as well as the correlation of 'abstract' with 'symbolic' signs to be tested for comprehension is proposed. However the choice of the tested visual items appears as an arbitrary option. The assumption goes together with the obvious consideration that familiarity and previous knowledge of icons, both abstract and concrete, by users is an important variable in comprehension results: a statement that coincides with Nadin's view that the user must understand the computer language in order to use it.

Computer language is a specific language with rules such as the association of certain actions with certain icons, their syntax or else the logical structure underlying the interface.

The diffusion of fuzzy concepts such as *concrete* versus *abstract*, *iconic* versus *symbolic signs* does not help to detect specific rules in iconic communication and is not justified by the corpora of icons proposed to illustrate them. The use of these concepts explains the unsatisfactory and conflicting results in intuitive tests of icons comprehension as stated above (Ferreira, 2004, Ferreira, Noble, Biddle 2006, Gatsou, Politis, Zevgolis, 2012).

I believe the reason lies in a limited exploitation of semiotic and rethorical mechanisms involved in visual communication that specify the syntactic iconic structure underlying images.

The overall question concerns the feasability of iconic communication through new icons, whether concrete or abstract, whose meaning be not specified by linguistic means, namely the labelling of intended meaning, in order to be memorized and conventionally recalled by users.

This implies the differential ease in intuitive recognition and memorization of new icons and whether or not the verbal language is always needed as a metalinguistic support to visual communication (Zuanelli, 2012).

In order to identify the phallacy of simplified interpretations I shall briefly recall approaches, analyses and solutions to pass on to a different position. I shall first recall Nadin's distinction between concrete and abstract icons and the triadic peircian articulation of signs in icons/indexes/symbols as applied to the analysis of interface design.

According to Nadin and the peircian triad of signs, the representation of iconic entities may be articulated as follows. The example concerns the representation of a pocket 'calculator'. The image seems to maintain certain visual features of the object in the real world, namely some quality of the physical object to which the image is related according to Peirce's assumptions.
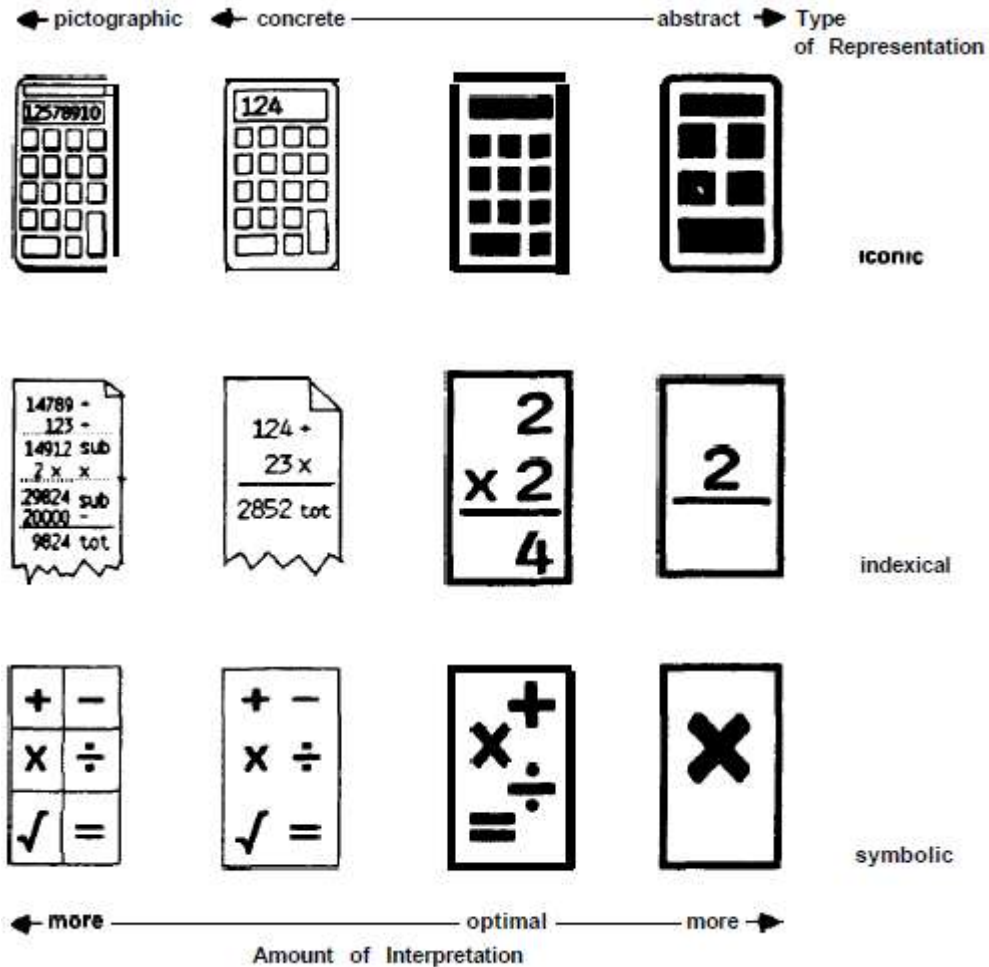
Figure 1: Nadin's representation of visual signs (1988)

