Addressing Animated Transitions already in Mobile App Storyboards

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Abstract. Animated transitions are key elements that contribute to the user experience (UX) of mobile Apps. Unfortunately, animated transitions are usually addressed too late in software development. We recommend to consider animated transitions already during user interface (UI) storyboarding. Typically, UI storyboards do not address the kind of transition, they focus on the screens and visualize a transition just with a simple arrow. Therefore, we investigated the leading mobile phone operating systems iOS 5, Windows Phone 7.5 and Android 4 with respect to their utilization of animated transitions. We developed a catalog consisting of 21 different types of animated transitions. Based on this catalog of 21 different types of animated transition we developed a vocabulary of 66 simple icons. These icons enhance the abilities of storyboards to the extent that they are now able to illustrate animated transitions.

Keywords: mobile apps, user interface, storyboards, animated transitions, user experience.

1 Motivation

Animated transitions are key elements that contribute to the user experience (UX) of mobile apps. To be able to efficiently and reliably interpret what has happened when the screen changes state, a user must be prepared with an expectation of what the screen will look like after his actions. When the user cannot visually track the changes occurring in the interface, the causal connection between the old state of the screen and the new state of the screen is not immediately clear. How are the current objects on the screen related to the ones which were there a moment ago? Are they the same objects, or have they been replaced by different objects? What changes are directly related to the user's actions, and which are incidental? To be able to efficiently and reliably interpret what has happened when the screen changes state, the user must be prepared with an expectation of what the screen will look like after performing an action. In the case of unanimated hard transitions this expectation can only be estimated by experience [1]. Today, smartphones have increased display resolutions and

computing power that allows the use of smooth animated transitions and commonly employ smooth animated transitions to shift between different views of the system.

Therefore, we describe the advantages of animated transitions in UI design in general (section 2). To use common animated transitions already during UI storyboarding (section 3) we created a catalog of existing animated transition from iOS, Android and Windows Phone operating systems (section 4). Based on this catalog we developed a vocabulary of icons for these transitions that can be used during UI storyboarding (section 5).

2 Animated Transitions

Animated transitions can build a clear causal connection between the old state of the screen and the new state of the screen [2]. Furthermore, animated transitions can be used to make the application more pleasing by creating a perception of natural and smooth movements [2], as well as to improve the usability and efficiency of the mobile User Interface [3]. Good animated transitions simulate an object's real-world physical properties and behavior. This helps users to predict and understand the results of their interactions. Users should never be surprised or confused by the results [7]. Animated transitions can add aesthetic pleasure, which contributes to the overall User Experience. It has been shown that perceived aesthetics has a correlation with the perceived usability [5], although the relationship is a quite complex one [6]. Animated transitions do not have to demand attention to be successful. In fact, they are often used to avoid drawing attention to program mechanics that users do not need to be aware of. Many successful animations are so natural that users are not even aware of them and rather users would only notice their absence [7]. Frequency of the animated transition increases the necessity for subtlety, so common interactions need simple animations that communicate a simple idea in a simple way. Special, complex animated transitions should be reserved for special, infrequent experiences [7]. Smartphones have limitations compared to PCs due to their inferior computing power and small screens. However, in cases where the mobile device responds slowly because of technical reasons e.g. data transfer or processor delay, animated transitions can be used to create an illusion of continuity in the browsing experience. Changing from one User Interface view to another is a common stage for delays to occur. An animated transition can be used to patch the moment and the user feels time passing faster than it does [3]. Moreover, it has been found that the acceleration of an animation makes its duration feel shorter [4]. Furthermore, well-designed animated transitions are a great way to add personality, character, and style to the mobile device. The specific way in which the animation is performed shows the program's personality. Good animations project the right personality for your program, whether serious or whimsical, or somewhere in between [7]. The User Interface personality should reflect the nature of its tasks and the personality of its users, so it is not an arbitrary choice. Rather, a well-designed personality should feel authentic and never try to force it. The personality should make an emotional connection to the user [7].

