

From Skeuomorphism to Material Design and back.

The language of colours in the 2nd generation of mobile interface design.

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1. Introduction

As Apple firstly launched iPhone at the beginning of 2007, the first generation of mobile devices rapidly raised using the same interface design approach established by *iOS Human Interface Guidelines* that means *skeuomorphism*. The interface of iOS and Android smartphones were 3D, bold, rounded, coloured, shaded and hyper-metaphorically similar to the real world. As always happened in design field, when something new is introduced into the market, it uses a mimetic approach with the already existing world so that people can easily create a mental model based on their previous experience. Colours were used in a *natural* way to convey a recognizable and reliable image of the world, so realistic to be transparent to the users' perception. The enhancement in 2013 of iOS7 to *flat* design represents a significant breaking point. Quickly implemented and expanded as *material design* in a deeply well-structured Android manual, flat approach has significantly altered the use and the language of colours applied to graphical and touch interfaces both in mobile and desktop operating systems, (responsive) web sites and mobile applications.

On one hand, material design introduces a wide, massive and bold use of colours so that they become one of the most powerful and expressive assets of the interaction in the experience system. But, on the other hand, they assume a connotative and abstract role in identifying elements and in guiding the users across sections, navigations, call-to actions and feedbacks.

2. The language of visual design: a strategic asset for user experience

According to new research and design trends in usability and user experience (Ux) studies, the aesthetic value in graphic and multimodal user interfaces (UI) is becoming even more a strategic asset.

The concept of *playfulness* —however not directly related to the interface in itself— is already expressed in the ISO 9241-11:1993 Standard that defines the concept of *usability* in the following way: “This part deals with the extent to which a product can be used by specified users to achieve specified goals with *effectiveness* (Task completion by users), *efficiency* (Task in time) and *satisfaction* (responded by user in term of experience) in a specified context of use (users, tasks, equipment & environments)” [1].

The guideline proposes three parameters to evaluate the usability level of a product: *effectiveness*, *efficiency* e *satisfaction*. Although most methodologies are focused and able to measure the first two, *satisfaction* remains often in the background.

On one hand satisfaction is a qualitative value that can't easily be described with standard or quantitative parameters —such as the number of tasks correctly executed or the time used to complete them— on the other hand it involves a personal *emotional* experience and feed-back.

Kurosu and Kashimura [2] established a first approach defining a new parameter: the *apparent usability* intended as a usability aspect *perceived* by the user “strongly affected by the aesthetic aspect rather than the inherent usability. [...] *Apparent usability* is less created with the *inherent usability* compared to the apparent beauty”. Suggesting to designers to improve the apparent usability they means the *aesthetic aspects* of the interfaces.

This research track was developed by the further studies of Tractinsky, Katz & Ikar [3], Lavie & Tractinsky [4], Rosenfeld & Morville [5] and Donald Norman, both in the paper *Emotion and design: Attractive things work better* [56] and the recent book *Emotional design* [7].

This shift of focus —from *rational* to *emotional* elements— restores the centrality of visual design and its languages, among them, the colours issues.

As stated in the *classical* Garret's diagram [8], the visual design of the interface surface is the *space* where the interaction between digital and people happens. For this reason its language should be strongly connected to every daily user experience, mental models and expectations. Furthermore graphic design applied to digital artefacts —despite having to face a number of specific constraints due to the medium nature— could find in colour a powerful expressive tool not limited —as in printed world— by costs and production limitations (see Zeldman [9] and Postai [10] and Bollini & Greco [11] for a deeper discussion of this issue and the transition from paper to digital communication design).

3. Skeuomorphism: the colours of the world

As happened to many design and technologies innovation —moreover in immaterial field— when introduced in mass market, also the new mobile operative systems have adopted a *mimetic* approach to existing material references and/or interface patterns already familiar for the users. Even for *early adopter* —therefore people susceptible and motivated to learn new mind set of interaction according to the *diffusion of innovation theory* by Rogers [12]— the first mobile operating system of the iPhone and its visual and touch interface was based on a metaphor —as happened with the first Apple OS and its GUI designed by Susan Kare— modelled on the real world. A leather-bound diary, a '50s radio microphone, a 3D compass where the icon that once *tapped* —one of the gesture to interact with touch interfaces listed by Villamor, Willis and Wroblewski [13]— launch the applications.