The range of visual representations of the same virtualized object/function proposed by Nadin goes from a pictographic representation which is considered to be concrete and iconic to a gradual simplification of the graphic rendering of the same object down to a so called abstract representation which is considered to be symbolic. The same concrete/abstract distinction applies to the indexical and the symbolic representation of the object. Nadin's interpretation elicits a number of questions.

First, we can observe that the reduction of graphic details in the four items of the first row from concrete to abstract in the iconic representation still releases a concrete, almost figurative realization in the abstract icon too. In the abstract iconic representation, in fact, we can still guess the identification of the virtual object 'calculator' through essential features such as the rectangular shape, the proportion of lines and the articulation of square boxes/buttons inside the rectangular figure. A possible ambiguity is present in items three and four of the row where the lack of numbers that refer implicitly to operations might elicit other interpretations of the object/functionality if the icon were taken outside a specific context, namely the reference to a TV remote control dispositive or a cellular phone. Therefore, beside the shape and the boxes, the third visual information clue seems to be the presence of numbers and their metonymic/indexical relation as referred to operations in a calculator: 'if numbers on an object then digital operations through a calculator' since numbers are metonymically implied in operations and the tool for this action is a calculator.

Visual metaphors and metonymies

At this point, let me introduce, the concept of *visual metonymy* to explain the correlation of icons with the intended meanings.

In the essay on translation Jakobson evokes the semiotic nature of the verbal language, indirectly quoting Peirce by referring to the fact that the meaning of a word is its transposition into another sign that can replace it more completely (Jakobson, 1966 a, p. 57). He defines the *intersemiotic translation* as the interpretation of verbal signs by means of non verbal sign systems.

In another famous essay on aphasia (Jakobson, 1966 b) he introduces the semantic distinction between the metaphorical and the metonymic orientations in language constructions referring to the relation of one theme with another by *similarity* (typical of metaphors) and *contiguity* (typical of metonymy). The verbal metonimy presents a semantic contiguity with the verbal item it stands for, for instance the part for the whole, the tool for the action, the container for the content. The contiguity concerns position that is the syntax/combination of words. If we accept this analysis we can define a metonymy as the replacement of an expression with another semantically related to it by contiguity that is by means of a syntactic relation. What is implied is that the meaning of a metonymy requires a syntactic analysis that specifies the relation.

Let us apply these assumptions to the intersemiotic translation namely from words to icons through the metaphorical (substitution) and the metonymic (combination) relations and return to the calculator example.

The visual component,'numbers', is a doubly indexical/metonymic clue, meaning 'if numbers then mathematical operations' and 'if mathematical operations then the tool calculator'. The conclusion would be that the first and the second image are 'concrete' as far as the iconic metaphor of a calculator is accomplished through the presence of an additional clue, numbers, that is not available in the third and the fourth items of the row, being insignificant the number and the types of boxes inside the rectangular shape for an unambiguous interpretation. A direct implication would be that in concrete representations of interface design for a virtual calculator, essential and *distinctive* graphic clues are needed as compared with a general photographic or pictographic miniaturized iconic representation.