In spite of its advantages, animated transitions have numerous possible drawbacks. The most notable drawback is that animated transitions take considerable amount of time to complete a viewpoint transformation, thereby increasing system response time [9]. This additional time may not benefit users who are familiar with the task or when the task is not complex. The gratuitous use of animations and transitions can make the User Interface distracting and even annoying. The animated transition has to attract the right level of attention. Good animated transitions are usually subtle and draw only the attention required to fulfill their purpose [7]. Additionally, if animated transitions are not designed carefully, they can disrupt user performance and lead to distractions [10]. From a design standpoint, implementing animations also requires more development effort.

3 User Interface Storyboarding

In light of these possible drawbacks it is even more important for developers to choose or design the most beneficial animated transition for their User Interface. In fact this part of application development is often neglected.

One of the design techniques used, is to create UI storyboard prototypes. UI storyboarding is used in software development as part of identifying the specifications for particular software. During the specification phase, screens that the software will display are drawn, either using pen and paper or using other specialized software, to illustrate screen flow of the mobile app [11]. The storyboard is then modified by the engineers and the client while they decide on their specific needs. The reason why storyboarding is useful during software engineering is that it helps the user to understand exactly how the software will work, much better than an abstract description [12]. Thereby, it is possible to obtain feedback early in the design process.

Fig. 1. Storyboard for Apple's Weather App without the Usage of Icons of Animated Transitions

It is also cheaper to make changes to a storyboard than to an implemented piece of software [12]. Furthermore, the technique enables to work effectively with a multi-disciplinary team to create highly usable, user centered designs [11]. Storyboarding is an iterative, interaction design methodology that uses a series of sketches or pictures to demonstrate an end to end solution for an user scenario [11]. This type of low fidelity prototype is used to illustrate design concepts. In a typical storyboard of mobile device application design, there is much design that goes into the details of the views, but less thought is given to the transitions between them [1]. Figure 1 depicts a storyboard from Apple's iPhone weather app and is a typical example for a storyboard of mobile application software development. Each iPhone mockup represents a system state and is illustrated in detail, but the transition from one state to another is only depicted by a small black arrow. The beginning of the arrow is associated with the old state and the arrow head points to the new state. At the beginning of the arrow it is textually described by what action the transition gets triggered.

Unfortunately, such storyboards take no responsibility of the important task of choosing or designing the most beneficial animated transition. In order to choose an appropriate transition, we need a catalog of existing animated transition to choose from and a vocabulary of icons for these transitions to symbolize them in UI storyboards.

4 Animated Transitions in iOS, Android and Windows Phone

We investigated the leading mobile phone operating systems iOS 5, Windows Phone 7.5 and Android 4 with respect to their utilization of animated transitions. Thereby, we created a catalog consisting of 21 different types of animated transition (see Table 1).

As a reference for developers we described and pictured every animated transition that is used by at least one of these mobile operating systems (see [8] for the full catalog including links to videos that show each transition). To give an example of our catalog, we use the very first animated transition that every iPhone user is confronted with when he wants to unlock his iPhone. The unlock transition is triggered by the patent-registered "slide to unlock" action. If the phone is locked, the display shows four elements: a status bar, a clock, a background image and a slide bar (see Figure 2). The device gets unlocked, if contact with the display corresponds to the predefined gesture, moving the unlock button of the slide bar along a horizontal path from the left to the right side of the screen. Subsequently, the transition to the "home screen" is performed. On closer examination of the animated transition three different individual transitions can be observed: Fade-, Move- and Buttons Fly transition (see Figure 2, 3 and 4).