This first generation of mobile OS —which was followed by Android developed by Google and firstly installed on the devices of Apples competitor Samsung— adopted a digital skeuomorph strategy to visual design, or a *skeuomorphism* style “in which certain images and metaphors, like a spiral-bound notebook or stitched leather, are used in software to give people a reassuring real-world reference” as underlined by Wroblewski himself [14].

The term *skeuomorphism* is a compound by the Greek words *skéuos* [σκεῦος]: container or tool and *morphé* [μορφή]: shape, used since 1890 to describe material object and nowadays applied to digital interface as already reported by Gessler in 1998 [15].

If—generally speaking—3D effects, materiality and touch-feeling are the basic design patterns of the representation language of skeuomorph-interfaces, colours and their conceptual use is directly drawn from the world. Elements are rendered through textures and hues or tins which depict explicitly physical objects that are intended to symbolize or, at least, visually synthesize.

according to this *philosophy* the denotative value of colours is limited to few elements which refer to shared semiotics conventions such as the ternary of traffic lights: *red* to warn and alert users when approaching very *dangerous* actions such as *eliminate*, *cancel*, *undo*. On the opposite, *green* to show neutral or positive tasks aimed to finalize standard actions and giving a confirmative feedback.

Unless small semantic blur, the user experiences *transparent*—according to the Bonsiepe conceptualization [15]—for what concerns the chromatic language of the default applications because of their similarity with reality.

The colour and its symbolic meanings, in terms of user experience and interface design, wasn't one of the main elements of the first generation of mobile design.

On the other hand also custom applications or *responsive* version of web sites—a comprehensive modality to decline different versions of the same site or pages to be optimized and displayed on different devices and resolutions screen starting from the same source (see Marcotte [16] for further discussion about *responsiveness*)—colours application guidelines were declined according to institutional brand and corporate image design manuals.

3. Flat design: a touch of abstraction

The transition to iOS7 in 2013 [17] ends the pioneer phase of the mobile revolution: new generation of devices have been introduced—not only smartphones but also tablet, phablet, wearables and IoT—new brands have been raised in the market older player in IT and hardware field are missing the wave or definitely disappearing acquired or exhausted being no more able to compete in a new challenging world.

This transition phase represents the required time to normalize the first generation approach, preparing the field for experimenting and addressing further exploration to potentiality and specific features of the devices.

Mobile OS and apps design free themselves from realistic patterns and embrace the new language of the so-called *flat design*. The flat interfaces—bi-dimensional to differentiate from the 3D effects, synesthetic, tactile and shades—find a symbolic and minimal way to communicate to users although maintaining a almost clear *affordance* according to Norman [18] and Bagnara & Broadbent studies [19].

Colour, on the opposite, becomes one of the most important and valuable expressive repertoires in this second generation of UI-touch interfaces. In a even more abstract context the visual language of colours has a connotative, identifying role in telling

stories and let people understand interaction and feed-backs in a playful way.

Although the three main mobile operating systems —iOS, Android and Windows Surface— have different approaches, colours are one of the most valued, well-defined and explored assets in design guideline manuals.

In particular Google creates and launched a document *Material design* [20] in 2014 in which theoretical concepts and principles and practical examples are given and explained to allow pros to better design apps coherent with the whole approach of Android development and framework. In this interactive guide the philosophical perspective is declared and discussed to understand the declination of single principles and in particular of colours choice, use and implementation.