A second observation concerns the indexical representations in the second row. The first three items are really indexical, 'if mathematical operations on a sheet then an implicit activity of calculus and a virtual tool for operations' that is a virtual calculator, whereas the last item of the row would very doubtedly be understood as an operation and could only be considered a symbol for operations through a visual convention. Two further details are offered for items one and two of the indexical row, namely the sheet/file. The sheet adds an indexical detail: the virtual sheet for operations is the indexical realization of the 'concrete' sign/function, operations written on a piece of paper, to be virtualized in a further metonymic assumption namely the translation from the virtualized sheet to the implicit tool/calculator display. This indexical clue is not present in the two other images.

The third row poses a different question consisting in the arbitrary nature of symbols as historically discussed by Peirce and Saussure (Peirce, 1998, Saussure, 1972, Zuanelli, 2012). If a symbol is originally arbitrary and can be interpreted only by means of convention, the four images are not properly symbols, unless they be conventionally used as such. In fact, the three items are rather indexical whereas the 'abstract' quality of the image should be originally unmotivated and conventional in order to be a symbol, at least according to Saussure. The different nature of symbols is the basic distinction between the verbal and the iconic language.

The complex relational structure of iconic *semes*, defined here as the pertinent and distinctive graphic components of the icon, becomes evident and blurs the notion of concrete representations as opposed to abstract ones of the types we have examined. Either we accept the fact that abstract icons coincide with an originally arbitrary representation of symbolic icons that only communicative digital conventions can turn into symbols or admit that a symbolic sign may be as concrete as an iconic one and this assumption would blur the distinction between iconic and symbolic signs, given the fact that both must be conventionally recognized as such. In other words, we must accept the fact that iconic symbols are not necessarily arbitrary at their origin as words are. The symbol of justice, a humanized female figure that holds a scale, has an undoubtful metaphoric and metonymic meaning that was conventionally assumed whereas the symbol/word 'justice' does not present inherent properties of the concept of justice in its *signifiant* that could have been originally a totally different string of phones/sounds. We must also face the problem of the introduction of new icons whose not 'figurative' quality does not correspond yet to a conventional meaning. In other words 'figurative' signs related to objects/functions seem to elicit complex semantic structures that lead to comprehension through metaphoric and metonymic translation, which is not the case with 'abstract' non figurative signs. If this is the assumption, we can revisit the results of intuition tests formulated according to the opposition of iconic versus symbolic signs, concrete versus abstract ones, as we shall see. In order to do that, we must deal with another problem: the syntactic difference between *single* and *compound* icons. Finally, we need to distinguish among typological sets of computer functionalities recalled by icons to be interpreted in different ways according to context, namely their being system icons or application icons or state icons. In order to anwer these questions we formulate the hypothesis of the existence of an implicit verbal syntax under the iconic representations that mediates and conditions their comprehension. Let me come to the point.

Single and compound icons: a syntactic analysis

In a previous analysis of mine, I had recalled the fact that icons as present in graphic user interfaces (GUIs) inform us of two basic things.

First, icons and words define both the *context of interaction* and the *actions* suggested for interaction to users in the computer dialogue. The context is generally rendered through visual environment metaphors and verbal labelling as in menus and functionalities/actions are conferred to visual metaphors/metonymies usually verbally defined. Second, graphic interfaces use different functional typologies of visual information: graphs, icons, colors, space, etc. with the implication that *concrete icons*, which I had rather called *figurative icons*, as we have seen, are better understood than *abstract* or new ones (Dormann, 1994, Ferreira, 2004, Zuanelli, 2012, 2013).