A Fade transition uses the opacity property and lets content gradually appear or disappear on the display. The terms Fade-Out and Fade-In are used to describe a transition to and from a blank image [13]. If content is appearing on the screen it is named Fade-In and in case of disappearing of content Fade-Out. Figure 2 depicts the Fade-Out of the background image into a black background that is performed at first of the unlock transition. Hereafter, there is only the clock, the status bar at the top and the slide bar at the bottom of the screen displayed. In this way an animated transition from the initial screen view to a black screen view is performed.

Table 1. Catalog of Identified Animated Transition on Mobile Operating Systems

#	Animated Transition	ios 5	Windows Phone Put people first.	android
1	Fade	✓	✓	✓
2	Cross-Dissolve	✓	✓	✓
3	Move	✓	✓	✓
4	Move Partial	✓	✓	✓
5	Push	✓	✓	✓
6	Push Partial	✓	✓	✓
7	Zoom	✓	✓	✓
8	Buttons Fly	✓		✓
9	Carousel	✓		✓
10	Fade Sequential		✓	✓
11	Stretch-In / Stretch-Out		✓	✓
12	Curl	✓		
13	Curl Partial	✓		
14	Flip	✓		
15	Iris	✓		
16	Genie	✓		
17	Fly By		✓	
18	Flip Partial		✓	
19	Turnstile		✓	
20	Turnstile Feather		✓	
21	Rotate			✓

In case of a Move Partial-In transition, the new view slides (i.e. translates) into place over any existing content of only a part of the page, e.g. the move in of the keyboard from the bottom of the screen that covers only the lower part of the screen. A Move Partial-Out transition reveals the underlying content when the view slides out of the screen. Figure 3 shows the second step of the animated iPhone unlock transition. The clock and the slide bar move simultaneously out of the screen. The clock moves out to the top and the slide bar to the bottom of the screen. In doing this, the underlying black content is revealed. Each of the two movement transitions affect only a part of the screen and do not move over the whole screen. Along the way an acceleration of the movement can be observed. At the end of the second part, only the status bar is displayed and the residual part of the screen is display in black color. The Move Partial transition begins at the left side, the right side, the top or the bottom of the screen. The Move Partial transition is a special form of the general Move transition.

The third part of the transitions consists of a Fade-In of a four-button task bar at the bottom of the screen. Following this the Buttons Fly transition takes place. Figure 12 depicts the Buttons Fly-In transition. The home screen buttons fly in from all sides of the screen to their particular position. The buttons increase their speed during the movement. With the Buttons Fly transition the overall animated transition from the unlock screen to the home screen is completed.

Fig. 2. Fade-Out Transition [14]

Fig. 3. Move Partial Transition [14]

Fig. 4. Buttons Fly-In Transition [14]

5 Vocabulary for Animated Transitions in UI Storyboards

Based on this catalog of 21 different types of animated transition we developed 66 simple icons (see some of them in Table 2). These icons enhance the abilities of storyboards to the extent that they are now able to illustrate animated transitions.

As described before animated transitions are often inadequately described in storyboards by a simple black arrow. Therefore, we designed a standardized vocabulary of icons for animated transitions to extend the possibilities of storyboards to even illustrate animated transitions. Each developer must first learn the meaning of every icon.

Therefore, the meaning of an icon should be recognizable as simply as possible. Another important reason for simplicity is the time saving aspect in sketching a storyboard. They must be quickly to draw. The icon needs to be clear and easy to recognize and to sketch as well. No artistic skills may be a prerequisite. The simpler and more laconic the icon is the better. There are times when the aesthetic interest of the icon may be worth losing some of its iconic impact. It is always a judgment call, and needs vary with each design [15], but in the case of storyboards icons should be simple as possible. Since storyboards are either drawn by hand (e.g. on a paper or a whiteboard) or by other specialized software they have to fulfill particular requirements. One has to be wary of placing too many items into an icon design, or overly illustrating an icon [15]. It is preferable to keep the number of objects in a single icon to a minimum [16]. The icons should be two-dimensional objects shown straight-on and therefore easy to sketch by hand on a storyboard. Its shape should be simple with clean lines, without too much detailing in the design. This is particularly important because storyboards are often sketched with a thick pen. Icons also need to be unique and clearly distinguishable from other icons [16]. For reasons of simplicity shaping different light sources, shadows and reflections are omitted. The icons need to contrast well with a white background that is usually the background color within storyboards. Therefore, black is used as the color for icons. The usage of other colors is avoided. A limited perspective is used for the icons; they are all being looked at from straight ahead. Text is avoided in icons, because it is directly language-related and if the icon is small, it is impossible to read the text [15].