The aim of Google —applied successively to other digital services of the platform not only in mobile ducts— is to create a visual language that “synthesizes the classic principles of good design with the innovation and possibility of technology and science” but the declared *material metaphor* has a very different interpretation compared to skeuomorphism. It grounds in *tactile reality*, inspired by *study of paper and Ink*, but “yet open to imagination and magic.” But the concept of materiality, in this new context, means multi-layered, tactile, 2-dimensionals, flat, geometrical surfaces barely differentiated by lightning effects and animations. Dramatic changes of bold background colours indicate space articulations or subdivisions and cognitive organization of the interface structure.

In the absence of more explicit references to patterns or systems already known by the user the visual grammar and the language of graphic design become the conceptual tools to create the new imaginary as declared: in the fifth principle of the nine conceptual premises: “Content is bold, graphic, and intentional: bold design creates hierarchy, meaning, and focus. Deliberate color choices, edge-to-edge imagery, large-scale typography, and intentional white space create immersion and clarity.”

In the end, *flat* firstly and *material design* next introduces a bold use of colors in a very abstract and connotative way. Colorus become “unnatural”, saturated, vivid, acid. Contrasts are strong and effective and they become one of the main expressive assets of the mobile interface design.



Fig. 1 - iOS 7: *skeuomorph* vs. *flat* icon and built-in application UI: visual comparison.

Nevertheless, some of the established pattern- semiotic- and cultural-meanings — coming both from Gestalt Theory and basic design— are disregarded creating misunderstandings and errors in the users experience.

4. The unique colours language three different approaches

As previously underlined all the three main second-generation mobile operating systems converge on colours language and its modulations to convey identity, hierarchy, coherence and feedbacks to the users when interacting with the system itself and commercial apps. Although the starting point is common, the design philosophy, the whole look & feel and the final results are significantly different.

4.1. Colours language according to Apple-iOS

At its very first launch, flat design of iOS 7 was mainly concerned with simplification of the whole user experience both in emotional and mental model and in technical aspects. Loosing 3D and shaded effects, the vintage look and the dark, heavy metaphor referring to the ‘50s object almost unknown to the younger *digital natives* and *millennials* generations immediately gives a new perspective.

As reported by Matt Gemmell in a deep-debated and well-documented post “iOS 7 is much, much lighter - in the colour sense, and consequently also in visual weight. Breathable whitespace is everywhere, and is used to unify... The overall impression is of brightness and openness. iOS 7’s new look is bold, opinionated and readable.” [21]. So, the new wave of bi-dimensional visual elements, surrounded by a wide amount of white negative space let the chromatic choices speaking loudly, although not always clearly. According to the UI Design Basics section of the iOS Human Interface Guideline released by Apple “Let color simplify the UI. A key color — such as yellow in Notes— highlights important state information and subtly indicates interactivity. It also gives an app a consistent visual theme.

The built-in apps use a family of pure, clean system colors that look good at every tint and on both dark and light backgrounds.” Embracing the flat philosophy, also means to use bold, well-defined coloured shape to identify buttons, call to actions or interactive portions of the interfaces: “In content areas, a borderless button uses context, color, and a call-to-action title to indicate interactivity. And when it makes sense, a content-area button can display a thin border or tinted background that makes it distinctive.”

Colour becomes, therefor, the key-element to build interface affordance and meaning —as visually described by figure 2— and, at the same time, to build an emotional connection with users.



Fig. 2 - iOS 7: flat design look & feel of built-in applications' icons. [from iOS Human Interface Guideline].

The colours family proposed (see figure 3) is a palette of strong, pure, clean, saturated colours with *effective personality* which works well both with dark or light backgrounds or other combinations in a *colours enhanced communication perspective*.

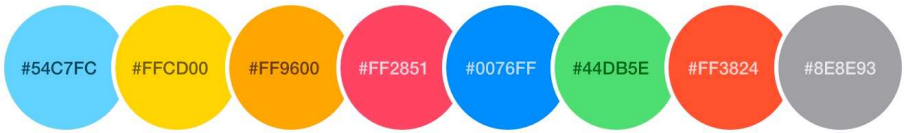


Fig. 3- iOS 7: main colours palette for built-in and other applications. [from iOS Human Interface Guideline].