As a second assumption, both single and compound icons imply a verbal syntax where the verb/action, as in a prefix rule, is evocated by an iconic metonymy: the visual tool 'printer' for the action of printing, the visual object 'sheet' for the action of opening a file. The implied iconic verbal linear syntax would appear as follows:

Verb (either iconically implicit or explicit) + **Object** or **Complement**

The synopsis of Microsoft Windows Word and Outlook Express presents a linguistic syntactic typology that refers to the conceptualization of contents identifying digital functionalities.

Types of icon	Iconic metaphors	Syntactic relations in icons	Linguistic syntactic relations	Abbreviated syntactic relations
TYPE 1	single concrete icon **iconic metaphor** FILE	object (file) for action (open) (**syntactic metonymy**)	verb ellipsis +object	**(V) O**
TYPE 2	single concrete icon **iconic metaphor** SCISSORS	tool (scissors) for action (cut) (**index/syntactic metonymy**)	verb derived from name/iconic metonymy+object ellipsis	**N V (O)**
TYPE 3	single abstract icon (**conventional iconic orientation metonymy**) ARROW	graphic **symbo**l (arrow) for action (cancel) (**symbol/syntactic metonymy**)	verb+object ellipsis	**V (O)**
TYPE 4	composite abstract icon (**conventional orientation metonymy**) ARROW + concrete icon (envelope)+ abstract composite icon (electronic address symbol over paper/email) (**conventional orientation metonymy/composite icon**) ENVELOPE and EMAIL	graphic **symbol** (arrow) for action (**symbol/ sintactic metonymy** + **object** and **modifier** (electronic envelope) (web address symbol)	verb+object	**V NN →VO**
TYPE 5	same concrete icons/duplication (**metaphors**) WRITTEN SHEETS	**duplicated icon** for action (copy) (**sintactic metonymy**) + object (sheets**/iconic metaphor**)	verb and iconic object coincide	**NNVO**
TYPE 6	abstract icon and concrete icon (**metonymy/metaphor**) ARROW + FOLDER	**graphic symbol** for action (open) object of action (**iconic metaphor**)	verb and object	**V O**

Figure 2: Iconic syntax (Zuanelli, 2013)

The functionalities are translated into the iconic language by means of rhetoric-semiotic mechanisms. In the synoptic table, types correspond to 'concrete' and/or 'abstract'/conventional icons, single and compound, namely two or more visual signs.The composition of icons, two or more, is realized through a horizontal or a vertical spatial location, juxtaposition or superimposition of iconic signs. Even when superimposed, the compound icons correspond to a linear syntactic sequence mutuated from the English language.

In Type 3 we can observe that the 'symbolic' icon arrow for the verb 'delete', as stated above, contains a double metonymy: the 'return' action that implies the action of 'deletion' in an indexical causal extension: 'if virtual return then delete'. Moreover the semiotic value of the arrow varies as related to the implied syntactic context and composition: in Type 4 the arrow means 'send' whereas the doubly oriented arrow in email means 'send and receive'.

As a conclusion, the intersemiotic metaphor from the verbal to the iconic code by means of a 'concrete' or an 'abstract' icon coincides with a specific structure where the concrete image is an icon that in Peirce's approach has a physical qualitative resemblance to the virtual object it represents, as well as an index/metonymy based not only on the causal relation (if...then) but also on the semantic *contiguity* (Jakobson,   p.40) typical of the metonymic relation, in general.

We may also assume that abstract concepts (such as 'justice', 'peace' or 'Internet', 'phone call') imply originally a verbal metonimy that is translated into a 'concrete' symbolic visual metaphor, the symbol for justice, peace, Internet, etc. and a visual metaphor of the verbal metonymy as in 'phone call' or 'message'.

Single versus compound icons: predicative or modifying structures

Among problems to be faced in this analysis we should now deal with the following issues: are single icons easier to understand then compound ones and concrete icons better then conventional or new abstract ones; are photographic iconic representations better than pictographic ones and do compound icons subsume the same syntactic structure as single ones? An overall question to be posed could be whether different subsumed syntactic structures imply different degrees of comprehension, namely if a Verb+Object structure is easier than a Verb+Complement structure. Now we can address these issues. Let me start with the first question concerning the structural quality of compound icons.