Table 2. Overview of Icons for Animated Transitions (Excerpt)

#	Computer Sketched Icon	Name	Hand Sketched Icon	Reference	#	Computer Sketched Icon	Name	Hand Sketched Icon	Reference
1		Fade In		Fade Transition	27		Squeeze Out Horizontal		Squeeze-Out and Stretch-In Transition
3		Cross-Dissolve		Cross-Dissolve Transition	30		Stretch In Vertical		Squeeze-Out and Stretch-In Transition
4		Fade Sequential In		Fade Sequential	31		Curl Up from Top Left		Curl Transition
5		Move from Right		Move Transition	48		Flip to Bottom		Flip Transition
10		Move Partial from Top		Move Partial Transition	55		Iris Close		Iris Transition
16		Push from Bottom		Push Transition	64		Turnstile Feather Forwards from Top		Turnstile Feather Transition
21		Zoom In		Zoom Transition	66		Rotate to Right		Rotate Transition
23		Buttons Fly In		Buttons Fly Transition					
25		Carousel Clockwise		Carousel Transition					

Based on our catalog of 21 different types of animated transition we developed a vocabulary of 66 simple icons, applying the abovementioned guidelines. Table 2 shows an expert of our vocabulary (see [8] for our complete vocabulary including detailed description for every single icon).

The Table also comprises a hand-sketched version of the created icons to emphasize the possibility of sketching the icons easily. Thereby, a thick permanent marker was used for drawing the icons.

As it is described above, some transitions like the unlock-transition are a sequence of several individual animated transitions, like Fade-, Move- and Buttons Fly-transition. As a consequence three corresponding icons are used to symbolize the animated unlock-transition. This sequence of icons indicates the corresponding sequence of simple animated transitions. Thereby, the sequence starts from the icon that is closest to the origin of the arrow and ends with the icon closest to the arrowhead. Figure 5 illustrates the syntax for storyboards with the usage of icons of animated transitions. The numbers in the boxes are placeholder for icons of animated transitions and indicate their execution order. Thereby, the ascending sequence starts with box 1, followed by box 2 and 3.

Fig. 5. Syntax for Storyboards with the Usage of Icons of Animated Transitions

To illustrate the usage of our vocabulary of icons for animated transition within UI storyboards we use Apple's iOS weather app as an example, again. Figure 5 shows a storyboard without using icons of animated transitions. The arrows represent the possible flow between the different views of the system. On the origin of each arrow a text bar is located. The text represents an action that has to be performed to trigger a transition to another view of the system. Figure 6 shows the same storyboard of iPhones weather application but with the usage of the icons of animated transitions. The storyboard now distinguishes between transitions that are animated or not.

Fig. 6. Storyboard for Apple’s Weather App without the Usage of Icons of Animated Transitions

Fig. 7. Storyboard for Apple's Weather App with the Usage of Icons of Animated Transitions

6 Future Work

We are currently using our vocabulary of icons for animated transitions in first industrial and research projects and have received great feedback so far. Nevertheless, we will have to perform an empirical evaluation to confirm the expected benefits in the development of mobile Apps. Furthermore, we consider providing our vocabulary through a mobile App. Thereby mobile app developers could use the app as a reference for our icons as well as a reference to the animated transition itself, as the app can playback the animation. Thus, the developers can experience each transition whenever they want.

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