Furthermore coordination and contrast become the main paths to investigate and experiment when working and designing custom applications. A balanced asset of the colors language – a range of pastel colours or, on the contrary, strong colors for example— on one hand or a sufficient-well-contrasted juxtaposition between fore- and background. [22] Nevertheless this *trust* in colours as the unique or, at list, the main way to identify and decline all the visual and interactive elements of the built-in apps risks to create an ambiguous and inefficient user experience.

If basic design principles of the colour language are misused or *forgotten*. One of the more evident problem is well visible in the calendar build-in app. The identifying colour of this function applied to all the elements of the interface is red. Every visual message is given by using red, even if they positive messages whether negative.

Add is red as well as *delete* (see figure 4) although they have opposite meaning and functions deliberately ignoring the semiotic triad of red/yellow/green well embedded in the every-day experience of the user and/or the basic design principles and meaning deeply grounded in our culture.

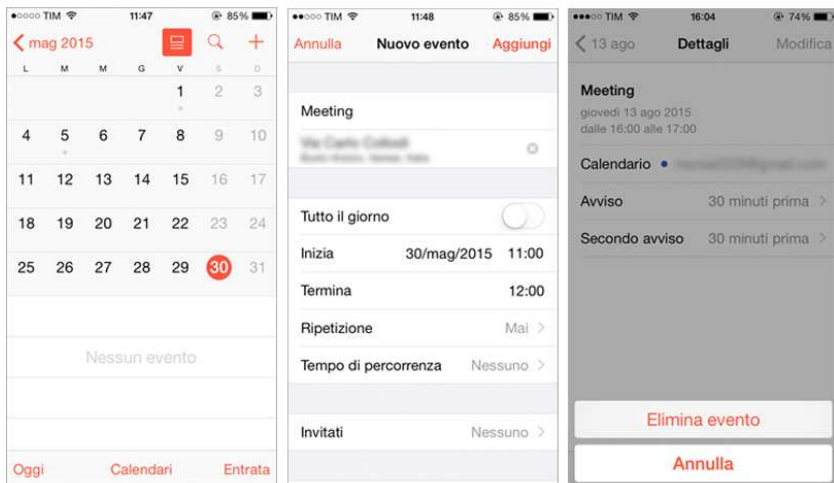


Fig. 4- iOS 7: Calendar interfaces and task sequence “add/delete an event”.

Only to resume this language in other applications which have a different identifying colors such as in *mail*—characterized by the use of cyan (see figure 5)— where *red* is now the alerting chromatic element to warn user in doing *dangerous* procedures.

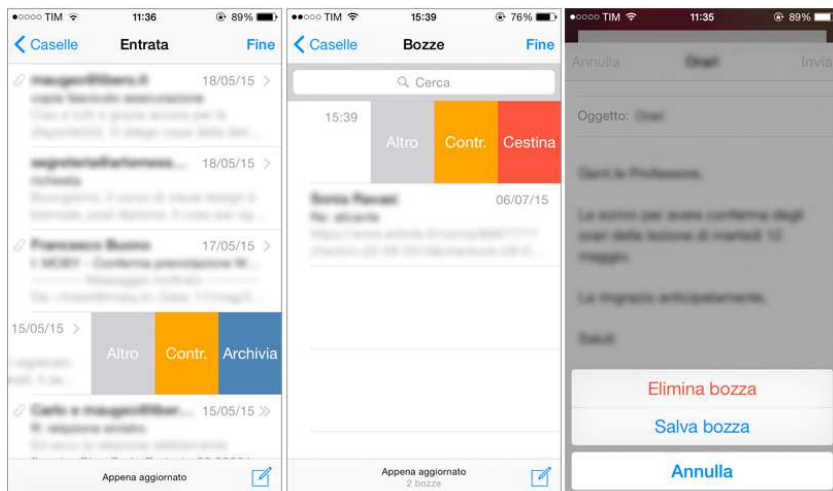


Fig. 5- iOS 7: Mail interfaces and task sequence “archive/delete an email”.