In her proposal of compound icons Dormann theorizes the existence of an 'iconic' syntax where the term syntax coincides with different ways of combining icons: *combination* (superimposition, conjunction, concatenation, juxtaposition), *transformation*, *derivation* and *inheritance*, *duplication*.

Figure 3: Examples of iconic combination (Nadin, 1994, p. 82)

These techniques, as she calls them, for creating compound icons are 'the syntax' (Dormann, 1994, p. 81).The visual techniques for different types of combination are represented above. Whilst examples of superimposition let understand that two icons are put together, one on top of the other, to create a new concept, concatenation can be described as the multiple duplication of the same icon on a vertical superimposition. Juxtaposition appears to be the composition of an icon with another one on a spatial coexistent area.

Whatever the combination, the important observation is that compound icons 2, 3 and 4 create a new conceptual entity: 'modem', 'stack', whereas items 1 and 5 correspond to a compound icon of a second type where one icon is the *modifier* of the other: idea 'of a stack', 'world wide' network according to the verbal syntax of the English language with left and right modification. In these cases, there is no *predicate syntax* but only a *word composition*. According to my analysis, the substantial matter is that different compound icons correspond to different syntactic functions: a *modifying function* and a *predicative function*. One way of considering icons and their functionalities would then be that the identification of different verbal structures subsumed by different types of compound icons is needed for comprehension.
In other words, we can make the guess that the meaning of compound icons is more difficult to retrieve, given the need to understand a different underlying syntactic structure: a predicative structure straightly related to the functionality as different from a modifying structure having to do with an adjectival/appositional and specificational property attributed to the object/function. Secondly, as evidentiated by various analyses, the

specific context of icons (static, system, application functions) would determine their proper comprehension, having to do as well with the familiarity/previous knowledge of the icons by users.

Predicative and modifying structures

Let us come to this point and have a look at *system icons*, both single and compound, to put forward examples of their different structure and check the double, often semantically ambiguous value of compound ones.

In the Control Panel of Microsoft Windows 98, the system icons are rendered through single and compound icons that correspond all to an implied generic function of 'management of programs' and have to do with the thematic contents of the implied function. Only a few verbal labels specify the kind of actions explicitly proposed to users even though the verbal labelling of functionalities does not correspond to an imperative/directive function but has to be considered as a *false imperative*, standing for a title of the function (Zuanelli, 2009). See, for instance **Add new Programs, Add and Remove Programs, Find Fast.** In these cases, the verbs represent thematic functionalities as confirmed by all the other nominal formulations of contents. They are *thematic labels* performing the titling function that includes a number of internal actions related to system, network and Internet functionalities.

Figure 4: Microsoft Windows 98 Control Panel

In the iconic presentation of the programs of the control panel, predicative structures and modifying syntactic structures are present. Let us comment a few cases.

In **Desktop Themes**, we can see the juxtaposition of four metaphoric/metonymic icons: the metonymic capital **A** standing for 'graphic letters', the metonymic **palette** standing for 'colours', the metonymic **megaphone** standing for 'sound', the background **computer screen** meaning the literal metaphorical concept of a computer screen.

In a syntactic iconic analysis we can interpret the three superimposed icons on the fourth one as 'manage the screen script, colour and sound'.The syncretic comprehension of the icons is facilitated by their concrete metonymic meaning and by a simple (V) + O relation, the object being the appositive modifying structure we have postulated ('screen script, colour and sound'). An intuitively simpler structure (V) + O is the case with **Mouse** whereas **Regional Settings** could hardly be understood iconically as such, due to the use of the globe as a conventional concrete symbol for the Internet, metonymically meaning instead 'geographic areas as part of the