For wider and detailed examination of the problem see the paper previously presented and discussed at the *X Conferenza del Colore* in 2014 [23].

4.2. Colours language according to Google-Android

Android coming after the *flat revolution* of iOS 7 reinforces and makes dramatically extreme the use—and abuse!— of colours language. In its design guidelines defines three different ways to choose and articulate a palette: *primary*, *secondary* and *accent* colours, suggesting to “Limit your selection of colors to three hues from the primary palette and one accent color from the secondary palette”. The first one should represent the chromatic brand identity of the application and should be chosen among the bold primary color palette proposed by Android, when possible. The second one should guarantee enough contrast in term of hue and luminosity and declined in lighter or darker tints. Accent colors have a highlight function and should be limited to “floating action button and interactive elements, such as: Text fields and cursors; Text selection; Progress bars; Selection controls, buttons, and sliders; Links” that means to interactive and significant elements in the user perception and experience as exemplified in figure 6. [22]

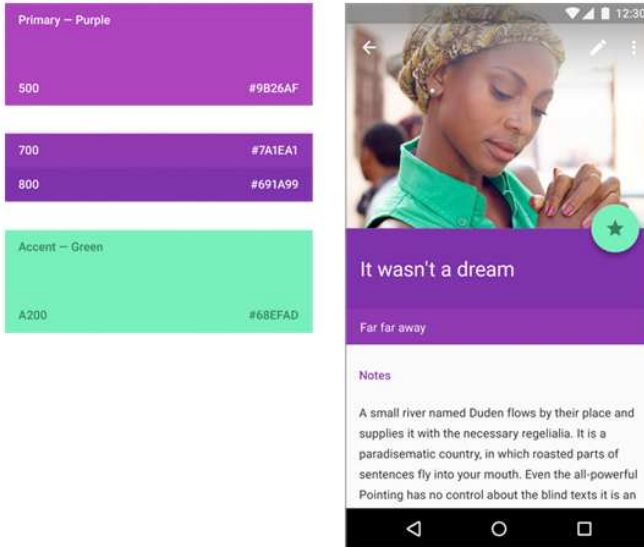


Fig. 6 - Android: how to choose and use a triadic colours scheme according to Material Design Guidelines. [Google, Material Design Guidelines, Style: colors]

Google gives also explicit indications in using chromatic contrast for foreground elements and backgrounds according to the surface layering metaphor described in the main principles. Opacity becomes one of the variation strategies suggested to convey hierarchy or importance relationships among contents, spaces and visual elements. Design directions are given both for text and icon placement on coloured shapes or backgrounds suggesting to use opacity instead of grey or hue/tint modulation of foreground object to guarantee legibility and perceptive discriminations of fonts and pictograms.

Although all these precise indications material design too seems to fail in using basic design principle in built-in apps when using colours as distinctive elements. As shown in figure 7, Android chooses —on the opposite of Apple— *green* as calendar app main connotation incurring in the same error. In this case main messages are *green*, but the accent hue for *add* bottom is depicted with a dystonic *red*. And, the negative call to actions *undo* and *cancel* adopt a reassuring *green*.

Android is credited to have tried to give deep and well organized guideline bringing UI design back to its guest role and cultural origins rooted in graphic design culture, nevertheless it seems to miss the *big picture* which lies under every project and the basic *common sense* both of every day life and of usable and *friendly* interfaces. The final result seems more a *style* exercise rather than a *concrete* result.