globe'. A slightly more complicated analysis would be applied to **Find Fast** that presents an iconic modifying structure (Verb + Adverb) that would loosely correspond to the iconic representation that is proposed in a reverse order as 'fast find' (first the 'lightning' for 'fast' then the 'binocular' for 'find'). The iconic structure presents a rather complicated visual metonymy: the lightning icon standing for quick, 'fast' and the binocular virtual tool for 'finding'. A double metonymy is implied: 'a binocular for a magnified vision' as related to a 'tool for search' and 'if search then (possibly) find'. In this analysis we could wonder how many of the iconically synthesized functions represented in the table could have been interpreted without a verbal labelling. We could also wonder if the compound icons, as the case is with **Find Fast,** corresponding either to a verb (find), however placed iconically in a reverse position (fast find) and a modifying adverb (fast) or to an adjective + noun (iconically 'fast find') as applied to virtual contents, can be more intuitively understandable than a single object icon as the case is with **Mouse**, a literal iconic metaphor. The complex syntactic iconic structure for **Find Fast** as compared with **Mouse** would appear as follows.

Find Fast: the reverse order in the iconic representation

V + **Modifier** (adverb) + (**Object** implicit)

Fast Find: iconically correspondent

Modifier (adjective) + **Noun**
'fast search'

Mouse

(Verb) + **Object**
('manage') mouse'

Our conclusion, to be tested, is that compound icons subsume conceptually complex and at times ambiguous structures that require more processing time for the detection of their meaning as compared with the comprehension of single ones. Further difficulties derive from the creation of 'abstract contents' such as 'settings' rendered through a concretization of 'regional' into a globe metaphor and a misleading icon combination that implies a poor or unsatisfacory iconic rendering as the case is with **Regional Settings.** Moreover, the overall menu testifies the lack of an iconic logical architecture if compared with local menus of programs such as Word or Outlook express. In subsequent Microsoft examples the problem is faced by grouping icons according to a labelled content categorization.
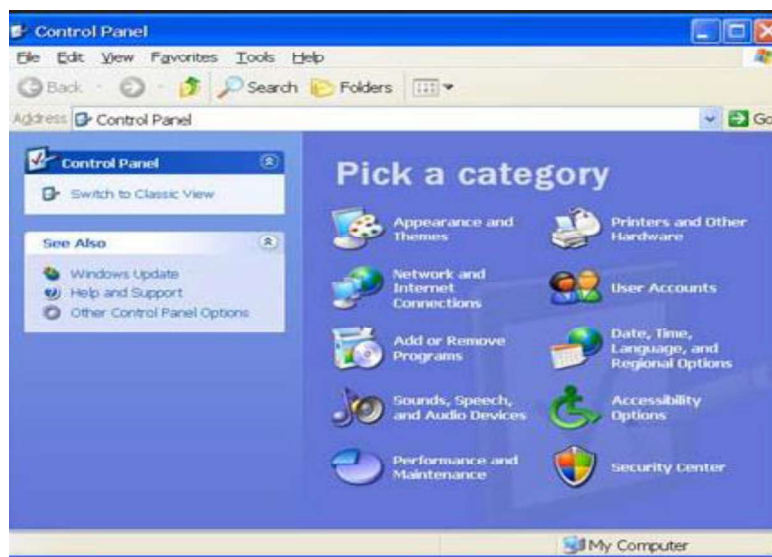

Figure 5: Microsoft Microsoft Windows XP Control Panel

The need for an architectural cognitive and functional iconic display and the choice of iconic solutions is dramatically evident if we pass on to mobile devices (smart phones, ipads, etc.) where the iconic mania is furiously fighting against the need for a simple comprehension of contens by users.

In the following example, the iconic language appears more and more as a mixture of conventional icons taken from other types of contents representations, new single and compound icons, and a multilingual combination of icons, verbal language, numbers.

Figure 6: Iphone 4

A quick look at this menu leaves us puzzled, both with single and compound icons, when labels are missing and system or network applications are not displayed in a structured scheme.

Let us conclude the analysis with a redefinition of the results of an intuitive test of mobile icons identification in order to verify our position.

A redefinition of results of mobile icons comprehension

In the application of the concrete/abstract opposition for mobile icons recognition, Gatsou, Politis, Zevgolis (2012) propose the following test and results.