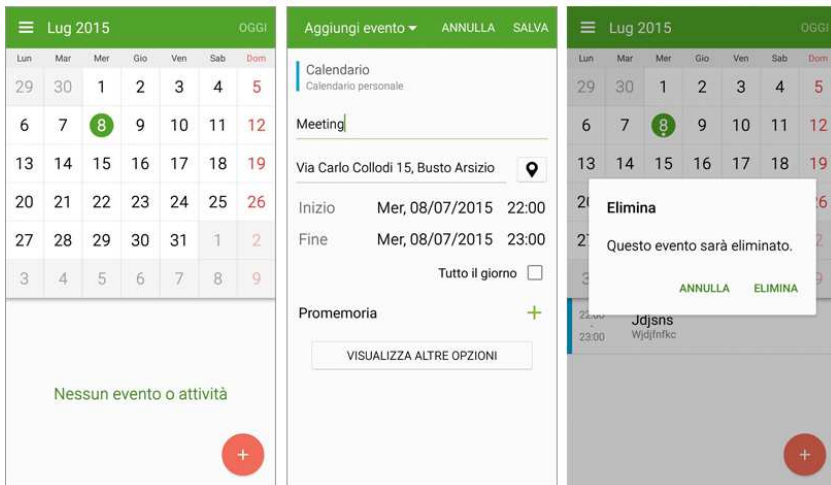


Fig. 7- Android: Calendar interfaces and task sequence “add/delete an event”.

4.3. Colours language according to Windows-Surface

Microsoft deserves a separate discussion. Although it arrived late in mobile technologies field, it tried to create its own niche to differentiate its products and services from competitors. Microsoft remains probably the only market player who is not directly producing a device —at least smartphones— but using its dominant position in the field of desktop operating systems to create a whole *world* of cross-services and experiences where boundaries between smartphone, tablet, netbook, notebook and desktop is no more relevant. The breaking point and represented by *Surface* in 2008 become a tablet-line in 2012: a new multi-touch interface paradigm totally different from iOS and the simulative approach of Android.

As Microsoft declares in its Developer resources for Windows App the philosophy that inspires the interface design in its different elements is, above all, *simplicity* the same *minimal* principle of the *flat* revolution: “We believe in timeless principles of good design inspired by the International Typographic Style that emphasize simplicity, clarity and universality to achieve beautiful and practical experiences. Grid, Type, Color, Icons and other elements are related to each other in deep and meaningful ways. The mathematical relationship between the basic components enables order, beauty, harmony, clear hierarchy and flexibility, allowing expressive designs or functional experiences. [...] Our goal is to define one design language that is familiar and persistent across Microsoft ecosystem.” [24]

The colours choice for UWP (*Universal Windows Platform*) Apps are rigorously settled both in a theoretical way and in a practical ones.

The design logical is described by the statement: “Color provides intuitive wayfinding through an app’s various levels of information and serves as a crucial tool for

reinforcing the interaction model.” According to this principle colours have to be selected as a *single accent* among 48 possible hues and composed with *colour selections*, that means, light and dark shades of the accent color are created based on HCL values of color luminosity to create a strong chromatic hierarchy and clear visual interaction signals.

Furthermore Windows introduced another original concepts in managing colors as a user experience resource: *colour themes* a set *positive* or *negative* —in terms of hue and contrast— palette —at the moment limited to smartphone applications— among which the user can customize his or her visual interface (see figure 8). The Design Guidelines suggest that: “Apps using light theme are for scenarios involving productivity apps. Examples would be the suite of apps available with Microsoft Office. Light theme affords the ease of reading long lengths of text in conjunction with prolonged periods of time-at-task. Dark theme allows more visible contrast of content for apps that are media centric or scenarios where users are presented with an abundance of videos or imagery. In these scenarios, reading is not necessarily the primary task, though a movie watching experience might be, and shown under low-light ambient conditions.” [25]

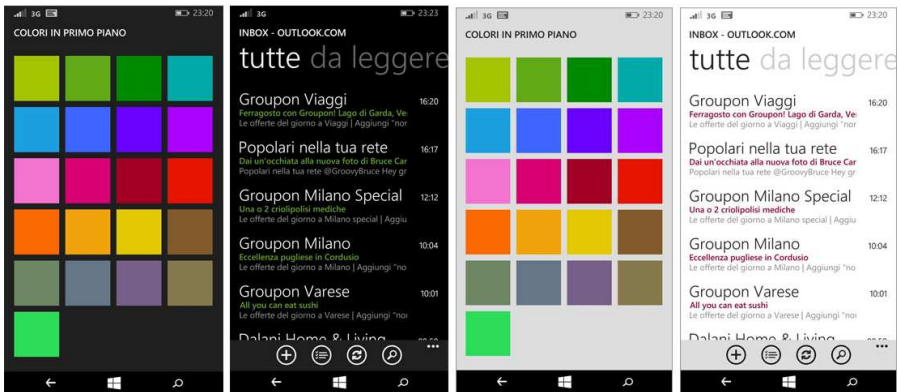


Fig. 8 – Windows Universal Windows Platform App accent colours palette and dark/light colours themes [Windows Dev Center]

The Windows approach differs totally from its competitors when applied to single built-in applications. Using the calendar/agenda app to compare the user experience as already done for iOS7/*flat* and Android/*material* design the first evidence is that colours are not the way to convey interactive actions and messages to the user. *Save*, *add* or *delete* call-to-action are visualized usign icons instead of colours. The 2obsolete” floppy-disk symbol an “X” tell the user what to do. Not colours. The graphical interface is solved just usign black & white elements both visual and textual and shapes to cluster, differentiate or isolate the interactive triggers as shown in figure 9.

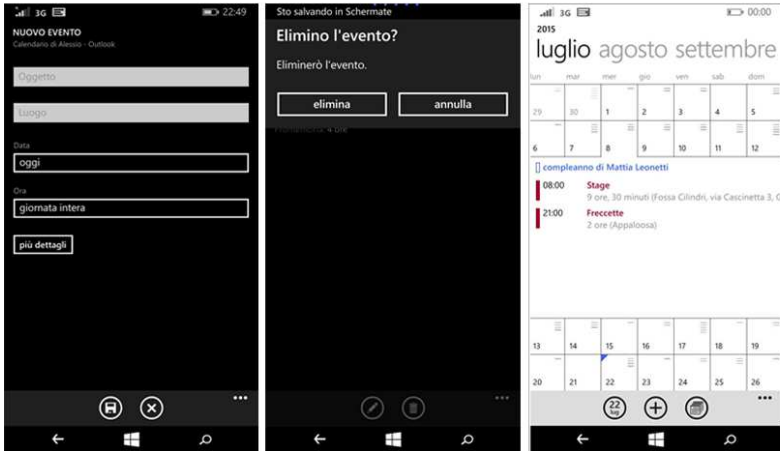


Fig. 9 – Windows: Calendar interfaces and task sequence “add/delete an event” dark and light theme.

The single coloured elements —purple and blue in the given example of figure 9— are chosen by the user who can customize his/her own visual glossary according to a personal mental model. Unlike the other mobile operating systems, Windows gives on/off/highlights feed-back state up.

5. Conclusions

The transition between first and second generations of mobile operating systems represents a huge revolution in the language of user interface design that reinforces and gives a central role to colours language in creating affordance, hierarchy and visual cue to distinguish interactive elements.

If skeuomorphism was keen to simulate the real world to reassure people giving a well recognizable transposition of their mental habits and knowledge the minimal approach of *flat/material* design breaks this reassuring scenarios and assigning new roles and meaning in project strategies.

Colours become, then, the main driver in building the meanings, the cognitive model and a vivid, clear, playful experience to users. Design guidelines give and assure an explicit and specific function to primary, secondary and highlights chromatic elements intentionally building a grammar, a syntax and a semiotic structure to colours language. The operating systems proposed colour palette —selected among vivid, bold, artificial hue— are the shared vocabulary where design and experience find the common ground and an new *idiomatic* way to express visual concepts and interactions. Colours become the *play makers* of the user experience, On the other hand designers should remember and consciously use —in this new abstract declination of hue, tints and de/saturations— the symbolic logic and meanings already embedded in the users’ mind and in the everyday experience.

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