Given a multiple representation of the same functionalities, according to different technological brands, tested through gender and age diversity as well, the authors offer results whose interpretation is given according to the concrete/abstract opposition.

Assuming as a reference parameter the percentage of correct guesses equal to 66% in order to consider icons as acceptable by ISO, according to their analysis, the results display a various range of comprehension problems, ranging from a poor visual rendering of the function to the assumed better performance of 'concrete' icons as compared with abstract ones.

No	A1	A2	A3	A4	A5	A6	A7	A7	
Phone book									
Recognition	56.7	63.3	78.3	30.3	56.7	56.7	40.7	70.0	
No	B1	B2	B3	B4	B5	B6	B7	B8	B9
Phone call									
Recognition	75.0	50.0	60.0	20.0	53.3	21.7	55.0	60.0	60.0
No	C1	C2	C3	C4	C5	C6			
Message									
Recognition	98.3	93.2	88.3	86.7	95.0	96.7			
No	D1	D2	D3	D4	D5	D6	D7	D8	
Setting									
Recognition	65.0	91.7	90.0	68.3	95.0	58.3	58.3	91.7	
No	E1	E2	E3	E4					
Camera									
Recognition	78.3	96.7	96.7	100.0					
No	F1	F2	F3	F4					
Clock									
Recognition	60.0	100.0	61.7	61.7					
No	G1	G2	G3	G4	G5	G6	G7	G8	G9
Internet									
Recognition	40.0	68.3	93.3	45.0	95.0	91.7	95.0	85.0	65.0
No	H1	H2	H3	H4	H5	H6			
Games									
Recognition	78.3	40.0	30.0	81.7	85.0	93.0			

Figure : 7 Gatsou, Politis, Zevgolis (2012)

In all cases we can observe that single icons score best. The same is true of concrete versus abstract conventional icons as the case is with the conventional 'abstract' **double arrow** in phone call and **the tools** (concrete and metonymic) in setting.

The best score is for **camera** and **clock** (100.0) where the implied syntactic structure is **(V) + O,** a literal metaphor of the type 'manage camera', 'manage clock' with no metonymic extension.

Summing up the results of our analysis, we can draw the following conclusions for new improved parameters in icons design.

Conclusions

In my analysis I have tried to demonstrate that the opposition concrete versus abstract icons and iconic versus symbolic icons needs redefinition. The following are the summarized lines of analysis that are needed to define new paradigms in interface design.

'Concrete' icons may refer to:
i.   a physical object as a literal metaphoric transposition from the verbal referent to the iconic code as the case is with 'camera', 'clock', etc.;
ii.   a physical object that is metonimically related to its referent as in 'file', 'scissors';
iii.   an abstract concept metonymically related to a physical referent as the concrete envelope for 'mail' or the concrete telephone for 'telephone call'.

Abstract icons correspond to:
i.   a conventional arbitrary graphic representation as in 'games' (H1);
ii.   a conventional Logo such as the Microsoft, Apple, etc. symbols;
iii.   a conventional symbol in the computer language: the 'globe' for Internet, the @ for the 'at' of email;
iv.   conventional computer symbols belonging to other codes as the X for 'closing' or the arrow for 'orientation';
v.   a totally new non conventionalized/arbitrary icon to be acquired as a symbol.

As a consequence, iconic and symbolic icons can both be 'concrete' according to the metaphoric and/or metonymic reference they imply.

As for single versus compound icons we may state that single icons imply a simpler predicative structure (Verb+Object, Verb+ Complement) whereas compound icons may imply an ambiguous modifying structure that possibly requires more processing time to be understood.

Finally, iconic concrete metaphors seem to guarantee a simpler translation when they do not require a further metonymic analysis as the case is with 'camera'or 'clock' that imply a (V)+O sintactic structure as compared with 'file', iconic metaphor of a phisycal sheet and metonymic syntactic extension for 'open file' (V)+ O or scissors for cutting (V)+C.

I consider this analysis a new prospective paradigm for interface design in iconic digital communication.

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